

# **COMMENT**

## **Industry Indicts Itself**

**A Comment on Air Quality Analyses Conducted by SIPCOT  
Industries of Ambient Air in SIPCOT**

**By**

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## Introduction

Between 25 and 28 November, 2004, Shiva Analyticals (India) Ltd carried out 8-hour high-volume sampling of ambient air at 10 locations in and around SIPCOT Industrial Estate, Cuddalore. The exercise was carried on behalf of and at the cost of the Cuddalore SIPCOT Industries Association (CSIA). Shiva Analyticals' findings contained in "A Report on Ambient Air Quality in and around SIPCOT Industrial Complex, Cuddalore" corroborates findings by the SIPCOT Area Community Environmental Monitoring that the ambient air in SIPCOT is dangerously polluted.

In September 2004, SIPCOT Area Community Environmental Monitoring released Cuddalore's first ambient air quality report – titled "Gas Trouble" -- documenting toxic gases in the air breathed by residents of SIPCOT. The report, which was based on five grab samples, found 22 toxic chemicals of which 13 were raw materials used in one or more SIPCOT industries. SACEM's report too detected high levels of chloroform, among other chemicals, in the ambient air. At least 14 out of 22 chemicals found in SIPCOT air by SACEM violated US EPA Region 6 effects screening levels.

India has no standards for toxic VOC and sulphur-based gases. In the absence of such standards, communities living alongside industries continue to be gassed by industries. In September 2004, the Supreme Court Monitoring Committee instructed the Central Pollution Control Board to develop such standards, and to use US EPA norms until the standards are developed. Also, responding to the report, the Supreme Court Monitoring Committee directed the Tamilnadu Pollution Control Board to bring ambient air quality in line with USEPA norms by December 31, 2004.

The TNPCB sought and obtained an extension till 30 June, 2005. As of July 15, 2005, SACEM has no knowledge of any effort made by TNPCB to assess the air quality in SIPCOT for the presence and characterisation of toxic gases. However, in its press release of May 11, the TNPCB maintains that the air in SIPCOT is safe without providing any basis to counter SACEM's findings.

As recently as July 6, CSIA has said that SIPCOT air is safe and breathable. Interestingly, the Association does not refer to the findings of the above study that was commissioned by it.

## The Shiva Study

The following parameters were analysed:

- |                        |                       |
|------------------------|-----------------------|
| ▪ SPM                  | ▪ Formaldehyde        |
| ▪ RSPM                 | ▪ Ethyl Alcohol       |
| ▪ NOx                  | ▪ Acetyl Chloride     |
| ▪ SO2                  | ▪ Triethylamine       |
| ▪ Fluoride             | ▪ Trichloroethylene   |
| ▪ Acetone              | ▪ Toluene             |
| ▪ Methanol             | ▪ Methylene Chloride  |
| ▪ Chloroform           | ▪ Hydrogen Sulphide   |
| ▪ Carbon tetrachloride | ▪ n-Hexane            |
| ▪ Isobutylene          | ▪ Isopropyl Alcohol   |
| ▪ Acrolein             | ▪ Methyl Ethyl Ketone |
| ▪ Acrylonitrile        | ▪ Acetonitrile        |
| ▪ Acetaldehyde         | ▪ 1,2, Dichloroethane |

The sampling locations were selected by Cuddalore SIPCOT Industries Association (CSIA).

- Top of Tagros Security room-West gate
- Vanavil factory premises – Top of fire hydrant pump house room
- Top of Kudikadu Panchayat School
- Shasun Chemicals SW corner
- SIPCOT borewell no:7

- Selvam house Echankadu (sic) Village
- Top of SIPCOT Office
- CUSECS pump house-2, Opp. to EB sub station
- Sonanchavadi village
- Top of Tamilnadu Hotel, Opp. to Bus Terminal – Cuddalore

### **Highlights:**

CSIA's report finds that "all routine parameters are within the limits as per CPCB Limits. However the comparison indicates that the levels of VOCs are well within the limits as per Indian and International OSHA and EPA standards in most of the component and locations. CSIA may study for the reasons for the deviations in few cases."

