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Thanking you

Yours faithfully
For SGS India Pvt Ltd.

S. Suresh Kumar
Technical Manager - National

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LIST OF ANNEXURES

CHAPTER - I

1.0 EXECUTIVE SUMMARY:

This report encompasses the details of a study carried out to measure the volatile organic compounds in the Tarapur, Dombivali, Navi Mumbai, Chandrapur and Aurangabad Industrial areas to find out the VOC concentrations.

The aim of this study was to investigate composition of VOCs and their concentrations in ambient air, fugitive emissions and industrial effluents in all five industrial areas. Maharashtra State Pollution Control Board, Mumbai along with M/s SGS India Pvt. Ltd, has carried out the in-depth baseline study to monitor the VOCs concentration in ambient air and fugitive emissions & effluent discharge from the industries. MPCB engaged M/s SGS India Pvt Ltd., Chennai for carrying out sampling and analysis.

The sampling and analysis is followed as per EPA TO-17 for sampling of Ambient Air Quality and Fugitive emissions using pre and post calibrated personal samplers with Multibed Adsorbent tube (Carboxen + Tenax). The preservation and transportation of the samples are followed as per the method protocol.

The AAQM locations are selected based on the maximum solvent used in industries located, type of industries located, wind direction, geographical spread of the industrial area etc..

Wastewater samples were collected from CETP and ETP raw effluent on segment wise at different identified industries. EPA Method 5030C/8260B is adopted for the analysis of VOCs in wastewater.

I. TARAPUR INDUSTRIAL AREA:

Ambient Air Quality: Five AAQM stations are established based on the industrial spread and wind direction across the industrial area. There are 17 VOCs are detected in this industrial cluster in which 7 are halogenated and 10 are non-halogenated. The total VOC on 24 hours average got detected in all five locations in the range between 58µg/m3 - 440 µg/m3 in which Dichloromethane, Chloroform, Carbon Tetrachloride, Tetrachloroethane, Ethyl Benzene, m&p – Xylene and Naphthalene are present and all are suspected carcinogenic compounds. It has been observed that VOC concentrations are high in the night hours rather than in day time due to inversion and higher %Relative Humidity.

Fugitive Emission Monitoring: Industries were selected for fugitive emission monitoring based on the number of solvents used, process conditions, and walkthrough survey with PID analyser (major contributors to AAQM concentration). The prominent VOC emission sources in industries are Effluent collection sump, aeration tank, process, solvent recovery unit, solvent storage and hazardous waste storage areas. The samples were collected nearby these sources (between 1 – 2m distances from the source). The total VOCs detected for fugitive emission monitoring on different industries in the range between 91.8 – 8585.0 µg/m3 in which Dichloromethane, Chloroform, Carbon Tetrachloride, Tetrachloroethane, m&p – Xylene, Ethyl Benzene and Naphthalene and all these solvents are used by the industries in this industrial cluster which in turn contributing to ambient air.

Wastewater Monitoring: 5 industries were selected for waste water sampling in their raw effluent from collection sump. VOC concentrations are very high in wastewater samples when compared to Fugitive as well as ambient air samples. The total VOC concentration range between 58.4 µg/m3 – 13067 µg/m3 in which Dichloromethane, Carbon Tetrachloride, Chloroform, Chlorobenzene, Toluene, m&p – Xylene, 1,2-Dichloroethane and Tetrachloroethane. Presences of VOCs in wastewater affect the quality of ambient air, efficiency of ETP system and quality of final receiving body. VOCs are emitted into the environment during various treatment unit operations particularly during aeration in Equalization tank and aeration tank.

Surface Water Monitoring: Two surface water samples collected nearby industrial area to know the VOC concentration in which Surya River (MIDC Pumping Station) found Total VOC of 3560 µg/l followed by Toluene, Chloroform, Carbon Tetrachloride, Chlorobenzene, Ethyl Benzene detected with little high concentration when compared to other detected VOCs. The other surface water (Sea Water – Naupur Creek) sample is not detected any VOCs except Tetrachloroethane (µg/l) which also to be very less concentration.

II. NAVI MUMBAI INDUSTRIAL AREA:

Ambient Air Quality: Four AAQM stations are established and there are 19 VOCs are detected in this industrial cluster. The total VOC on 24 hours average got detected in all four locations in the range between 53.3µg/m3 – 86.9µg/m3 in which 1,2-Dichloroethane, o-Xylene, Carbon Tetrachloride, Tetrachloroethane, and Naphthalene are present in all the locations. Except Carbon Tetrachloride, Chlorobenzene, Tetrachloroethane, 1,2-Dichloroethane (halogenated) and rests are non-halogenated compounds. Most of the chlorinated and some non-halogenated compounds detected in these locations are suspected carcinogen.

Fugitive Emission Monitoring: Totally 16 VOCs are detected in the fugitive emission samples collected from 3 industries. The total VOCs detected for fugitive emission monitoring on different industries in the range between 33.6 – 335.9µg/m3 in which Benzene, Toluene, Tetrachlorethane, Chlorobenzene, o-Xylene and 1,2-Dichloroethane detected and all these solvents are used by the industries in this industrial cluster which in turn contributing to ambient air. Benzene (23.5µg/m3) and 1,2-Dichloroethane (252.6µg/m3) got detected with maximum concentration in the fugitive samples and these compounds are highly carcinogenic in nature.

Wastewater Monitoring: 5 industries were selected for waste water sampling in their raw effluent from collection sump. The total VOC concentration range between 2.5 µg/l – 32229 µg/l in which Dichloromethane, Vinyl chloride, Carbon Tetrachloride, Chloroform, Benzene, o – Xylene and 1,2-Dichloroethane. 1,2-

Dichloroethane got detected in all collected effluent samples in the range between 49.3 µg/l – 21945 µg/l.

Surface Water Monitoring: Three surface water samples collected nearby industrial area to know the VOC concentration in which Rabaci lake and sea water (back water) samples are detected only few VOCs that too with very low concentration of total VOC in the range between 6.5 µg/l - 8.7 µg/l . But Nacil Lake water sample got detected 11 VOCs and total VOC concentration was 472.9 µg/l in which Benzene (139 µg/l), Carbon Tetrachloride (104.1µg/l), 1,2-Dichloroethane (49.3µg/l), Toluene (75.7µg/l) and Chloroform (59.0µg/l) and rests are very low concentration levels.

III. DOMBIVALI INDUSTRIAL AREA:

Ambient Air Quality: Five AAQM stations are established and there are 12 VOCs are detected in this industrial cluster. The total VOC on 24 hours average got detected in all five locations in the range between 79.4µg/m3 – 732.4µg/m3 in which Dichloromethane, Carbon Tetrachloride, Chlorobenzene, Chloroform and Styrene are detected with high concentration when compared to other detected VOC.

Fugitive Emission Monitoring: Totally 14 VOCs are detected in the fugitive emission samples collected from 6 industries. The total VOCs detected for fugitive emission monitoring on different industries in the range between 13.2 – 479.6µg/m3 in which Dichloromethane, Benzene, Toluene, Chlorobenzene, Chloroform, Carbon Tetrachloride, o-Xylene and Ethylbenzene detected and all these solvents are used by the industries in this industrial cluster which in turn contributing to ambient air. Benzene (24.6µg/m3) and Chlorobenzene (205.9µg/m3) got detected with maximum concentration compared to other detected VOC in the fugitive samples and these compounds are highly carcinogenic in nature.

Wastewater Monitoring: 6 industries were selected for waste water sampling in their raw effluent from collection sump. The total VOC concentration range between 1395.7 µg/l – 7529.6 µg/l and the analytes detected are Dichloromethane, Carbon Tetrachloride, Chloroform, Toluene, o – Xylene, Chlorobenzene, 1,2-Dichlorobenzene and 1,2-Dichloroethane. In CETP (Chemical) raw effluent contains 18 VOCs and the Total VOC concentration is 4079.9 µg/l in which Dichloromethane, Chloroform, Toluene and 1,2-Dichloroethane got detected with maximum concentration. In CETP (Textile) raw effluent contains 25 VOCs are detected and the total VOC concentration is 7529.6 µg/l in which Dichloromethane, Chloroform, 1,2-Dichloroethane, Toluene, Chlorobenzene and 1,2-Dichlorobenzene are detected with maximum concentration compared to the other detected VOCs.

IV. CHANDRAPUR INDUSTRIAL AREA:

Ambient Air Quality: Five AAQM stations are established and there are 19 VOCs are detected in this industrial cluster but the concentration levels are very low. The total VOC on 24 hours average got detected in all five locations in the range between 58.5µg/m3 – 150.5µg/m3 in which Naphthalene, Toluene, Ethyl benzene, Dichloromethane, and Chlorobenzene are detected with high concentration when compared to other detected VOC.

