
Groundwater Quality in SIPCOT Cuddalore - An Analysis of TNPCB Sample Results of Groundwater

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Background:

Since they were set up in the early 1980s, industries in SIPCOT Cuddalore have operated without adequate or appropriate infrastructure for environmental protection. Residents complain of falling water tables and constantly degrading water quality in the region. Water that was once available at the depth of 30 feet is now available at 800 feet or more. On the one hand, industrial extraction of groundwater from the vulnerable coastal aquifer has led to salinity intrusion. On the other, indiscriminate discharge of solid and liquid effluents from the industries has contaminated subsurface water.

Even today, SIPCOT companies routinely dump their solid wastes and discharge their toxic effluents onto land within or outside their premises. Over the years, the groundwater quality in villages around SIPCOT has deteriorated, and people have been put to great hardship. Impacts of the pollution in the region have been highlighted since 1998 when the State Human Rights Commission headed by Retd. Justice Nainar Sundram investigated reported environment-related human rights violations in SIPCOT. Justice Sundaram, in his report, stated that the SIPCOT Cuddalore is over-polluted and that people's health and the local environment cannot withstand the burden of any new chemical industries.

Members of SIPCOT Area Community Environmental Monitoring (SACEM) have consistently monitored and reported the deteriorating quality of the groundwater to the authorities since 2004. SACEM's demand all along has been provision of clean drinking water at the cost of SIPCOT industries and remediation and restoration of the contaminated groundwater.

Groundwater Quality Status in 2013-14:

On 9 July 2014, SACEM received a response from the office of Tamil Nadu Pollution Control Board (TNPCB), Cuddalore, on their RTI application-seeking results of all groundwater samples collected and analyzed by the Board in the year 2013-14.

According to the data, TNPCB had taken 41 samples from at least 11 locations in and around SIPCOT between February 2013 and April 2014. The samples were analyzed for basic parameters to ascertain their potability and for presence of heavy metals like lead, cadmium, chromium etc.

Sample locations:

The locations sampled were mostly bore-well or overhead tank drinking water sources.

Nine out of 11 locations were inside the premises of various factories in SIPCOT Complex. These were:

1. Ground water taken from the SIPCOT Project Office

2. Ground water taken inside the premises of M/s Tagros (Near HW Storage Shed)
3. M/s Chemplast Sanmar – Bore well water near VCM Tank
4. Ground water taken inside the premises of M/s Tagros (Near VTFD Inlet)
5. Ground water taken inside inside the premises of M/s SPIC campus
6. Ground water taken inside Chemplast, East of SLF
7. Ground water taken inside Chemplast, East of HW Storage Shed
8. Ground water taken inside Chemplast, West of ETP
9. Ground water from inside Chemplast, East of VCM Storage

Only 2 sources were outside the premises of any industrial unit. These are:

1. Water from Kudikadu Over Head Tank (source of water is a 110 ft borewell in the Kudikadu Panchayat limits)
2. Ground water taken opposite to JK Pharma (source of water was a publically accessible handpump which was dismantled in early 2014 since it was out of use)

Sampling frequency:

It is also seen that some of the sources were sampled at repeated intervals and some were tested only once in the entire period between Feb 2013 and April 2014. TNPCB has provided no explanation for either selecting the sampling locations or the frequency of the samples taken from the locations.

Overall, during the period between Feb 2013 and April 2014, TNPCB collected and analyzed 10 groundwater samples from M/s Chemplast Sanmar – Bore well water near VCM Tank; 9 groundwater samples from the SIPCOT Project Office; 8 water samples from Kudikadu Over Head Tank (OHT) and 7 groundwater samples from inside the premises of M/s Tagros (Near HW Storage Shed).

Only one sample each was taken from the following sites in the period between February 2013 and April 2014:

- a. Inside the premises of M/s Tagros (Near VTFD Inlet)
- b. Inside the premises of M/s SPIC campus
- c. Inside Chemplast, East of SLF
- d. Inside Chemplast, East of HW Storage Shed
- e. Inside Chemplast, West of ETP
- f. Inside Chemplast, East of VCM Storage
- g. Opposite to JK Pharma

Sample Results & Analysis:

SACEM compared all the results of the samples with the (drinking water) standards prescribed by the Bureau of Indian Standards (BIS) as the “**Requirement (Acceptable Limit) as per IS 10500, 1991 R. 1993 Ist Rev**”.

From the results of analysis of the samples, it is clear that the ground water in and around SIPCOT Industrial Complex is heavily contaminated including with carcinogens and is not suitable for drinking or other purposes involving contact with humans or cattle.