However, even going by the standards used by Shiva for comparing the SIPCOT air findings, the levels of VOCs and sulphur compounds found in the Shiva study are more than mere "deviations in few cases." Shiva has compared the findings with the US EPA Reference Concentration (RfC)<sup>1</sup> levels. The Bangalore-based laboratory analysed for 21 chemicals, including 20 VOCs and Hydrogen Sulphide. Some additional parameters were also analysed, but this report is restricted to detection of toxic gases -- VOCs and sulphur-based. The CSIA report does not test for 11 chemicals that were detected in the 9 samples taken by SACEM using the bucket technique.

### **Comparison with RfC as per Shiva Analyticals' report**

The following is a summary of findings of the CSIA study of SIPCOT air as per Shiva's own reference standard:

1. 13 out of 20 VOCs tested were found in the air. Eight of the chemicals detected by Shiva were also detected by SACEM.
2. The levels of 8 VOCs exceed the US EPA Reference Concentration levels
  - Acetonitrile exceeded safe levels in 8 out of 10 samples.
  - Chloroform exceeded safe levels in 6 out of 10 samples. The sample from "Top of Tagros Security-West room" exceeded the screening level by a factor of 22.
  - Acrylonitrile found in the sample from Top of Tagros Security-West room exceeded the screening levels by a factor of 70.
  - Triethylamine found in the sample from atop the SIPCOT Borewell No 7 exceeded the screening levels by a factor of 91.

*Chloroform and Acrylonitrile are known or suspected human or animal carcinogens*

3. 11 out of 13 chemicals found are also used raw materials in one or more SIPCOT industries.
4. At least 6 of the chemicals found are known to cause cancer in animals and are potential human carcinogens.
5. Out of the 13 chemicals found - 11 target eyes, 10 target the skin, 9 target the respiratory system and the Central Nervous System, 8 target the kidneys, 7 target the liver, 6 target Cardio Vascular System and 1 targets the reproductive system and the gastrointestinal system (Refer Annexure 1).

### **Comparison with US EPA Region 6 effects screening levels as per SACEM procedures**

- The levels of 9 VOCs exceed US EPA Region 6 Screening Levels.
- Chloroform exceeded safe levels as prescribed by US EPA in 6 out of 10 samples. The levels were between 3346 and 19,429 times higher than safe levels. The sample from "Top of Tagros Security-West room" exceeded the screening level by a factor of 19429.

- Acrylonitrile found in the sample from Top of Tagros Security-West room exceeded the screening levels by a factor of 6008.
- 1, 2-Dichloroethane found in the sample from Shasun Chemicals SW corner exceeded the screening levels by a factor of 194.
- Trichloroethylene found in the sample from Sonanchavadi village exceeded the screening levels by a factor of 1237.

*All the above chemicals are known or suspected human or animal carcinogens.*

**Conclusion:**

CSIA's report confirms that the VOCs in SIPCOT air are clearly above dangerous limits rendering the air unsafe for the residents. Vulnerable populations, including women, children and the elderly, are particularly at threat. The Government has a duty to protect its citizens from known dangers. The very presence, leave alone the high levels, of VOCs and sulphur gases in the air breathed by residents are unacceptable. Chloroform, a carcinogen, was detected in excess of 19000 times above safe levels.

CSIA's report also confirms SACEM's bucket findings that SIPCOT air is grossly polluted and unfit to breathe. Under the circumstances, any plan to increase the toxic load in the region is tantamount to intentional poisoning of communities by the state.

**SACEM demands that:**

- a) The TNPCB take steps to eliminate air pollution, particularly due to toxic gases such as VOCs and sulphur compounds, with the involvement of the Cuddalore Local Area Environmental Committee, and local communities.
- b) The Tamilnadu Government should withdraw all proposals for polluting industries in SIPCOT Cuddalore, and should allow only non-polluting industries in the region.