Fugitive Emission Monitoring: Totally 6 VOCs are detected in the fugitive emission samples collected from 3 industries. The total VOCs detected for fugitive emission monitoring on different industries in the range between 1.3 – 1702.7µg/m3 in which Dichloromethane, Carbon Tetrachloride, Ethyl benzene, Naphthalene, o-Xylene and m&p-Xylene detected and all these solvents are used by the industries in this industrial cluster which in turn contributing to ambient air. Carbon Tetrachloride (50.7µg/m3), Dichloromethane (16527µg/m3) and Naphthalene (418.0µg/m3) got detected with maximum concentration compared to other detected VOC in the fugitive samples and these compounds are highly carcinogenic in nature.

Wastewater Monitoring: 2 industries were selected for waste water sampling in their raw effluent from collection sump. The total VOC concentration range

between 7.0 µg/l – 524.2 µg/l and the analytes detected are Dichloromethane, Chloroform, o – Xylene, m&p-Xylene and Naphthalene. In which Chloroform (482.87µg/l) and Dichloromethane (37.57µg/l) was detected maximum in the wastewater samples.

Surface Water Monitoring: Three surface water samples collected nearby industrial area to know the VOC concentration. But in all three samples no VOCs are detected. The locations are Borewell Water (Ashok Gedem House), Wardha River and Erai River.

V. AURANGABAD INDUSTRIAL AREA:

Ambient Air Quality: Five AAQM stations are established and there are 14 VOCs are prominently detected in this industrial cluster but the concentration levels are very low. The total VOC on 24 hours average got detected in all five locations in the range between 4.6µg/m3 – 94.5µg/m3 in which Naphthalene, Toluene, o-Xylene, Ethyl benzene and Chloromethane are detected with high concentration when compared to other detected VOCs. Only Chloromethane (212.1µg/m3) is the maximum concentration found in one of the AAQM locations and all the other detected VOCs are very less concentrations.

Fugitive Emission Monitoring: Totally 4 VOCs are detected in the fugitive emission samples collected from 4 industries. The total VOCs detected for fugitive emission monitoring on different industries in the range between 0.3 – 117.7µg/m3 in which Chloromethane, 1,3-Dichlorobenzene and 1,4-Dichlorobenzene are detected and all these solvents are used by the industries in this industrial cluster which in turn contributing to ambient air.

Wastewater Monitoring: 4 industries were selected for waste water sampling in their raw effluent from collection sump. The total VOC concentration range between 5.2 µg/l – 33344 µg/l and the analytes detected are Dichloromethane, Chloroform, Toluene and Chloromethane. In which Chloroform (5759.0µg/l) and

Dichloromethane (26406.0 µg/l) was detected maximum in the wastewater samples.

Surface Water Monitoring: Two surface water samples and one well water sample was collected nearby industrial area to know the VOC concentration. But in all three samples no VOCs are detected. The locations are CHIKANTHANA - SUKNA RIVER, WALUJ - KHAM RIVER and well Water sample from GOOD YEAR - WALUJ.

Overall Observations:

The Ambient air quality VOC concentrations will vary with meteorological parameters, process conditions, product changes, leaks in the components etc., will be the major factor affecting the change in the concentration levels with every sampling and analysis.

Tarapur, Navi Mumbai and Dombivali are the major VOC emission industries and we got detected number of VOCs with high concentration. But the AAQM results of Chandrapur and Aurangabad showed a very few VOC detected with less concentrations due to minimum solvent used industries and also widely spreaded across the industrial area.

It has been observed that major VOCs emission sources are Leaks in the components (flange, valve, connector, open end pump seal etc.,), Effluent treatment plant area that too specifically nearby collection sump or equalization tank, Aeration tank area, solvent loading and unloading operations, filtration, centrifuge operations etc.,

Most of the detected halogenated and non-halogenated VOCs are highly toxic and those should be the suspected carcinogen compounds and these VOC emissions can be controlled by the way of (i) Leak Detection and Repair Programme(LDAR) by

which we can able to minimize the fugitive emissions of more than 30 - 40%, (ii) Fume extraction system in all the possible emission source areas in the production process and connected to common duct followed by adsorbent bed before it is dispersing into atmosphere by which we can able to minimize VOC emissions of 10 – 15%, ETP collection sump or Equalization tank to be completely covered by the cement sheet and need to be fixed the hood to take out all VOC emissions into adsorbent bed before vapours sent to atmosphere by which we can reduce 10%, Good operating practices, conducting industrial hygiene study by which we can reduce 20%.

It was found that VOCs are present in some of the surface water samples that is due to illegal discharge into river.

Regular sampling and analysis of VOCs are required to find out the representative baseline data irrespective of the other affecting factors. One time sampling and analysis will not give the true representative concentrations on location wise.

CHAPTER - II

2.0 INTRODUCTION:

Volatile organic compounds (VOCs) are emitted from various sources, both anthropogenic and biogenic. They are important precursors in photochemical reactions, and the formation of secondary aerosols. Therefore in controlling ozone concentration & secondary aerosols, sources of precursors need to be defined. Volatile Organic Compounds (VOCs) mostly industrial solvents which are used in Chemical Industries (Pharmaceuticals, Pesticide, Dye & Dye Intermediates & other Chemicals) are emitted in to the environment in most of the industrial estates. Some of them being known carcinogens can be identified as Hazardous Air Pollutants (HAPs) and needs special attention. Uncertainties in emission inventory are greater for VOCs than the criteria pollutants such as TSPM, SO_2 and NOx. The diversity of VOCs sources includes vehicles, industry, solvent-containing products and biological processes. In urban areas, VOCs are mainly from anthropogenic sources such as vehicle tailpipes emitting gases from both the complete and incomplete combustion of gasoline, evaporation of gasoline from engines & tanks, solvents used in industry as well as in household products.

The development of effective strategies for controlling VOCs refers on quantifying the ambient concentrations and the identification of emission sources of these pollutants. However, information on ambient concentrations and the composition of VOCs in India still limited.

In India, due to the absence of standards for VOCs (except Benzene in ambient air) and recommended monitoring procedure, it is difficult to initiate appropriate action by the regulatory and enforcing authorities. Many countries have standards for many chemicals of concern, however in the absence of standards in India, it is utmost important that precautionary measures are taken promptly. Presently, criteria pollutants viz. SPM, PM 10, PM 2.5, SO_2, NOx and other pollutants viz. NH_3, Cl_2 & Acid Mist etc. are monitored regularly to know the concentrations and impact on the ambient air quality

2.1 About Volatile Organic Compounds (VOCs) :

Volatile Organic Compounds (**VOCs**) are organic chemical compounds that have high enough vapour pressures under normal conditions to significantly vaporize and enter the atmosphere. A wide range of carbon-based molecules, such as aldehydes, ketones, and other light hydrocarbons are VOCs.

2.1.1 Some Definitions:

There is no clear and widely supported definition of a VOC. VOC is a term used more in relation to air quality and environmental studies. From a chemistry viewpoint "Volatile Organic Compound" can mean any organic compound (all chemical compounds containing carbon with exceptions) that is volatile (evaporating or vaporizing readily under normal conditions). This is a very broad set of chemicals. Definitions vary depending on the particular context and few are quoted below:

- **Canada**

Health Canada classes VOCs as organic compounds that have boiling points roughly in the range of 50 to 250 °C (120 to 480 °F). The emphasis is placed on commonly encountered VOCs which would have an effect on air quality.

- **European Union**

A VOC is any organic compound having an initial boiling point less than or equal to 250 °C measured at a standard atmospheric pressure of 101.3 kPa.

- **United States**

A VOC has high vapor pressure and low water solubility. The US EPA's Terms of Environment defines a VOC as any organic compound that participates in atmospheric photochemical reactions except those designated by the EPA as having negligible photochemical reactivity. Under the Code of Federal Regulations it is similarly defined as any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate,

which participates in atmospheric photochemical reactions. Worldwide, legal definitions of the term "VOC" are in many respects, more a matter of policy than a matter of science.

2.1.2 Classification of the VOCs:

Some of the classifications are given as:

2.1.3 Based on Boiling Point:

- VVOC : Very Volatile Organic Compounds : < 0 up to 50 – 100°C
- VOC : Volatile Organic Compounds : 50–100 up to 250 – 260°C
- SVOC : Semi Volatile Organic Compounds : 250 – 260 up to 380 – 500°C
- POM : Polycyclic Organic Materials : > 380°C

2.1.4 Based on Toxicity to Human Health:

- **Highly harmful:**

Highly harmful VOCs are the substances such as Benzene, Vinyl Chloride and 1,2 dichloromethane pose serious health risks to humans.

- **Class A VOCs:**

Class A VOCs are the VOCs which may contribute substantially to the creation of photochemical ozone, depletion of stratospheric ozone or global warming. These are considered as having a medium degree of harmfulness. Examples include carbon tetrachloride, 1, 1, 1-trichloroethane, trichloroethylene and trichlorotoluene.

- **Class B VOCs:**

Class B VOCs are the remaining majority of VOCs are considered as having a lower degree of harmfulness than class A VOCs. Examples include butane and ethyl acetate.

