

Chemical Odour Incidents in SIPCOT Industrial Area, Cuddalore

SIPCOT Area Community Environmental Monitor

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Introduction

For at least 20 years, residents living in and around SIPCOT chemical industrial estate, Cuddalore, have complained of a variety of illnesses related to industrial pollution in general, and the poor air quality in particular. Regulatory authorities have dismissed these claims without offering any scientific bases or air quality data for doing so. In the absence of regulatory oversight, chemical companies too have seen no reason to curb emissions of harmful chemicals.

Between April and July 2004, SIPCOT Area Community Environmental Monitors (SACEM) conducted an indicative study of chemical odour incidents in which they recorded 283 instances of odorous emissions; 223 of these were of severe intensity. The study used simple documenting techniques based on the sensory perceptions of Community Environmental Monitors and discussions among the monitors to evolve common evaluation and documentation criteria to generate air quality and trend data.

It also provides a conclusive case for the need for remedial action and continuous monitoring of air quality for toxic gases in SIPCOT by the Tamilnadu Pollution Control Board.

The study recorded 36 different types of chemical odours, and 30 health symptoms associated with them. The report also found that serious odour incidents tended to happen more frequently in the evenings and night (85 % of total reported incidents as opposed to 75 percent between 12 midnight and 6 a.m.) corroborating long-standing claims by the resident community about an increase in noxious industrial emissions at night.

Monitors report the following chemical odours as characteristic of some of the units in the SIPCOT area – public toilet smell or the smell of human excreta associated with SPIC Mitocon; decaying corpse or burning dead body smell from with Pioneer Miyagi; hospital smell and sweetish sugarcane-like smell with Tagros; chikkoo smell from Asian Paints. Other companies like Shasun -- also named by monitors as a serious air polluter -- emit a wide variety of chemical odours.

In 2003, the Indian People's Tribunal (IPT) headed by Justice (Retd) J. Kanakaraj reported "a noticeable stench of chemicals in the air around SIPCOT, a 'sort of suffocating and choking atmosphere.'" The IPT report goes on to say that "Villages such as Kudikadu, Thaikal, Eachangadu and Sonnanchavadi lie in a virtual "gas chamber" surrounded on three sides by chemical factories and bounded on the fourth by the river."¹

The Health section of the IPT report analyses and summarises complaints by villagers to the tribunal members about the effects of pollution in their villages: "Children in the villages, women claim, are prone to frequent illnesses. Headaches, fevers, cold and cough, skin diseases, intelligence deficits, listlessness and developmental problems ranked among the most frequent complaints made by village women regarding their children's health. The women say the health of their children improves remarkably when they leave their villages."

¹ "Indian People's Tribunal Report on Human Rights Violation, Industrial Pollution and Implications of the Proposed Chemplast Sanmar PVC Factory in SIPCOT, Cuddalore, T.N." July 2003 [Indian People's Tribunal on Human Rights and the Environment, Mumbai]

A testimony of a resident of Eachangadu is telling: "At night, the stench engulfs us. We just can't breathe. There's nothing we can do except go indoors and shut all the doors. We can't bear it. Our eyes burn. We feel like somebody is tearing them, and our chest feels suffocated every time the wind brings the smell."²

Regulatory authorities perceive odour as a "nuisance." However, it is a fact that chemical odour is often an indicator of pollution. The chemical industries in SIPCOT use a variety of chemicals that can be distinguished by their odours. Toluene, for instance, has a sweet, pungent odour; nitrobenzene has a shoe-polish like odour. [Refer Annexure 1 for "List of Commonly Used Chemicals in SIPCOT, Their Odours and Related Health Effects"]

To explore the link between commonly reported chemical odour incidents and toxic gases and volatile organic compounds like toluene, the SACEM have also taken ambient air samples in and around SIPCOT, Cuddalore, as part of their routine environmental monitoring. The analytical results of these samples will be released separately in September 2004.

Meanwhile, this study conclusively establishes the frequent occurrence of chemical odour incidents in and around the SIPCOT industrial area in Cuddalore.

Methodology:

The study records a snapshot of the odour incidents that occurred in SIPCOT industrial complex over the study period.