**Analysis of the chemicals found in the air samples, comparisons to the USEPA Reference Concentration levels and the USEPA Region 6 Health based screening levels.**

NOTE: The units of the chemicals have been converted from **mg/m3** to **ppb** for comparisons with the USEPA Region 6 levels. The units are converted using this formula

$$\text{ppb} = \frac{\text{mg/m}^3 \times 24.45}{\text{Molecular weight of the chemical}} \times 1000$$

**Sample 1:**

**Location:** Top of Tagros Security room-West gate

**Date of Sampling:** 26.11.2004

**Time of Sampling:** 4:30 pm to 12:30 am

**Duration of Sampling:** 8 hours

S No.	Parameter	Results mg/m3	RfC as per US EPA (mg/m3)	No. of times it exceeds the screening levels (approx)	Result (ppb)	EPA Region 6 Screening Level (ppb)	No. of times it exceeds the screening levels (approx)
1.	Acetone	1.82016	370	--	768	308	2.5
2.	Toluene	0.06786	0.4	--	18	--	
3.	n-Hexane	0.01412	0.2	--	4	--	
4.	Chloroform	6.6057	0.3	22	1362	0.0701	19429
5.	Methylene Chloride	0.03123	0.004	7.8	9	3.42	2.6
6.	Acetonitrile*	0.0664	0.06	1.1	40	--	
7.	Triethylamine	0.42642	0.007	60.9	103	6.09	17
8.	Isobutylene	5.496	NA	--	2400	--	
9.	Acrylonitrile	0.14	0.002	70	140	0.0233	6008

\*Violates Texas Long Term Screening Levels

**Sample 2:**

**Location:** Vanavil factory premises – Top of fire hydrant pump house room

**Date of Sampling:** 27.11.2004

**Time of Sampling:** 4:00 pm to 12:00 am

**Duration of Sampling:** 8 hours

S No.	Parameter	Result mg/m3	RfC as per US EPA (mg/m3)	No. of times it exceeds the screening levels (approx)	Result (ppb)	EPA Region 6 Screening Level (ppb)	No. of times it exceeds the screening levels (approx)
1.	Trichloroethylene	0.06444	0.06	1	12	0.918	13
2.	Toluene	0.0377	0.4	--	10	--	
3.	n-Hexane	0.00706	0.2	--	2	--	
4.	Acetonitrile	1.4442	0.06	24	87	51.7	1.6
5.	Isobutylene	0.1832	NA	--	80	--	

**Sample 3:****Location:** Top of Kudikadu Panchayat School**Date of Sampling:** 26.11.2004**Time of Sampling:** 9:30 pm to 5:30 am**Duration of Sampling:** 8 hours

S No.	Parameter	Result mg/m3	RfC as per US EPA (mg/m3)	No. of times it exceeds the screening levels (approx)	Result (ppb)	EPA Region 6 Screening Level (ppb)	No. of times it exceeds the screening levels (approx)
1.	Toluene	0.06786	0.4	--	18	--	
2.	n-Hexane	0.00353	0.2	--	1	--	
3.	Isobutylene	0.5496	NA	--	240	--	

**Sample 4:****Location:** Shasun Chemicals SW corner**Date of Sampling:** 27.11.2004**Time of Sampling:** 5:00 pm to 6:30 am (In between 5 hrs. 30 minutes equipment is stopped)**Duration of Sampling:** 8 hours

S No.	Parameter	Result mg/m3	RfC as per US EPA (mg/m3)	No. of times it exceeds the screening levels (approx)	Result (ppb)	EPA Region 6 Screening Level (ppb)	No. of times it exceeds the screening levels (approx)
1.	Acetone	0.34839	370	--	147	--	
2.	Toluene	0.03393	0.4	--	9	--	
3.	n-Hexane	0.00353	0.2	--	1	--	
4.	Chloroform	1.9885	0.3	6.6	410	0.0701	5848
5.	1,2-Dichloroethane	0.0486	0.4		12	0.0617	194
6.	Acetonitrile	0.08798	0.06	1.4	53	51.7	1.02
7.	Triethylamine*	0.01656	0.007	2.3	4	--	
8.	Isobutylene	0.1603	NA	--	70	--	