2.2 Effects of VOCs:

The following are the effects of VOCs:

- Human health impacts; some VOCs are known or suspected carcinogens, most of the chlorinated VOCs may contribute for 35 – 55% of outdoor air borne cancer risk;
- Nuisance effects such as odours;
- Contribute to global warming; and
- Some VOCs also react with nitrogen oxides in the air in the presence of sunlight to form ozone i.e., increases in levels of troposphere (ground-level) ozone and decreases in levels of stratospheric ozone.

The list of 60 VOCs which are identified by USEPA and mostly impart toxic effects to human health considered for the sampling and analysis is enclosed as **Annexure-I** and the important physical properties of all 60 VOCs is enclosed as **Annexure – II.**

2.3 OBJECTIVE:

The aim of the study was to identify typical levels of VOCs in this industrial cluster where monitoring of this unregulated but important group of pollutants has rarely been conducted. The objectives of the study can be listed as below:

- To identify and quantify the VOCs presence in the ambient air and wastewater
- To prioritize the most toxic and most predominant VOCs in the Ambient air
- To generate the database for future monitoring and subsequent standard development for enforcement
- To develop a protocol for sampling and analysis method for VOCs in Indian context
- To compare concentration with International AAQ standards/guidelines

Each of these objectives requires a proper selection of the various elements constituting the sampling strategy such as type and number of locations to be included in the study, the sampling method, frequency and duration.

CHAPTER - III

3.0 METHODOLOGY:

The definition of VOC is based on ranges of boiling points. According to this definition, VOCs are volatile organic compounds which boil between 50°C and 260°C. However, no exact limit exists between the said four categories. The reason is that in practice, the categories are determined by the methods used to sample organic pollutants from air. Most of the methods rely on pre concentration of organic compounds on adsorbents and therefore the type & amount of adsorbent & the sample volume have to a certain extent influence the boiling point range of the trapped compounds. Using combinations of appropriate adsorbents very volatile (VVOCs) and volatile organic compounds (VOCs) can be sampled simultaneously, and, hence the distinction between them may even become redundant.

The volatile organic compounds (VOCs) constitute a wide range of carbon molecules i.e., aliphatic & aromatic hydrocarbons, ketones, aldehydes, chlorinated hydrocarbons. The industries like refineries, petrochemicals, pharmaceuticals, pesticides, dye and paints & varnish are the major sources, which emit VOCs in the atmosphere. As the industries are using different solvents in their processes they emit huge amount of VOCs to the environment. The aliphatic, aromatic and chlorinated hydrocarbons were the target volatile organic compounds. The sampling for volatile organic compounds was done for ambient air, fugitive emissions and effluent. For ambient air and fugitive emissions, the sampling was conducted using calibrated SKC low flow sampler at low flow rates ranging between 200 ml/min and 500ml/min using Tenax and Carboxen multi tube. The VOC adsorbed samples in the multibed adsorbent tubes were transferred to lab desorbed thermally by using Active Thermal Desorption System & then analyzed using capillary GC-MS to find out the VOC content in the sample. Measurements of VOCs are usually subdivided into sampling and analytical steps, of which the sampling is carried out in the ambient environment. The steps involved in the study are:

- Selection of Industrial Area of Tarapur for the VOC monitoring;

- Collection of Information and dry data from Industries as well as from Maharashtra State Pollution Control Board & MIDC
- Literature review;
- Selection of ambient air quality monitoring locations primarily based on wind direction, proximity to residential/commercial area, indicative concentration shown by Photo ionic detector and safety, availability & accessibility of locations;
- Selection of wastewater sampling locations based on wastewater sources, pollution potential etc. in industrial area, Inlet of CETP.
- The monitoring of VOCs was carried out at the selected locations as described later in the report.

3.1 METHODS FOR AIR SAMPLING:

It is decided to follow EPA TO-17 for sampling of Ambient Air Quality and Fugitive emissions using pre and post calibrated personal samplers.
The criteria of choosing the Method TO-17 for sampling are:

- Many compounds which boils at above 100^{o}C also efficiently collected by these methods
- These method have a flexibility of sampling the gas stream at a high flow rate of 1 lpm and at low flow rate of 0.1 to 0.5 lpm
- These methods have an option of sampling smaller volumes at lower flow rates and should be used when the boiling points of the VOCs of interest are below 35^{o}C.
- The target detection limit of these methods is 0.1µg/m^{3}.

Adsorption/thermal desorption with multisorbent air-sampling cartridges was developed for the determination of 60 analytes including halogenated alkanes, halogenated alkenes and aromatics. The volatilities of the compounds ranged from that of dichlorofluoromethane to that of 1,2,3-trichlorobenzene. The 60 volatile compounds were determined using a 240-L air sample and a sample cartridge containing 100 mg of Tenax and 125 mg of Carboxen. Analysis and detection were done by gas chromatography/mass spectrometry. The minimum detectable level

(MDL) concentration values ranged from 0.1 parts per billion by volume (ppbv) for all volatiles. No breakthrough was detected with the prescribed sample volumes with the spiked VOCs observations and the analyte stability on the cartridges was very good. Excellent recoveries were obtained with independent check standards. Travel spike recoveries ranged from 90 to 110% for 57 of the 60 compounds. The recoveries were less than 70% for bromomethane and chloroethene and for a few compounds such as vinyl chloride, Dichlorofluormethan that are subject to losses by high volatility, the lowest travel spike recovery was obtained for bromomethane (62%). Blank values for all compounds were either below detection or very low. Analytical precision was measured using duplicate sampling. There are no significant variations observed.

The choice of the sampling method depends on the objective of an investigation and the VOCs of interest.

3.1.1 About Adsorbent Tubes:

Based on the merits and demerits, it was decided to adopt EPA TO-17 method (as detailed below) for the sampling of VOCs at ambient air as well as fugitive emissions.

Active Thermal Desorption (ATD) combination tube: -

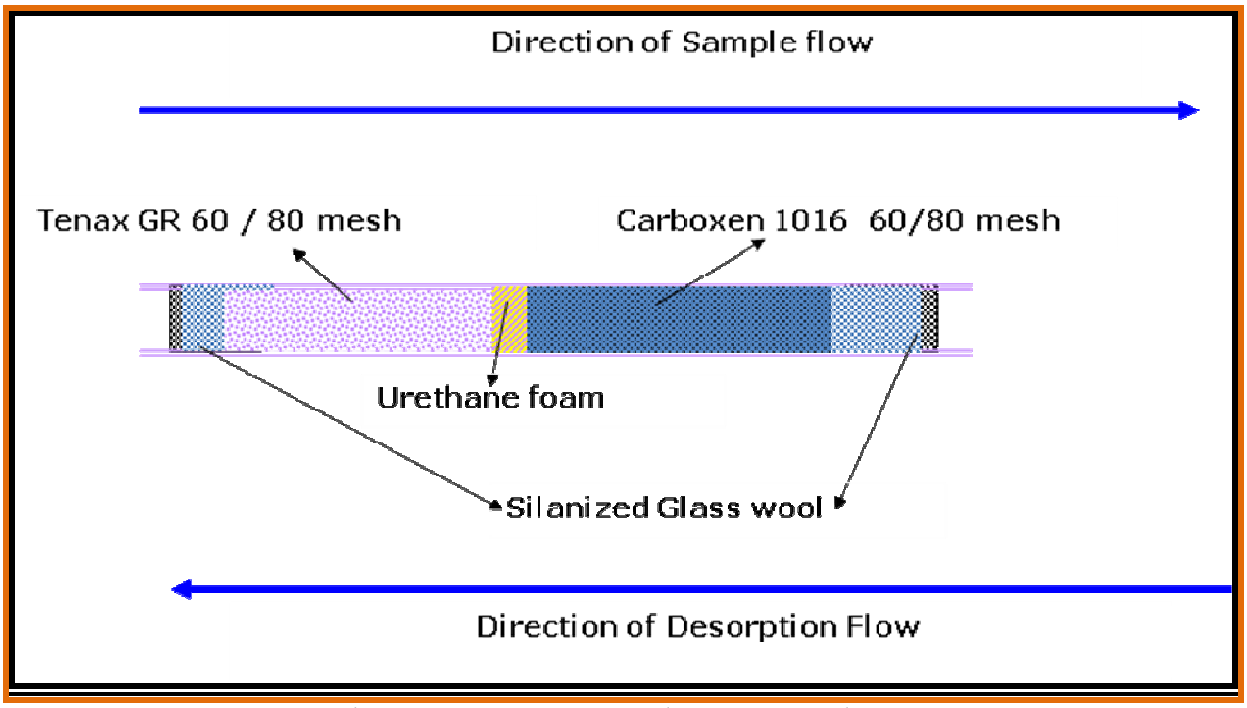
Compendium Method TO-17 using Tenax and Carbopack ATD Method. Thermal desorption (TD) is a complementary gas extraction technique whereby sorbent tubes (depicted in Figure below) are heated in a flow of carrier gas. Trapped vapours desorb from the sample tubes into the gas stream and are transferred, via a refocusing device, into the GC/MS analyzer. Conversely, thermal desorption allows complete transfer of all target analytes to the analytical system, with no dilution or solvent interference. Detection limits offered by thermal desorption methods are typically at least 1000 times higher than equivalent solvent extraction methods, facilitating ambient monitoring at ppt/ppb levels as well as higher ppm (and %-level) concentrations.