Results of one or more samples from 10 out of 11 sampling locations recorded higher than permissible levels of one or more of the following parameters:

- a) Total Dissolved Solids (TDS)
- b) Total hardness
- c) Magnesium
- d) Calcium
- e) Sulphates
- f) Chlorides
- g) pH
- h) Turbidity

This indicates that the water is hard, has high levels of salts and is not suitable for drinking purposes.

It is important to note that the two publically accessible sources of water – Kudikadu OHT and handpump opposite JK Pharma showed results higher than permissible levels of one or more of the above-mentioned parameters.

Four locations, including the overhead drinking water tank supplying water to Kudikadu village, indicated presence of high levels of carcinogens like cadmium and chromium and other toxic heavy metals like lead and iron. These locations were regularly monitored throughout the period.

Level of **Cadmium** was 5 to 128 times above permissible limits in samples collected from SIPCOT Project office; it was 3 to 125 times above limits in samples collected from Kudikadu overhead tank; it was 3 to 130 times above limits and 3- 128 times above limits in samples collected from samples collected from the premises of M/s Tagros and M/s Chemplast Sanmar respectively.

Total Chromium was 1 to 2.5 times above limits in samples collected from SIPCOT Project office; it was 1 to 2.4 times above limits in samples collected from Kudikadu OHT; it was 1.3 to 6.6 times above limits and 1.86 to 1.88 times above limits in

samples collected from the premises of M/s Tagros and M/s Chemplast Sanmar respectively.

Lead was found to be 1 to 2.5 times higher than the prescribed limits in samples from SIPCOT Project Office, M/s Tagros and M/s Chemplast Sanmar.

Health Effects of some of the chemicals found in the sample:

Cadmium – The body stores cadmium in the liver and kidneys and it is slowly excreted in urine. Eating food or drink with very high concentrations of cadmium can cause abdominal pain, nausea, vomiting and intestinal bleeding. Exposure at lower concentrations over many years can damage the kidneys, bones, lungs, liver and nervous system and may cause several types of cancer.

Eating lower levels of cadmium over a long period of time can lead to a build-up of cadmium in the kidneys. If the build-up of cadmium is high enough, it will damage the kidneys.

Exposure to lower levels of cadmium for a long time can also cause bones to become fragile and break easily.¹

Chromium – According to the Agency for Toxic Substances and Disease Registry (ATSDR), “the main health problems seen in animals following ingestion of chromium (VI) compounds are to the stomach and small intestine (irritation and ulcer) and the blood (anemia). Chromium (III) compounds are much less toxic and do not appear to cause these problems”².

Lead –Lead affects the kidneys and the central nervous system in the body. Children exposed to lead have shown a slower rate of growth and mental development. Lead also affects the IQ and induces behavioral changes in children. Children ages 6 and under are at the greatest risk. According to the US Environment Protection Agency (US EPA), “Pregnant women and nursing mothers should avoid exposure to lead to protect their children”³.

Discussion:

Right to Water is a fundamental right. Indian law also recognizes intergenerational equity as a governing principle for decision-making, particularly regarding natural resources. Intergenerational equity is a concept that says that humans 'hold the

¹ Public Health Statement for Cadmium – ATSDR
<http://www.atsdr.cdc.gov/phs/phs.asp?id=46&tid=15>

² Public Health Statement for Chromium – ATSDR
<http://www.atsdr.cdc.gov/phs/phs.asp?id=60&tid=17>

³ <http://water.epa.gov/drink/info/lead/leadfactsheet.cfm>

natural and cultural environment of the Earth in common both with other members of the present generation and with other generations, past and future'. It means that we inherit the Earth from previous generations and have an obligation to pass it on in reasonable condition to future generations⁴.

Although the problems of contamination and salinity intrusion in and around SIPCOT Industrial Complex surfaced more than two decades ago, and have been acknowledged by expert agencies like the Asian Development Bank and NEERI, no steps have been taken to curtail pollution, arrest salinization or provide permanent alternative sources of water for the affected communities.

Salinity intrusion:

As early as in 1994, the Asian Development Bank had warned of salinity intrusion in the region. "The supply of water to the industries is dependent on groundwater. Since the aquifer in the Cuddalore region is close to the coast, there is a danger of seawater intrusion to the aquifer if there is a severe depletion of its quantity without adequate recharge from other sources. This will result in deterioration of the groundwater quality. Present data show that saline intrusion has already occurred in the Cuddalore coastal area."⁵

All investments in handpumps and borewells in the area have gone to waste. Just in Sangolikuppam village, about 300 hand pumps are not in use due to saline water ingress.⁶

Despite glaring evidence of salinity intrusion, the Tamil Nadu Government is encouraging water-intensive industries and water-table depleting construction in the Cuddalore-Nagapattinam region. Some of the new industries include the Nagarjuna refinery, the SIMA textile park, and the IL&FS and SRM coal-fired thermal power plants.