\*Violates Texas Long Term Screening Levels

**Sample 5:****Location:** SIPCOT borewell no: 7**Date of Sampling:** 28.11.2004**Time of Sampling:** 2:15 pm to 10:15 pm**Duration of Sampling:** 8 hours

S No.	Parameter	Result mg/m3	RfC as per US EPA (mg/m3)	No. of times it exceeds the screening levels (approx)	Result (ppb)	EPA Region 6 Screening Level (ppb)	No. of times it exceeds the screening levels (approx)
1.	Acetone	0.29625	370	--	125	--	
2.	Toluene	0.29783	0.4	--	79	--	
3.	n-Hexane	0.01059	0.2	--	3	--	
4.	Chloroform	1.32405	0.3	4.4	273	0.0701	3894

5.	Methylene chloride	0.02082	0.004	5.2	6	3.42	1.75
6.	Acetonitrile*	0.0747	0.06	1.2	45	--	
7.	Triethylamine	0.6417	0.007	91.6	155	6.09	25
8.	Isobutylene	1.145	NA	--	500	--	

\*Violates Texas Long Term Screening Levels

**Sample 6:**

**Location:** Selvam house Echankadu Village

**Date of Sampling:** 27.11.2004

**Time of Sampling:** 3:50 pm to 11:50 pm

**Duration of Sampling:** 8 hours

S No.	Parameter	Result mg/m3	RfC as per US EPA (mg/m3)	No. of times it exceeds the screening levels (approx)	Result (ppb)	EPA Region 6 Screening Level (ppb)	No. of times it exceeds the screening levels (approx)
1.	Toluene	0.04901	0.4	--	13	--	
2.	1,2 Dichloroethane	0.04455	0.4	--	11	0.0617	178
3.	Isobutylene	0.2977	NA	--	130	--	

**Sample 7:**

**Location:** Top of SIPCOT Office

**Date of Sampling:** 26.11.2004

**Time of Sampling:** 6:00 pm to 2:00 am

**Duration of Sampling:** 8 hours

S No.	Parameter	Result mg/m3	RfC as per US EPA (mg/m3)	No. of times it exceeds the screening levels (approx)	Result (ppb)	EPA Region 6 Screening Level (ppb)	No. of times it exceeds the screening levels (approx)
1.	Toluene	0.04901	0.4	--	13	--	
2.	Acetone	0.62094	370	--	262	--	
3.	n-Hexane	0.00353	0.2	--	1	--	
4.	Chloroform	2.25525	0.3	7.5	465	0.0701	6633
5.	Acetonitrile	0.10126	0.06	1.6	61	51.7	1.17
6.	Triethylamine	0.00828	0.007	1.1	2	--	
7.	Isobutylene	1.8091	NA	--	790	--	

**Sample 8:****Location:** CUSECS pump house-2, Opp. to EB sub station**Date of Sampling:** 28.11.2004**Time of Sampling:** 1:30 pm to 9:30 pm**Duration of Sampling:** 8 hours

S No.	Parameter	Result mg/m3	RfC as per US EPA (mg/m3)	No. of times it exceeds the screening levels (approx)	Result (ppb)	EPA Region 6 Screening Level (ppb)	No. of times it exceeds the screening levels (approx)
1.	Toluene	0.01131	0.4	--	3	--	
2.	Trichloroethylene	0.0537	0.06	--	10	0.918	10.8
3.	Acetone	9.954	370	--	4200	308	14
4.	n-Hexane	0.00706	0.2	--	2	--	
5.	Chloroform	1.53745	0.3	5.1	317	0.0701	4522
6.	Acetonitrile	0.13778	0.06	2.2	83	51.7	1.60
7.	Isobutylene	0.229	NA	--	100	--	