The advantage of Method TO-17:

- No contamination occur since the sample is directly injected

- Wide spectrum of high molecular weight chlorinated and aromatic VOCs are captured
- Easy to capture

ATD Tubes



Pictorial presentation of inside of ATD Tube:-

Thermal desorption efficiency is readily validated and is always above 95%, independent of ambient conditions and the nature of the target analytes (polar/nonpolar, volatile/semi-volatile, etc.).

3.1.2 Sampling Preparation:

The steps followed are as given below:

- Determined the extent of the sampling effort, the sampling methods to be employed the type and amounts of equipment and allied supplies needed;
- Organized the necessary sampling and monitoring equipment;
- Sampling pumps are pre calibrated before sampling with soap bubble techniques;
- Prepared a schedule in consultation with CPCB and SPCB officials; and
- Performed a general site survey prior to the study, in accordance with the site specific health and safety plan for sampling locations.

3.1.3 Calibration Procedure:

To save time in the field, sampling pumps are pre-calibrated in the laboratory prior to arrival on-site. The calibration is checked in the field prior to and upon completion of sampling.

The steps followed are as given below

- Assembled the calibration train using a calibrated (external) rotameter, sampling pump, a tube holder system and an adsorbent tube. The adsorbent tube is a representative tube from the same lot of tubes that is used for sampling.
- Turned on the pump and adjust the flow using the flow adjust mechanism on the tube holder until the float ball on the rotameter is aligned with the rotameter's pre-calibrated flow rate value.
- Marked to the manifold and pump indicating the pre-calibrated flow rate and sampling media.
- Calibrated sampling system, flow regulator and tubing kept ready before sampling. Broke both ends of the adsorbent tube before sampling and

ensured that each opening is at least one half the inside diameter of the tube.

- Kept one field blank at each sampling station and three at laboratory blank with opened both ends of the ATD tube. This blank will give if any contamination in field during sampling as well as during the analysis in the laboratory.
- Fixed the ATD tube into sampling line and placed back-up section nearest to the pump. Position the tube in a vertical position to avoid channeling of air through adsorbent section.

3.1.4 Field Operation:

- Mobilized the pre-calibrated sampling equipment to save the time at the sampling site and fine tuning of the flow should be required.
- Placed the sampling tubes in the breathing zone. The pump and adsorbent tubes are placed on any solid stationary surface.
- Removed the caps of ATD tubes
- To set up the sampling train with ATD tube, Tenax end of the adsorbent tube is open to atmosphere and Carboxen back up portion is towards the manifold of the sampler. The manifold is attached to the inlet plug on the pump. The photograph of sampling arrangement is shown below:

- Adjusted time on the pump to required sample time i.e. 8 hrs for each cycle. The sampling flow rate of 0.5 LPM is constantly maintained at all locations.
- Two rounds (one round- 24 hrs consists of three cycles of eight hrs each) of monitoring on 18.02.11.
- Verified regularly the sampling flow using the calibrated rotameter. Recorded the final flow rate on the air sampling data sheet.

3.1.5 Post Operating Procedure:

- Recorded the sampling time on the air sampling data sheet
- Removed the adsorbent tube from the sampling pump
- Covered the adsorbent tubes with teflon tape followed by Caped adsorbent tubes with metallic caps immediately after sampling. Never use rubber caps.
- Placed the sample in a whirl bag labeled with sample ID Number
- Recorded all applicable information on the air sample data sheet (sample volume, ID number, location of the sampling, date and weather parameters)
- Sampled adsorbent tubes are stored in a cooler box (less than $10^{o}C$) and the maximum storage time is one week from the date of sampling.

3.1.6 Sample Storage and Preservation:

1. After sampling the identified samples are capped securely.
2. Samples collected in adsorbent tubes should not be kept in warm places or exposed to direct sunlight. After sealed the samples are kept in a cold storage box.
3. Samples are transported immediately after the sampling is over and stored under refrigeration until they are analyzed. Samples were analyzed within two to four days.

3.1.7 Quality Assurance / Quality Control:

Based on protocol for a measurement will give information on the quality control performed. At least 10 % of samples taken should be duplicated. Blanks and field

blanks have to be analyzed in conjunction with the samples. The use of standards (internal and external), avoidance of contaminants and losses during sampling & storage also must be documented.

Quality Assurance and Quality Control (QA/QC) constitute an integral and important part of the entire sampling strategy and sampling management. The extent of QA/QC work will heavily depend on the sampling objective and other related factors.

Some of the salient features also been considered with regard to QA/QC of VOC measurements are: definition of the sampling & data quality objectives, design criteria for sampling, sampling media, sampling location and chemical analysis. In addition, the data quality objective is decided depending on the sampling objective. The choice of sampling parameters such as time, duration and location of sampling, are all closely related to the choice of the sorbent and the sampling technique. Many pitfalls are to be associated with sampling. The quality of the analytical results depends mainly on internal laboratory control, but it is equally important to know potential artifact formation in the sampling or in the analytical system. In addition, active participation in international inter-comparisons, round robin tests and certified reference materials should be used for validation & quality control. Compliance of following is necessary to ensure QA/QC:

- Data pertaining to the VOCs study are documented on a data sheet.
- All instruments are operated in accordance with operating instructions as supplied by the manufacturer.
- Equipment check and calibration activities were carried out before and after sampling.
- For every 20 samples one field blank and lab blank were set aside. These field blanks will be handled in the same manner as the sampling tube (break, seal and transport) except that no air is drawn through the tube.
- At all sampling stations, the samples were collected in ATD adsorbent tube.

3.1.8 Data Validation:

Results of the quality control samples are evaluated for contamination. This information is utilized for quality assessment of the environmental sample.

3.1.9 Sampling Duration, Time and Frequency:

The sampling duration depends clearly on the objectives, but it is also tightly linked to the sensitivity of the analytical method, the stability of the samples and the breakthrough volumes of the compound(s) of interest on the particular sorbent. These factors have to some extent to govern the decisions on sampling parameters.

It has to be taken into account that short-term sampling may lead to a loss of sensitivity whereas during long-term sampling some pollutants of interest may not be quantitatively collected.

Sampling duration is a very important factor to be considered if health effects are suspected to be related to indoor air quality / Ambient Air Quality. It has to be taken into account that short term sampling easily leads to a misrepresentation of a "true" average value due to the selected time for sampling.

Long-term sampling (from several hours to a few weeks) is suitable to assess average air pollutant concentrations. It is especially appropriate for ambient air quality investigations. When the objective is the evaluation of quantifying the volatiles presence in the atmosphere, the sampling duration must be in accordance with that applied in defining the safe sampling volume.

Concerning the sampling frequency, a single sample is rarely sufficient to assess ambient air quality. Minimum four to five locations across the industrial area based on the wind pattern to be required for getting representative data.

3.1.10 Selection of Ambient Air Quality Monitoring Locations:

Within one industrial cluster, different types of industries generally have different VOC emissions and moreover sources are not necessarily evenly distributed all over the industrial areas. Transfer of pollutants from one location to the other, depends on the air flow pattern in the industrial area. As the number of locations that can

be taken generally is limited, the appropriate selection of locations for sampling becomes necessary. The selection of locations are the obvious for some study objectives e.g., maximum solvent used in industries located, type of industries located, wind direction, geographical spread of the industrial area etc.. When there is no specific guidance given for location of the sampling, the up and down wind should normally be recommended for the sampling of VOCs in a industrial cluster and rest will be cross wind stations that too based on the segments of industries spread.

The level and homogeneity of the VOC concentration in a industrial area depends on a number of meteorological conditions like wind speed, wind direction, temperature, relative humidity etc.. Some of these conditions have a direct or indirect influence on source emissions; others influence the dilution and mixing of VOCs in a sampling location and thus have an effect on the results. Source emissions may depend on temperature and surface air velocity.

The sampling location is governed by:

- Objectives of study;
- Instrumentation and method involved availability;
- Accessibility of the sampling site;
- Obstruction (tall trees, wall etc.,) free environment. Trees, walls etc. can obstruct the free air flow and can reduce pollutant concentrations in ambient air;
- At a height of minimum 5M from ground level so that the interferences by locally generated pollutants are minimized;
- Consideration of up wind – down wind method; and
- Security against loss and tampering of instrument.