1. SACEM were trained in the importance of recording chemical odour incidents, and paying attention to parameters such as wind direction, and monitor's location in relation to industrial sources. These parameters were used to assess the integrity of the completed data sheet. For example, sheets indicating that the monitor recorded the chemical odour at a distance upwind of industrial sources rather than downwind of them were discarded. Out of 305 completed data sheets, 22 sheets were not usable.
1. Chemical odour incidents were first recorded collectively to standardise responses and odour intensities, and to generate a list of common odours. This exercise involved taking the group of monitors to various locations in and around SIPCOT. The chemical odour at any location neighboring and downwind of CUSECS No. 5 was used as a benchmark of 10. CUSECS 5 is a common effluent collection point, and is characterized day-long by intense odours. Total absence of odour, at a location removed from SIPCOT or other noticeable pollution sources such as highways, was used to benchmark a chemical odour rating of "0." Monitors engaged in group exercises by simultaneous show of rating at different locations within SIPCOT. A similar exercise was done where monitors were asked to describe chemical odours.

² Indian People's Tribunal Report, July 2003. pg. 24 [Indian People's Tribunal on Human Rights and the Environment, Mumbai]

Chemical odours with ratings at or above 5 were considered to be of “high intensity” or “serious incidents.” Chemical odours with ratings below 5 were considered “low intensity” or “minor incident.” The object of the study was not to accurately pinpoint the exact odour intensity. Rather it is to be able to distinguish serious odour incidents from less intense ones. [See section on limitations] The existence of chemical odour and its intensity (high or low) can be irrefutably recorded through this exercise.

1. A “Chemical Odour Incident Monitoring Questionnaire” was developed, pre-tested and revised over a period of one month (March 2004) by the SACEM, with inputs from technical advisors. Data from this period for the study was not used as the data sheets were being fine-tuned for integrity and detail.
1. Monitors were required to record notable odour incidents encountered by them as they went about their lives – working, going from place to place, resting at home etc. The study period was from 1 April, 2004 to 10 July, 2004. The completed questionnaires were collected at intervals of ten days at regular meetings, discussed and added to the database. [Refer Annexure 4 for “Questionnaire for Chemical Odour Incident Monitoring.”]
1. Because monitors tended to record most of the incidents during their work day, fewer incidents have been recorded between 6 p.m. and 12 midnight. The period 12 midnight to 6 a.m. includes many recordings made by two monitors who are river fishermen who set out to fish in the early hours of the day.
1. Monitors also conducted pollution patrols around the industrial estate 2-3 times a month. Information from pollution patrols included data on chemical odour incidents. This too was incorporated in the report along with the daily recordings.

Limitations of the Study

The Chemical Odour Incident Monitoring Study is an indicative study with a number of data items where subjectivity has intentionally not been eliminated. The fact that the study emphasizes individual sensory perceptions as the primary recording tool offers inherent advantages and limitations. For instance, two monitors may experience the same chemical odour by recording a similar kind of odour but with different intensities. Differences in recording of odour intensities could occur because of differences in individual sensory perceptions or temporary dampening of the ability to smell because of exposure to certain chemicals such as some mercaptans. Similarly, some individuals are more sensitive to chemicals than others, and may exhibit more symptoms or more intense symptoms.

While the inferences from this study are concrete, they represent only a conservative estimate because the study is not a systematic one of all chemical odour incidents covering the entire geographical spread of SIPCOT. The authors intend the current report to serve as a pilot for a more systematic chemical odour monitoring study.

Findings

In a 14-week period between April and July, 2004, SIPCOT Area Community Environmental Monitors recorded at least 305 chemical odour incidents indicative of air pollution, out of which the data sheets for 22 were discarded and not included in this research. The 283 incidents considered for this study represent merely a small subset of the total number of odour incidents or emissions that may have occurred in SIPCOT during the study period.

~ The chemical odour incidents occurring at the industries in SIPCOT are noticeable even outside the factory boundaries. **All 283 incidents were recorded outside the factory premises** and from places in or near residential areas or thoroughfares. Some common locations include – the river Uppanar, the Cuddalore – Chidambaram National Highway, Sonnanchavadi village in the southern part of the industrial area, Tamil Nadu Electricity Board office in Semmankuppam, telephone exchange, SIPCOT phase II, SIPCOT police station, Karaikadu cinema theatre etc. Incidents were also recorded from Eachangadu, Kudikadu, Karaikadu, Semmankuppam, and Sangolikuppam villages.

~ Out of 283 recordings of odour incidents, **223 (79 %) are incidents of “serious intensity.”**

~ The odour incidents are spread almost equally throughout the day. The proportion of intense incidents tended to be **higher between 12 noon and midnight** (84 percent during this period of the day as compared to 75 percent between 12 midnight and 12 noon).