**Sample 9:****Location:** Sonanchavadi village**Date of Sampling:** 27.11.2004**Time of Sampling:** 7:30 pm to 3:30 am**Duration of Sampling:** 8 hours

S No.	Parameter	Result mg/m3	RfC as per US EPA (mg/m3)	No. of times it exceeds the screening levels (approx)	Result (ppb)	EPA Region 6 Screening Level (ppb)	No. of times it exceeds the screening levels (approx)
1.	Toluene	0.05655	0.4	--	15	--	
2.	Acetone	0.17064	370	--	72	--	
3.	n-Hexane	0.00706	0.2	--	2	--	
4.	Chloroform	1.1446	0.3	3.8	236	0.0701	3366
5.	Acetonitrile	0.09628	0.06	1.6	580	51.7	11
6.	Isobutylene	0.3435	NA	--	150	--	
7.	Trichloroethylene	0.19332	0.06	3.2	36	0.918	1237

**Sample 10:****Location:** Top of Tamilnadu Hotel, Opp. to Bus Terminal – Cuddalore**Date of Sampling:** 28.11.2004**Time of Sampling:** 4:40 pm to 12:40 am**Duration of Sampling:** 8 hours

S No.	Parameter	Result mg/m3	RfC as per US EPA (mg/m3)	No. of times it exceeds the screening levels (approx)	Result (ppb)	US EPA Region 6 Screening Level (ppb)	No. of times it exceeds the screening levels (approx)
1.	Toluene	0.0754	0.4	--	20	--	
2.	Acetone	0.01659	370	--	7	--	



3.	n-Hexane	0.01059	0.2	--	3	--	
4.	Methanol	0.1179	10	--	90	--	
5.	Acetaldehyde	6.3	0.009	700	3500	0.726	4820
6.	1,2-Dichloroethane	0.01215	0.4	--	3	0.0617	49
7.	Trichloroethylene	1.36935	0.06	22.8	255	0.918	278
8.	Acetonitrile	0.2324	0.06	3.8	140	51.7	2.7

### Results of the 8 hour analysis compared with the grab samples

Chemicals found in 8 hour sampling at different locations	Chemicals found in grab sampling at different locations	Carcinogen
Acetone	Acetone	No
Toluene	Toluene	No
n-Hexane	n-Hexane	No
Chloroform	Chloroform	Yes
Methylene Chloride	Methylene Chloride	Yes
Acetonitrile	Acetonitrile	No
Triethylamine	<i>Not tested for</i>	No
Isobutylene	<i>Not tested for</i>	--
Acrylonitrile	<i>Not found</i>	Yes
Trichloroethylene	Trichloroethene	Yes
1,2-Dichloroethane	1,2-Dichloroethane	Yes
Methanol	<i>Not tested for</i>	No
Acetaldehyde	<i>Not tested for</i>	Yes
<i>Not found</i>	Hydrogen sulphide	No
<i>Not tested for</i>	Methyl mercaptan	No
<i>Not tested for</i>	Dimethyl disulphide	No
<i>Not tested for</i>	Ethanol	No
<i>Not found</i>	Isopropyl alcohol	No
<i>Not found</i>	Carbon tetrachloride	Yes
<i>Not tested for</i>	n-Butyl acetate	No
<i>Not tested for</i>	Carbon disulphide	No

<i>Not tested for</i>	Vinyl chloride	Yes
<i>Not tested for</i>	Bromomethane	Yes
<i>Not tested for</i>	Benzene	Yes
<i>Not found</i>	Acrolein	No
<i>Not tested for</i>	Vinyl acetate	Yes
<i>Not found</i>	2-Butanone (MEK)	No
<i>Not tested for</i>	4-Methyl-2-Pentanone	No
<i>Not tested for</i>	m, p-Xylenes	No