Chemical pollution:

A common complaint regarding water quality relates to the colour, odour and taste of water. Residents report coloured water (yellow or dark red), water that changes colour with time and exposure to sunlight, odours (sewer, metal or aromatic substances), oily film etc from the groundwater. All these indicate the presence of chemicals in the water.

⁴ Sharon Beder, *The Nature of Sustainable Development*, 2nd edition, Scribe, Newham, Vic., 1996

⁵ ADB, June 1994. "Tamil Nadu Environmental Monitoring and Pollution Control," T.A. No. 1366-Ind, Final Report - Vol. II, Pg 4.26

⁶ Report: Status of Groundwater in Villages around SIPCOT Chemical Estate, Cuddalore – SACEM 2005
http://www.sipcotcuddalore.com/downloads/status_groundwater_around_SIPCOT.pdf

Villagers have abandoned water sources that yield water that is noticeably polluted as drinking water sources. However, many such sources continue to be used for bathing, washing or other household needs, increasing the threat of exposure to users. Residents – particularly children – complain of skin problems and constant itching. Given that there isn't even sufficient water for maintaining basic hygiene, the health status of these pollution-impacted communities is abysmal.

Presence of heavy metals like cadmium, chromium and lead in the sample results once again reaffirm the claims of chemical contamination of the groundwater.

Role of Regulatory Agencies:

TNPCB has failed in discharging its duty of regulating the industries and protecting the environment and public health. It is shocking to see that the Board is in possession of data that indicates presence of high levels of carcinogens in the water and yet has not put any advisory out notifying the public.

Out of the 11 locations samples, water from one location – Kudikadu OHT is currently being used by the residents for household cleaning, washing purposes. The results indicate that this water is laced with high levels of cadmium, chromium, iron and chlorine. It is a well known fact that chemicals like chromium and cadmium to a certain extent, get absorbed by skin when in contact, yet no notice has been issued to the residents of this area to not use the water. By possessing these facts and not acting on it, the TNPCB has knowingly allowed residents to come in contact with poisonous water.

Demands:

SIPCOT Area Community Environmental Monitors demand from the Cuddalore District Administration and the State Government for:

1. Immediate prosecution of officials of TNPCB who have allowed the poisoning of residents of Cuddalore;
2. Immediate provision of clean piped water as per WHO guidelines to SIPCOT residents;
3. Ban on discharge of industrial effluents (treated or untreated) on land within or outside the industrial premises
4. Moratorium on industrial groundwater extraction and closure of factories illegally extracting groundwater;
5. Moratorium on the setting up of polluting or water-intensive industries in SIPCOT;
6. Mandatory recycling of industrial wastewater, and replacement of existing water needs through recycled water;
7. Assessment of damage, and sources thereof, to groundwater through pollution and salinity intrusion;
8. Remediation of groundwater at polluters' expense.

Overview of violations recorded in various samples:

1. Ground water taken from the SIPCOT Project Office:

| Total samples taken in 2013-14 | 9 | Range of Over Limit |
|---------------------------------------|-------------------------|----------------------------|
| TDS | 7 out of 9 above limits | 1.152 – 2.396 |
| Total Hardness | 7 out of 9 above limits | 1.3 – 8.25 |
| Magnesium | 5 out of 9 above limits | 1.05 – 6.88 |
| Calcium | 5 out of 9 above limits | 1.04 – 4.28 |
| Chlorides | 2 out of 9 above limits | 1.28 – 5.18 |
| Total Iron | 3 out of 9 above limits | 2.39 – 2.97 |
| Residual Chlorine | 1 out of 9 above limits | 22.15 |
| Lead | 1 out of 9 above limits | 1.1 |
| Cadmium | 7 out of 9 above limits | 5.33 – 128.6 |
| Total Chromium | 2 out of 9 above limits | 1.12 – 2.56 |
| Turbidity | 3 out of 6 above limits | 2 |