The ambient and fugitive emissions are monitored in the industrial estate to know the concentrations of each individual VOC and to understand its potential impact on the human health and the environment. The main parameters which affect the distribution & concentration of VOCs in the ambient air are its distribution into the atmosphere by predominant wind speed & its direction, distribution of industries across the industrial estate. The monitoring stations for both ambient and fugitive

emissions were selected on the basis of total VOC concentration persists in the ambient air as well as in the industry. The team carried out preliminary survey of entire industrial estate with Photo Ionization Detector (PID), which is capable of detecting the total VOC concentration in terms of PPM and also in terms of PPB. The instrument is normally used to determine the VOC leak detections in the work environment / plant / process areas. The ambient air quality monitoring locations were established on the basis of total VOCs concentration showed by PID, covering different directions of industrial estate and of course considering the safety of the instrument at monitoring place.

Ambient air samples were withdrawn by a pump and adsorbed on sorbent tubes, ¼ inch O.D., 3.5 inch long, packed with 100 mg of carboxen and 50mg Tenax (Supelco). Air collection flow rate was designed at 500 ml/ min. The actual flow rate was 0 - 1000 ml/min. ± 2 ml/ min. Sampling time was eight hours. When the sampling was finished, the sorbent tube was capped with brass Swagelok, wrapped with aluminum foil and put in a plastic bag, which was kept in an ice box and transported to the laboratory, and the samples were stored in a solvent-free refrigerator. The analysis work was carried out within one week after the sampling. Sorbent tubes for air sampling were cleaned each time before usage at 240 °C for 180 minutes.

Air samples were analyzed by the thermal desorption-GC/MS at the laboratory. The Thermal Desorber Unit (TDU) was from Unity, Markes International Limited. The TDU temperature program used was as follows: Purge for 5 minutes, and desorb at 190 °C for 20 minutes to cold trap –10 °C for 15 minutes and immediately heat to 310 °C to GC column. The GC/MS-QP5000 Column: was a Capillary column SPB TM 624, 60 m. long, 0.32 mm. i.d., thickness 1.8 µm. from Agilent. Mass spectrometry analysis used an Electron Impactor, Quadrupole mass spectrometer.

VOC sampling details viz. Date of sampling, time of sampling, sampling locations, flow rate, sampling duration and volume of air sampled for enclosed.

3.2 WASTEWATER MONITORING:

Methods For Wastewater Sampling:

Wastewater samples were collected from CETP and on segment wise at different identified industries.

The water samples collected in purge & trap amber vials directly with neck full of samples which can avoid any head space formation. After collection the samples were preserved in cooler with proper identification mark and the same is sealed.

3.2.1 Selection of Industries:

Chemical Industries, mainly Pharmaceuticals, Dyes and Dye Intermediates, Pesticide, use variety of solvents (volatile organic compounds) in their processes. These solvents, as pollutants, come into environment along with air, wastewater, and hazardous waste. Therefore some industries at Tarapur, Dombivali, Navi Mumbai, Chandrapur and Aurangabad Industrial Areas from Pharmaceutical, Dyes, Organic, Fine Chemicals, were selected for VOC Monitoring study.

In Pharmaceuticals, Dyes, Organic & Fine Chemicals Units, chemical synthesis (Reaction, Separation, Purification, Drying) and Extractions are the manufacturing phases responsible for significant emission of VOCs. Some VOCs, mostly chlorinated solvents, are known carcinogens and can be identified as Hazardous Air Pollutants. VOC emissions are generated as fugitive from reactor vents, filtering systems in the separation process, solvent vapours from purification tanks, dryers (including loading and unloading operations) and also from valves, tanks, pumps, and other equipments (e.g. centrifuge). VOCs are also emitted from effluent, Hazardous waste collection and treatment units because of carryover of solvents from the processes.

Industries were selected from the inventory available with MPCB. Collection of relevant information from industries and detailed information of plant premises was carried out to finalize the important locations for monitoring from fugitive emission point of view. Locations of fugitive monitoring in industries were selected on the basis of several factors viz. solvent handling and its storage practices,

leakages in the flanges, reactor vessels, high fugitive emission potential activities like filtration, centrifugation etc.. Because of its versatility in nature the maximum total VOC concentration will be in the work place, where the workers are more prone to the occupational health hazards. The PID was used in finalizing the locations for fugitive emission monitoring in industries. Based on the above observations and by keeping in the view point of occupational health related hazards the fugitive emission monitoring locations were selected.

3.3 Analysis for Ambient Air Quality & Fugitive Emission Samples:

Method EPA TO-17 (Active Thermal Desorption) and ASTM – 3687 (Purge & Trap) methods of analysis are used for Ambient Air Quality and Fugitive emission samples. The partial validation document with method description of EPA TO-17 & ASTM – 3687 Method is described at **Annexure- VII & VIII.**

3.4 Analysis for Water & Hazardous Waste Samples:

EPA Method 5030C/8260B is adopted for the analysis of VOCs in wastewater samples which is described in **Annexure - IX**.

One Set of Chromatogram is given at **Annexure-X**

3.5 LIMITATIONS OF THE STUDY

This study is an attempt to develop the baseline data and profiles of the VOCs present in ambient air, industrial effluents discharges and hazardous waste generated. The methods adopted for sampling and analysis are developed by overseas international institutions and methods standardized for Indian conditions are not developed and notified yet. Considering the fact, the total numbers of samples are optimized to cover wide range with available infrastructure for handling management and transportation of the samples for analysis.

VOC PROJECT REPORT ON TARAPUR INDUSTRIAL AREA

CHAPTER - IV

4.0 ABOUT TARAPUR INDUSTRIAL ESTATE:

Maharashtra Industrial Development Corporation (MIDC) has developed one of the largest industrial estates of Maharashtra in Palghar Taluka, at Tarapur. The industrial estate was established in the year 1972. Its proximity to Mumbai and location on Mumbai-Ahmedabad Western railway with ample availability of infrastructure always attracts industries. The industrial estate, MIDC, Tarapur is located in Thane District of Maharashtra State. It is one of the important industrial zones that developed by Maharashtra Industrial Development Corporation. Tarapur is approachable by road from Mumbai and Ahmedabad through National Highway (NH-8). The estate is also connected to Mumbai and Ahmedabad by rail. Boisar is the nearest railway station to the site. The Arabian Sea is hardly 5 km from the industrial estate. River Surya is the main source of water for the estate. Most of the industries located in the area are falling in the category of small to medium scale industries. Category-wise numbers of industries in Tarapur are given in following Table:

INDUSTRY STATISTICS OF TARAPUR

CATEGORY	LSI	MSI	SSI	TOTAL
RED	33	58	397	488
ORANGE	03	06	64	73
GREEN	01	11	458	470
TOTAL	**37**	**75**	**919**	**1031**

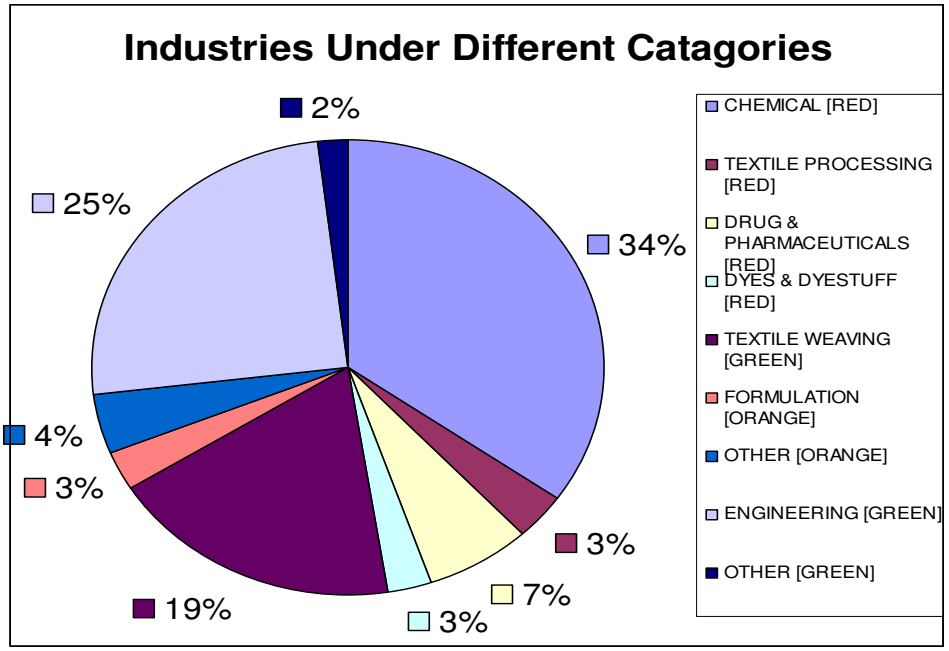
* Source : MPCB

The entire industrial estate is spread in about 1130.98 Ha area. The entire industrial estate is divided into number of zones and the chemical industries are mainly housed in N-zone.