## Annexure 1

### FACT SHEET ON CHEMICALS FOUND IN THE SAMPLES

S No	Chemical found	Odour	Health Effects	Target Organs	Carcinogen
1.	Acetone	A fragrant, mint-like odour	Irritation eyes, nose, throat; headache, dizziness, Central Nervous System depression; skin diseases	Eyes, skin, respiratory system, central nervous system	No
2.	Toluene	Sweet pungent benzene like odour	Irritation of eyes, nose, weakness and exhaustion, confusion, euphoria, dizziness, headache, tears to eyes, anxiety, muscle fatigue, liver injury, kidney damage	Eyes, skin, respiratory system, Central nervous system, liver and kidney	No
3.	n-Hexane	Gasoline like odour	Irritation of eyes, nose, nausea, headache, numbness, extremities, muscle weakness, dermatitis, dizziness, chemical pneumonia	Eyes, skin, respiratory system, Central Nervous System	No
4.	Chloroform	Pleasant odour	Irritation of eyes, skin; dizziness, mental dullness, nausea, confusion; headache, weakness, exhaustion; enlarged liver	Liver, kidneys, heart, eyes, skin, Central nervous system <b>Cancer Site:</b> [in animals: liver and	Yes

			[potential carcinogen]	kidney cancer]	
5.	Methylene Chloride	Faint sweet odour	Irritation eyes, skin; weakness, exhaustion, drowsiness, dizziness; numbness, tingle limbs; nausea; [potential occupational carcinogen]	Eyes, respiratory system  <b>Cancer Site:</b> [in animals: lung, liver, salivary & mammary gland tumours]	Yes
6.	Acetonitrile	Aromatic odour	Irritation nose, throat; nausea, vomiting; chest pain; weakness, exhaustion; convulsions; in animals: liver, kidney damage	Respiratory system, cardiovascular system, central nervous system, liver, kidneys	No
7.	Triethylamine	A strong, ammonia-like odour	Irritation eyes, skin, respiratory system; in animals: kidney, liver damage	Eyes, skin, respiratory system, cardiovascular system, liver, kidneys	No
8.	Isobutylene	NA	NA	NA	NA
9.	Acrylonitrile	An unpleasant odour	Irritation eyes, skin; headache; sneezing; nausea, vomiting; weakness, exhaustion, dizziness; [potential occupational carcinogen]	Eyes, skin, cardiovascular system, liver, kidneys, central nervous system  <b>Cancer Site</b> [brain tumours, lung & bowel cancer]	Yes
10.	Trichloroethylene	Chloroform	Irritation of eyes and	Eyes, skin, respiratory	Yes

		like odour	skin; headache, visual disturbances, weakness and exhaustion, dizziness, tremor, drowsiness, nausea, vomiting, liver injury, carcinogen	system, heart, liver, kidneys <b>Cancer Site:</b> [in animals: liver and kidney cancer]	
11.	1,2-Dichloroethane	Chloroform like odour	Irritation eyes; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]	Eyes, skin, kidneys, liver, central nervous system, cardiovascular system <b>Cancer Site</b> [in animals: fore-stomach, mammary gland & circulatory system cancer]	Yes
12.	Methanol	Characteristic pungent odour	Irritation eyes, skin, upper respiratory system; headache, drowsiness, dizziness, nausea, vomiting; visual disturbance, blindness; dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract	No
13.	Acetaldehyde	A pungent, fruity odour	Irritation eyes, nose, throat; eye, skin burns; conjunctivitis; cough; central nervous system depression; in animals: kidney, reproductive effects; [potential occupational carcinogen]	Eyes, skin, respiratory system, kidneys, central nervous system, reproductive system <b>Cancer Site</b> [in animals: nasal cancer]	Yes

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<sup>i</sup> **Reference Concentration (RfC)** means an estimate of a daily exposure, in units of milligrams of chemical per cubic meter of air ( $\text{mg}/\text{m}^3$ ), to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a portion of a lifetime (up to approximately seven years, sub chronic) or for a lifetime (chronic).