Table 1: Frequency of Intense Incidents by Time of Day

Time	Total Incidents	Intense Incidents
12 midnight to 6 a.m.	70	53 (76%)
6 a.m. to 12 noon	90	67 (75%)
12 noon to 6 p.m.	79	67 (85%)
6 p.m. to 12 midnight	44	36 (81%)
Total	283	223 (79%)

~ Monitors reported **36 different kinds of chemical odours** during the study period. The sources of some chemical odours were easily traceable to certain units. For example:

- ~ “chikoo smell” is specifically from Asian Paints;
- ~ “dead body or burning corpse” smell from Pioneer Miyagi Chemicals;
- ~ “hospital smell” from Tagros Chemicals;

“urine” or “public toilet smell” from Mitocon/SPIC Pharma unit.

Other common chemical odours reported are: acid, burnt curry, sour, rotten eggs, rotten fruits, nail paint, chilli powder, decaying corpse, sulphur, ammonia, sweet sugarcane-like smell, fire crackers, neem cake, kerosene, fruit juice, spoilt flour, dead animal, mosquito coil smell, sewer smell etc. [Refer Annexure 2 for “List of Recorded Chemical Odours of Industrial Origin”]

SPIC Mitocon, Asian Paints (Penta division), Pioneer Miyagi, Shasun Chemicals, Tagros, Bayer/Atofina complex and Tantech were noted frequently as the source of chemical odours by the monitors. However, barring the instances where such identification is associated with familiar characteristic chemical odours (described above), the study methodology does not allow for accurate pinpointing of odour sources.

Table 2: Frequency of odour incidents by source (as recorded)

Name of Company	Frequency of Reported Odour Incidents	Percentage of total
Pioneer Miyagi	84	30
SPIC	45	16
Bayer/Atofina	38	13
Shasun Chemicals	36	13
Asian Paints	31	11
Tantech	26	9
Tagros	12	4
Others	11	4

Monitors reported **30 different symptoms** associated with the chemical odour incidents. The most common symptoms recorded include headache, vomiting sensation, stomach discomfort, nausea, dizziness, eye burning and watering of eyes, throat irritation and throat constriction, breathing trouble, and suffocation. In two serious instances, monitors reported “pain in the chest” and “vomiting.” [Refer to Annexure 3 for “List of Recorded Symptoms.”]

Table 3: Commonly recorded chemical odours and related symptoms

Reported Chemical Odours	Reported Symptoms
Acid smell	Eyes burning and irritation; nose burning and irritation; throat burning; headache; nausea
Ammonia	Breathing trouble; eyes burning and irritation; headache
Chikoo smell	Headache; nausea
Decaying corpse, dead body, and dead animal smell	Headache; vomiting sensation
Public toilet smell	Nausea; headache; stomach churning and rumbling; constriction of throat
Rotten eggs	Headache; nausea; stomach discomfort and rumbling; breathing trouble

Discussion

The prevalence of chemical odours in the villages in and around SIPCOT is indicative of the industrial chemicals present in the air breathed by the villagers.

Given the intensity of odours, the likelihood cannot be ruled out that the levels of toxic chemicals and gases in the residential areas may exceed even occupationally permitted thresholds for 8-hour exposure in industrial settings. Women and children who spend all their time in the villages are potentially exposed 24 hours to chemical odour incidents.

There are no known or published air quality data on toxic gases in SIPCOT by the Tamilnadu Pollution Control Board (TNPCB) or any other agency. However, in response to an odour complaint made by the villagers of SIPCOT to TNPCB, the District Environment Engineer³ (DEE) simply attributes the odour to Mercaptans from Shasun Chemicals and Mycelium sludge of SPIC Pharmaceuticals Division, without recommending any effective corrective action.

Neither does the DEE's report explore the possible health effects that could result from long-term exposure to chemicals, such as mercaptans, that may be behind these odours. For instance, methyl mercaptan – a chemical associated with Shasun – causes irritation of eyes and skin, and convulsions. It also targets the respiratory system and central nervous system.⁴

What is known about health and pollution in SIPCOT Cuddalore, and about volatile chemicals, their odours and related health effects, is sufficient for precautionary action to be taken to protect resident communities from further exposure. Indeed the

³ Letter No. DEE/TNPCB/CUD/F.3632/2002, dated 22.08.2002 from Er. A. Palaniswamy, DEE, TNPCB, Cuddalore to Member Secy, TNPCB, Chennai

⁴ Pocket Guide to Chemical Hazards. US Department of Health and Human Services. February 2004

Precautionary Principle insists that protective action concerning environment and public health should not wait for conclusive proof of harm.