The numbers of different types of industries are given in following Table:

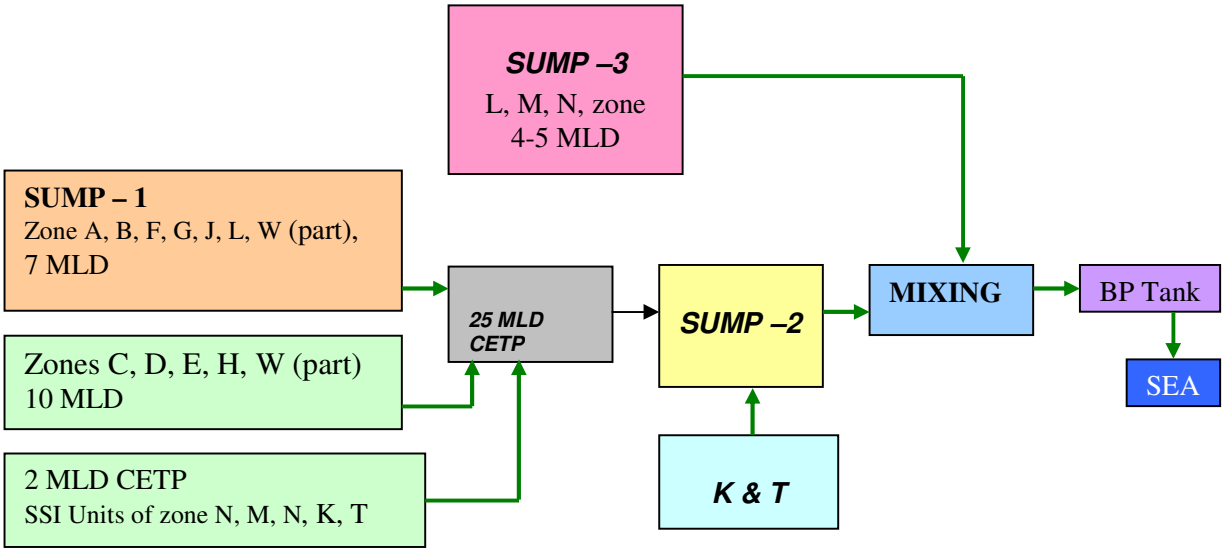
TYPES OF INDUSTRIES

CHEMICAL [RED]	357
TEXTILE PROCESSING [RED]	34
DRUG & PHARMACEUTICALS [RED]	68
DYES & DYESTUFF [RED]	29
TEXTILE WEAVING [GREEN]	192
FORMULATION [ORANGE]	28
OTHER [ORANGE]	45
ENGINEERING [GREEN]	258
OTHER [GREEN]	20
TOTAL	1031



4.1 Monitoring at Effluent Sumps & New CETP of Tarapur:

The effluent collection, treatment & disposal scheme of the industrial estate is studied & understood before finalizing the VOC monitoring locations. The details of scheme are depicted in following schematic flow diagram, which shows that effluent generated from part of K, L, M, N & T zones is directly discharged in to Sea without treatment in CETP. Chocking and leakage in MIDC drainage lines is one of the major problems in the industrial estate. Stagnation, spillage and flow of industrial effluent in natural drains are commonly seen in the industrial estate. There are leakages from the MIDC drainage lines and manholes.



The effluent generated from different zones of industrial estate is collected in three sumps through drainage system. After collection, effluent is finally disposed in Sea around 500 meters away from coastline. Details of sumps are given below:

SUMP NO. - 1

Effluent from A, B, F, G, J, L (Part), W (Part) & S zones is collected in this sump. Total quantity of effluent generated is about 7.0 MLD. Effluent collected in this sump is pumped to 25 MLD CETP (2.5 Kms. away) for further treatment & disposal.

SUMP NO. – 2

This sump receives effluent from 25 MLD CETP. Also effluent generated in part of K & T zones (about 1.0 MLD) enter in it after primary treatment only at individual industries level.

SUMP NO. – 3

Part of effluent generated in L, M & N zones is collected in this sump. The effluent is primarily treated at individual industries. Total quantity of effluent generated is about 5.0 MLD. This effluent from Sump no. 3 is directly pumped to mixing tank near M/s. SC Enviro Agro Industries Pvt. Ltd., T-137/113 where effluent from other zones, partly after treatment in 25 MLD CETP, also discharged. Thereafter the effluent goes by gravity to BP Tank and ultimately in to Arabian Sea. Pipeline for pumping the effluent collected at sump number 3 to 25 MLD CETP is yet to be commissioned. It is understood that acidic pH of effluent is found in night time.

4.2 Status of New Common Effluent Treatment Plant (CETP)

Tarapur Industrial Management Association (TIMA) reportedly formed a separate body named as Tarapur Environmental Protection Society (TEPS) in 2004 exclusively for looking after the matters related to environmental protection and pollution control in MIDC Tarapur. The CETP has designed capacity of 25 MLD with primary, secondary and tertiary treatment facility. The CETP has effluent receiving sump→Equalization Tanks with 04 surface aerators (03 nos. used alternatively to equalize the effluent)→Two parallel sets of flash mixer & clarifier→ Three Aeration Tanks (with diffused aeration system)→ Two clarifiers→One oxidation pond with diffused aeration→ Three parallel sets of Pressure Sand Filter & Activated Carbon Filter in series→Treated effluent sump. The treated effluent is discharged in to Sump No. 2 and finally in Arabian Sea through a closed pipeline. The CETP is not equipped with adequate flow measurement systems at inlet & outlet and sufficient sludge storage facility before sending it to TSDF.

Wastewater sampling for the analysis of VOCs were carried out at Inlet to New CETP, MIDC's effluent collection sumps and Equalization Tanks of selected

industrial units. The sampling was carried out to know the contents of VOCs in the wastewater.

4.3 Location of the Sampling:

The meteorological parameters have been studied and accordingly prevailing wind direction is North East to South West and sometimes North to South with minimum temperature of 22°C and Maximum 28°C. The relative humidity was found in the range of 45 – 65% and wind speed is ranging from 0.8m/sec to 2.2 m/s.

Following industries were selected for VOC monitoring:

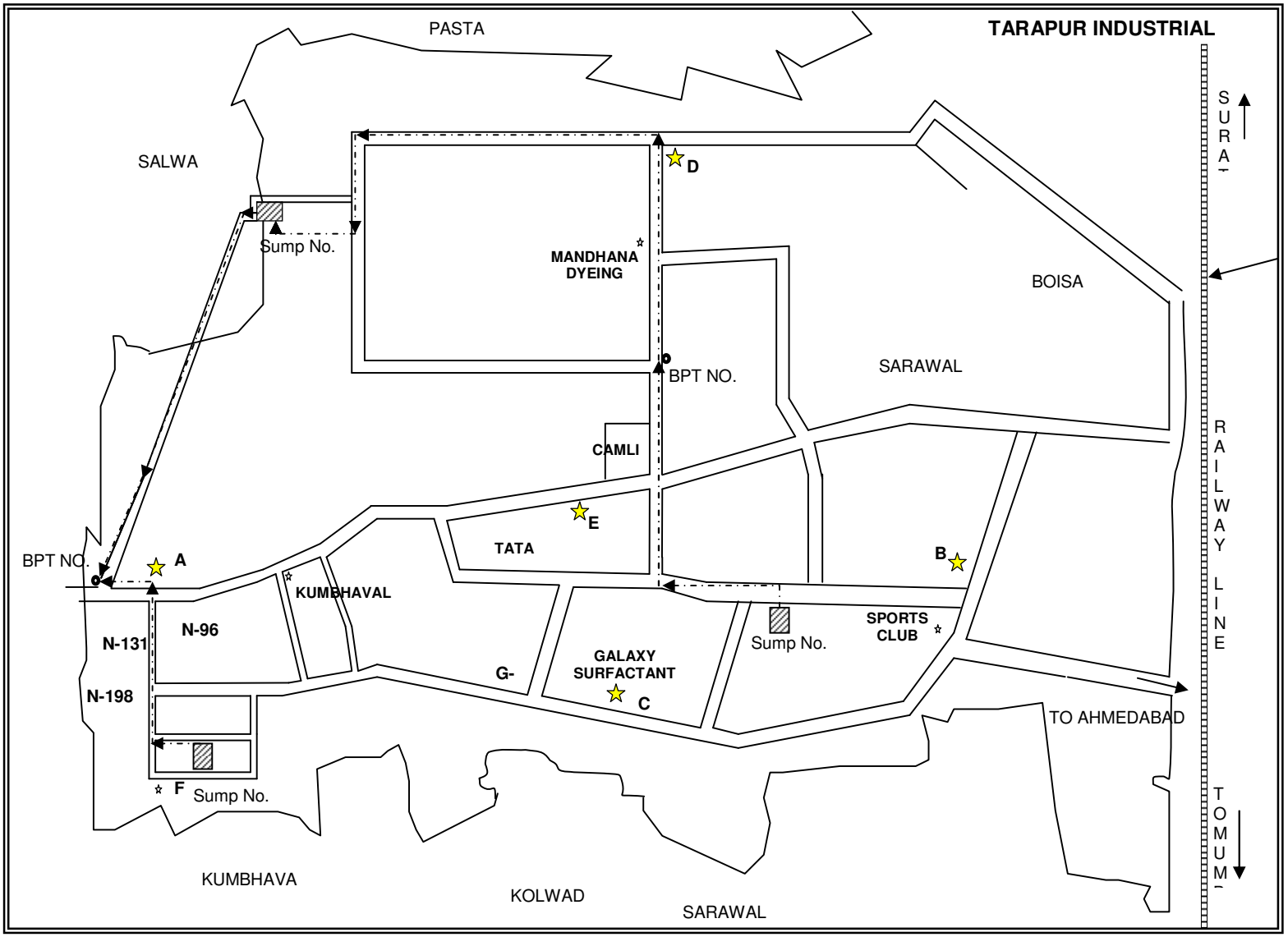
Up wind : (1) Premises of Dahanu – Palghar Sports Club in the East direction of industrial area.