2. Sample Results from Kudikadu OHT:

| Total samples taken in 2013-14 | 8 | Range of Over Limit |
|---------------------------------------|-------------------------|----------------------------|
| TDS | 3 out of 8 above limits | 1.008 – 1.768 |
| Total Hardness | 5 out of 8 above limits | 1.5 – 6.55 |
| Magnesium | 1 out of 8 above limits | 1.45 |
| Calcium | 4 out of 8 above limits | 1.01 – 6.41 |
| Sulphate | 1 out of 8 above limits | 1.53 |
| Total Iron | 2 out of 8 above limits | 1.78 – 2.68 |
| Residual Chlorine | 1 out of 8 above limits | 4.45 |
| Cadmium | 6 out of 8 above limits | 3.66 – 125.66 |
| Total Chromium | 3 out of 8 above limits | 1.04 – 2.44 |
| Turbidity | 5 out of 6 above limits | 2 |

3. Sample results from inside the premises of M/s Tagros (Near HW Storage Shed):

| Total samples taken in 2013-14 | 7 | Range of Over Limit |
|---------------------------------------|-------------------------|----------------------------|
| pH | 3 out of 7 above limits | Indicate acidic water |
| TDS | 5 out of 7 above limits | 1.512 – 4.806 |
| Total Hardness | 4 out of 7 above limits | 1.05 – 6.75 |
| Magnesium | 2 out of 7 above limits | 1.26 – 1.63 |
| Calcium | 3 out of 7 above limits | 1.22 – 7.05 |
| Total Iron | 1 out of 7 above limits | 40 |
| Lead | 1 out of 7 above limits | 1.2 |

| | | |
|----------------|-------------------------|------------|
| Cadmium | 6 out of 7 above limits | 3 – 130 |
| Total Chromium | 3 out of 7 above limits | 1.3 – 6.64 |
| Turbidity | 3 out of 6 above limits | 2 |

4. Sample result from M/s Chemplast Sanmar – Bore well water near VCM Tank

| Total samples taken in 2013-14 | 10 | Range of Over Limit |
|---------------------------------------|--------------------------|----------------------------|
| pH | 1 out of 10 above limits | Indicate acidic water |
| TDS | 4 out of 10 above limits | 1.008 – 3.168 |
| Total Hardness | 8 out of 10 above limits | 1.06 – 7.75 |
| Magnesium | 7 out of 10 above limits | 1.03 – 6.73 |
| Calcium | 2 out of 10 above limits | 2.4 – 3.84 |
| Chloride | 2 out of 10 above limits | 1.05 – 2.12 |
| Total Iron | 1 out of 10 above limits | 2.05 |
| Lead | 1 out of 10 above limits | 2.4 |
| Cadmium | 6 out of 10 above limits | 3 – 128 |
| Total Chromium | 2 out of 10 above limits | 1.86 – 1.88 |
| Turbidity | 3 out of 8 above limits | 2 |

5. Sample results from inside the premises of M/s Tagros (Near VTFD Inlet):

| Total samples taken in 2013-14 | 1 |
|---------------------------------------|-------------------------------------|
| | Number of time of Over Limit |
| pH | Indicate acidic water |
| TDS | 966.4 |
| Total Hardness | 8.95 |
| Magnesium | 7.87 |
| Calcium | 4.38 |
| Chloride | 331.6 |
| Sulphate | 192.1 |
| Fluoride | 1.1 |

6. Sample results from inside the premises of M/s SPIC campus:

| Total samples taken in 2013-14 | 1 |
|---------------------------------------|-------------------------------------|
| | Number of time of Over Limit |
| TDS | 1.45 |

7. Sample results from Opp to JK Pharma

| | |
|---------------------------------------|-------------------------------------|
| Total samples taken in 2013-14 | 1 |
| | Number of time of Over Limit |
| pH | Indicate acidic water |
| TDS | 2.184 |
| Total Hardness | 3.17 |
| Magnesium | 2.43 |
| Calcium | 1.77 |
| Chloride | 1.18 |
| Sulphate | 2.2 |
| Total Iron | 17.76 |

8. Sample result from Inside Chemplast, East of SLF:

| | |
|---------------------------------------|-------------------------------------|
| Total samples taken in 2013-14 | 1 |
| | Number of time of Over Limit |
| TDS | 1.392 |
| Total Hardness | 1.81 |
| Magnesium | 1.56 |
| Lead | 1.2 |

9. Sample result from Inside Chemplast, East of HW Storage Shed:

| | |
|---------------------------------------|-------------------------------------|
| Total samples taken in 2013-14 | 1 |
| | Number of time of Over Limit |
| TDS | 1.056 |
| Total Hardness | 1.68 |
| Calcium | 1.32 |
| Lead | 1.2 |

10. Sample result from Inside Chemplast, West of ETP:

| | |
|---------------------------------------|-------------------------------------|
| Total samples taken in 2013-14 | 1 |
| | Number of time of Over Limit |
| TDS | 1.12 |
| Lead | 1.1 |