Demands

The SIPCOT Area Community Environmental Monitors demand the following as steps to address the problem:

1. Implement the provisions of the Manufacture, Storage, Import of Hazardous Chemicals Rules 1989 requiring companies to publish information regarding hazardous chemicals used and stored on site. Implement the provisions of Tamilnadu Factory Rules 62B, 62D and 62-K regarding disclosure of information to workers and the Chief Inspector of Factories of information relating to hazardous processes, emissions, chemicals and emergency management plans.
2. Conduct and make public company-specific audits, mass balance exercises, and toxic release reduction plans to pinpoint and fix leaks, fugitive emissions and total losses to the environment of chemicals used or generated in the process.
3. Initiate continuous and long-term monitoring of emissions, including for toxic gases, and publish the results periodically.
4. Provide for long-term health monitoring by initiating health studies among the residents of villages in and around SIPCOT, Cuddalore.
5. Provide for specialised long-term medical care for residents of villages in and around SIPCOT, Cuddalore, at polluters' cost.

Annexure 1

Chemicals Commonly Used in SIPCOT, their Odours and Related Health Effects

No	Name of the Chemical	Name of the industry	Odour of the chemical	Health effects and target organs	Target Organs
1.	Methanol	Asian Paints, Morgan Industries Ltd.	Characteristic suffocating odour	Irritation of eyes, skin, upper respiratory system; headache; drowsiness; dizziness; nausea; vomiting; visual disturbance; optic nerve damage (blindness); dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract
2.	Acetaldehyde	Asian Paints	Pungent fruity odour	Irritation of eyes, nose, throat; eye, skin burns; dermatitis; conjunctivitis; cough; central nervous system depression; delayed pulmonary edema. In animals: kidney, reproductive, and transgenerational effects; potential occupational carcinogen	Eyes, skin, respiratory system, kidneys, central nervous system, reproductive system
3.	Formic Acid	Asian Paints	Pungent penetrating odour	Irritation of eyes, skin, throat; skin burns, dermatitis; discharge of tears; discharge of thin mucus; cough, breathing difficulty; nausea	Eyes, skin, respiratory system
4.	Ammonia	TANFAC Industries Ltd.	Pungent suffocating	Irritation of eyes, nose,	Eyes, skin, respiratory system

			odour	throat; breathing difficulty; wheezing; chest pain; pulmonary edema; pink frothy sputum; skin burns	
5.	Hydro Fluoric Acid	TANFAC Industries	Strong irritating odour	Irritation of eyes, skin, nose, throat; pulmonary edema; eye, skin burns; rhinitis; bronchitis; bone changes	Eyes, skin, respiratory bones
6.	Toluene	Tantech, Morgan Industries Ltd, SPIC Pharma Division	Sweet pungent benzene like odour	Irritation of eyes, nose; weakness, exhaustion; confusion; euphoria; dizziness; headache; dilated pupils; discharge of tears; anxiety; muscle fatigue; insomnia; dermatitis; liver, kidney damage	Eyes, skin, respiratory central nervous system kidneys
7.	Dichloroethane	Tantech	Chloroform like odour	Irritation of skin; central nervous system depression; liver, kidney, lung damage	Skin, liver, kidneys, central nervous system
8.	Nitrobenzene	Tagros Chemicals	Pungent odour like paste shoe polish	Irritation of eyes, skin; anoxia; dermatitis; anemia; methemoglobinemia. In animals: liver, kidney damage; testicular effects	Eyes, skin, blood, liver, cardiovascular system reproductive system
9.	Carbon Tetrachloride	Tagros Chemicals	Ether like odour	Irritation of eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness;	central nervous system lungs, liver, kidneys,

				dizziness; incoordination; potential occupational carcinogen	
10.	Epichlorohydrin	SPIC Pharma Division Shasun Chemicals	Irritating chloroform like odour	Irritation of eyes, skin with deep pain; nausea, vomiting; abdominal pain; respiratory distress, cough; cyanosis; reproductive effects; potential occupational carcinogen	Eyes, skin, respirato kidneys, liver, reprod