Downwind : (2) Premises of Police Chowki, Near Kumbhawali Naka (T-Zone) in the West of industrial area.

Cross - wind : (3) Premises of M/s Galaxy Surfactants, G-59 (G-Zone) in South direction of industrial area.

Cross - wind : (4) Premises of M/s Mandhana Dyeing, E-25 (E-Zone) in the North direction of industrial area.

Centre : (5) Premises of Tata Steel, A-6 (A-Zone) (almost in the centre of industrial area).


TARAPUR INDUSTRIAL
PASTA
SALWA
Sump No.
MANDHANA DYEING
D
BOISA
SARAWAL
BPT NO.
CAMLI
E
TATA
B
BPT NO.
A
KUMBHAVAL
N-96
N-131
N-198
G-
GALAXY SURFACTANT
C
Sump No.
SPORTS CLUB
TO AHMEDABAD
F
Sump No.
KUMBHAVA
KOLWAD
SARAWAL
SURAT
RAILWAY LINE
TOMUM

4.4 RESULTS & DISCUSSIONS:

4.4.1 Results & Discussion for Ambient Air Quality Monitoring at Tarapur:-

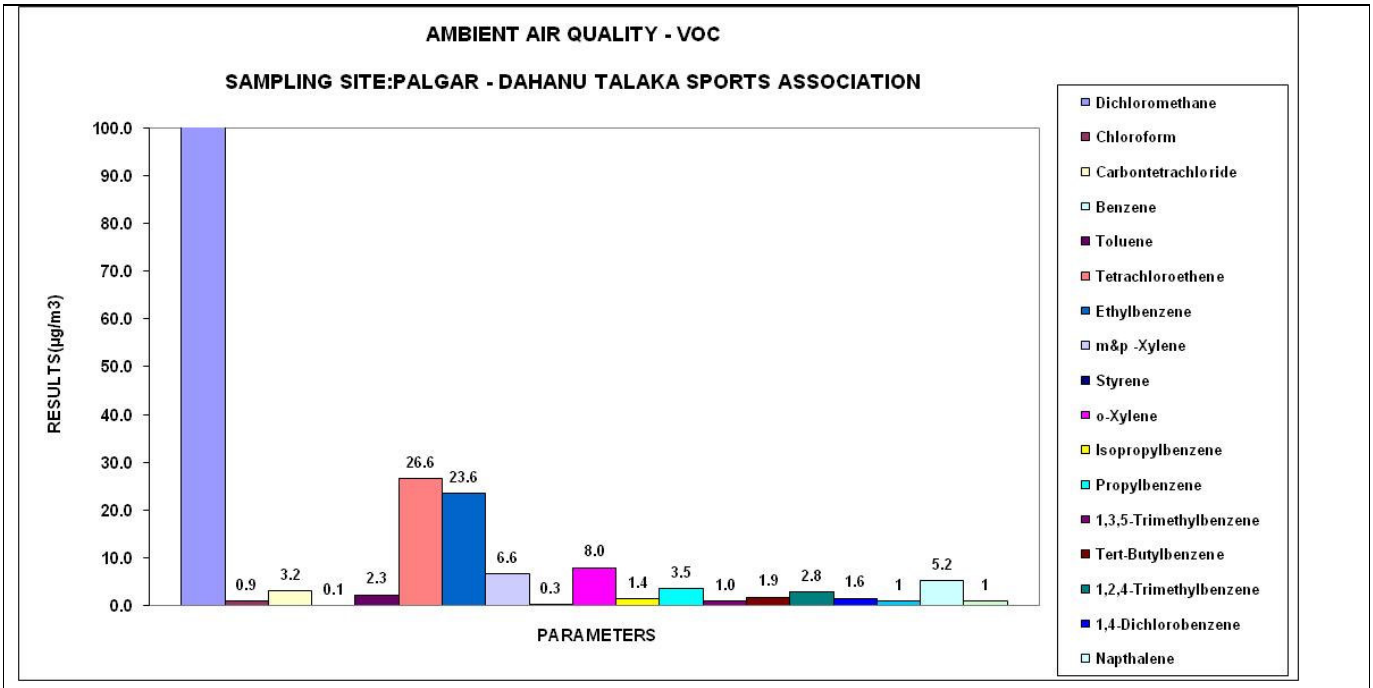
Station 1: Premises of Dahanu – Palghar Sports Club in the East direction of industrial area.

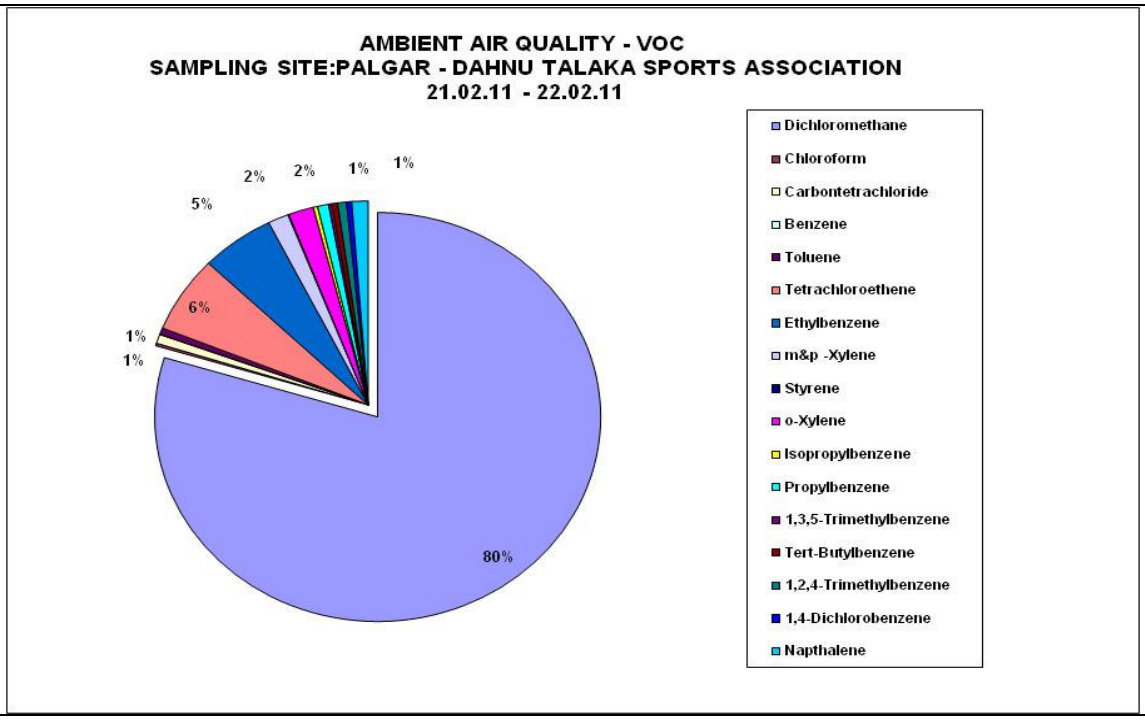
This station is located in up-wind direction of the industrial estate. 17 VOCs are detected in this location. The AAQM Station-1 was identified as up-wind station as per the prevailing wind direction at the time of the study. The wind direction was North - East to South-West and some time South West to North East. The ambient temperature was in the range between 22 – 28°C and the Relative humidity in the range of 45 – 75%. Approximate height from ground level is 15 feet.