11.	Carbon Disulfide	SPIC Pharma Division	Ether like smell	Dizziness, headache, poor sleep, weakness, exhaustion, anxiety, anorexia, weight loss; psychosis; ocular changes; coronary heart disease; gastritis; kidney, liver injury; eye, skin burns; dermatitis;reproductive effects	Central nervous syst peripheral nervous s cardiovascular syste kidneys, liver, skin, re system
12.	Benzene	Shasun Chemicals	Aromatic odour	Irritation of eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, weakness, exhaustion; dermatitis; bone marrow depression; potential occupational carcinogen	Eyes, skin, respirato blood, central nervou bone marrow
13.	Methylene Chloride	SPIC Pharma Division, Shasun Chemicals	Faint sweet odour	Irritation of eyes, skin; weakness, exhaustion, drowsiness, dizziness;	Eyes, skin, cardiovas central nervous syste

				numbness, tingling sensation in limbs; nausea; potential occupational carcinogen	
14.	Methyl Mercaptan	Shasun Chemicals	Disagreeable odour like garlic or rotten cabbage	Irritation of eyes, skin, respiratory system; narcosis; cyanosis; convulsions	Eyes, skin, respiratory system; central nervous system
15.	Vinyl Acetate Monomer	Morgan Industries Ltd.	Pleasant fruity odour	Irritation of eyes, skin, nose, throat; hoarseness, cough; loss of smell; eye burns, skin blisters	Eyes, skin, respiratory system

Source: Tamilnadu Pollution Control Board
 Pocket Guide to Chemical Hazards. US Department of Health and Human Services.
 February 2004

Annexure 2

List of Recorded Chemical Odours of Industrial Origin

1. Acid
2. Ammonia
3. Burning plastic or electric cable
4. Burnt body/ Corpse burning
5. Burnt curry/ Burnt gravy
6. Burnt material
7. Burnt rice
8. Burnt rubber
9. Chikoo
10. Chilli powder
11. Crushed neem seed/ neem cake/ Neem oil
12. Decaying corpse/ Dead body
13. Dead animal
14. Dough roasted and grounded
15. Firecracker
16. Fruit juice
17. Ground bone
18. Hospital
19. Human excreta
20. Kerosene
21. Mosquito coil
22. Nail paint
23. Paint
24. Phenyl
25. Public toilet
26. Roasted sugar
27. Rotten eggs
28. Rotten fruits
29. Rotten jackfruit
30. Rotten milk
31. Sewer / gutter smell
32. Sour
33. Sulphur
34. Sweet and sugarcane like
35. Spirit / alcohol smell
36. Urine smell

Annexure 3

List of Recorded Symptoms

1. Breathing trouble
2. Suffocation
3. Nausea
4. Pain in the chest
5. Eye irritation
6. Constriction of throat
7. Dizziness
8. Eye burning
9. Throat burning
10. Nose irritation
11. Eyes watering
12. Headache
13. Vomiting
14. Induced hunger
15. Stomach growling
16. Churning of Stomach and Vomiting Sensation
17. Stomach discomfort
18. Nose burning
19. Vomited
20. Throat burning and headache
21. Eyes watering and throat burning
22. Head swimming
23. Suffocation and shortness of breath
24. Stomach rumbling vomiting and suffocation
25. Stomach rumbling and headache
26. Nausea, headache and breathing trouble
27. Nausea, headache and eye burning
28. Nausea, dizziness and headache
29. Headache, nose irritation, throat irritation and breathing trouble
30. Headache and suffocation

Annexure 4

Questionnaire for Chemical Odour Incident Monitoring

Name of the Monitor: _____ **Date** of the
incident: _____
Address: _____ **Time of the**
incident: _____

Location of the monitor:

Name of the unit: (Please specify if the emissions/ leak was from any particular point of the unit)

Describe the wind flow during the leak:

From the plant –

a) gusty b) steady c) shifty d) Light e) none

What is the usual direction of the wind for the area at that time –

Identify the smell:

Rotten eggs

Sour

Acid like

Gasoline/ kerosene/ oil

Ammonia

Nail paint/ paint

Any other:

How would you rate the smell:

What is the immediate health effect of the smell:

makes feel nauseous

gives a headache

eyes burning

throat closing

difficulty in breathing

any other:

How does the emission look like:

Smoke

vapour clouds

Fire

explosion

Was there any flare? Yes/ No

Signature of the monitor