S.No	AMBIENT AIR QUALITY – VOC SAMPLING AREA: TARAPUR INDUSTRIAL ESTATE,MAHARASTRA SAMPLING SITE: PALGAR-DHANU TALUKA SPORTS ASSOCIATION /TOP OF THE ADMIN BUILDING – 21.02.11 TO 22.02.11				
	PARAMETERS	TIME:03.00-11.00	TIME:11.00-07.00	TIME:07.00-03.00	AVERAGE
		RESULTS (µg/m^3)			
1	Dichloromethane	BDL	1048.17	BDL	349.39
2	Chloroform	BDL	2.75	BDL	0.92
3	Carbontetrachloride	6.30	BDL	3.22	3.17
4	Benzene	0.32	BDL	BDL	0.11
5	Toluene	5.56	BDL	1.23	2.26
6	Tetrachloroethene	49.54	BDL	30.30	26.61
7	Ethylbenzene	36.56	4.92	29.21	23.56
8	m&p –Xylene	14.85	BDL	5.00	6.62
9	Styrene	BDL	BDL	0.88	0.29
10	o-Xylene	14.62	BDL	9.46	8.03
11	Isopropylbenzene	1.97	BDL	2.25	1.41
12	Propylbenzene	4.00	BDL	6.62	3.54
13	1,3,5-Trimethylbenzene	0.86	BDL	2.13	1.00
14	Tert-Butylbenzene	1.54	BDL	4.03	1.86
15	1,2,4-Trimethylbenzene	2.24	BDL	6.30	2.85
16	1,4-Dichlorobenzene	4.86	BDL	BDL	1.62
17	Napthalene	BDL	BDL	15.69	5.23
TOTAL VOC =		**144.72**	**1055.83**	**118.92**	**439.82**

Only one VOC was found common in all the cycles of monitoring out of the total detected 17 VOCs. Concentration of Dichloromethane was found to be highest in

second cycle of monitoring, however the concentration of Tetrachloroethane, Ethylbenzene and o-Xylene is also found to be maximum in this location.



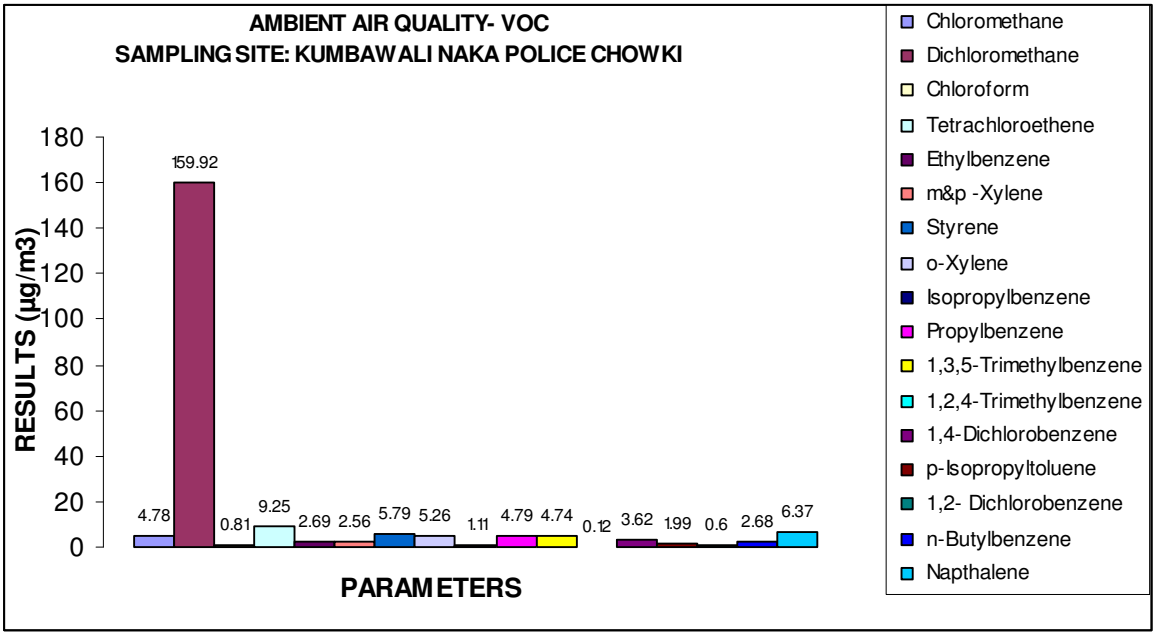


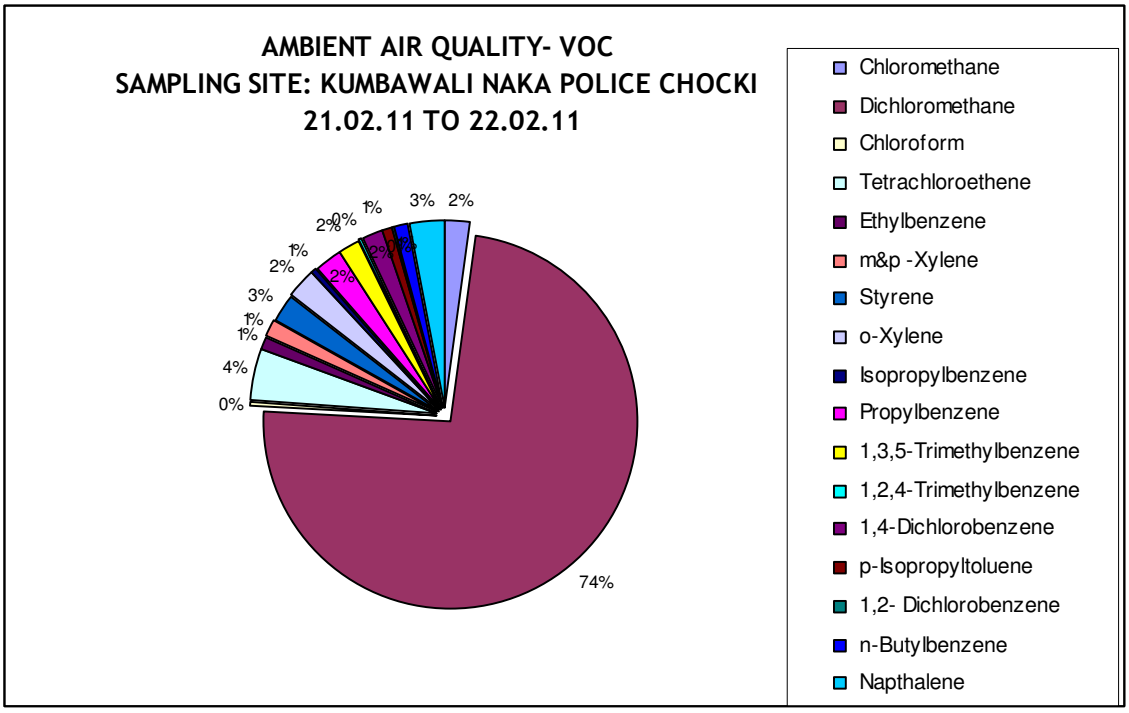
Station 2: Premises of Police Chowki, Near Kumbhawali Naka (T-Zone) in the West of industrial area.

The AAQ station-2 is identified as down-wind station as per prevailing wind direction at the time of the study. 17 VOCs are detected in this location. The wind direction was North-East to South-West and some time North to South. The ambient temperature was in the range between 22 – 28°C and the Relative humidity in the range of 45 – 75%. Approximate height from ground level is 15 feet.

S.No	AMBIENT AIR QUALITY – VOC				
	SAMPLING AREA: TARAPUR INDUSTRIAL ESTATE,MAHARASTRA				
	SAMPLING SITE:NEAR KUMBAWALI NAKA POLICE CHOCKI – 21.02.11 TO 22.02.11				
	PARAMETERS	TIME:4.30-12.30	TIME:12.30-08.30	TIME:08.30-04.30	AVERAGE
		RESULTS (µg/m^3)			
1	Chloromethane	BDL	14.33	BDL	**4.78**
2	Dichloromethane	BDL	479.75	BDL	**159.92**
3	Chloroform	BDL	2.42	BDL	**0.81**
4	Tetrachloroethene	10.86	BDL	16.88	**9.25**
5	Ethylbenzene	BDL	BDL	8.07	**2.69**
6	m&p -Xylene	0.19	BDL	7.49	**2.56**
7	Styrene	BDL	BDL	17.37	**5.79**
8	o-Xylene	BDL	BDL	15.77	**5.26**
9	Isopropylbenzene	0.49	BDL	2.83	**1.11**
10	Propylbenzene	1.29	BDL	13.07	**4.79**
11	1,3,5-Trimethylbenzene	2.28	BDL	11.94	**4.74**
12	1,2,4-Trimethylbenzene	0.35	BDL	BDL	**0.12**
13	1,4-Dichlorobenzene	BDL	BDL	10.85	**3.62**
14	p-Isopropyltoluene	0.54	BDL	5.43	**1.99**
15	1,2- Dichlorobenzene	1.81	BDL	BDL	**0.60**
16	n-Butylbenzene	BDL	BDL	8.05	**2.68**
17	Napthalene			19.12	**6.37**
TOTAL VOC =		**17.82**	**496.50**	**136.88**	**217.07**

Dichloromethane is found maximum concentration in the second cycle in this location followed by Tetrachloroethane, Naphthalene, Styrene, o-Xylene and dichlorobenzene.


AMBIENT AIR QUALITY- VOC
SAMPLING SITE: KUMBAWALI NAKA POLICE CHOWKI
RESULTS (µg/m3)
PARAMETERS
4.78
159.92
0.81
9.25
2.69
2.56
5.79
5.26
1.11
4.79
4.74
0.12
3.62
1.99
0.6
2.68
6.37
Chloromethane
Dichloromethane
Chloroform
Tetrachloroethene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
1,2,4-Trimethylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2- Dichlorobenzene
n-Butylbenzene
Napthalene

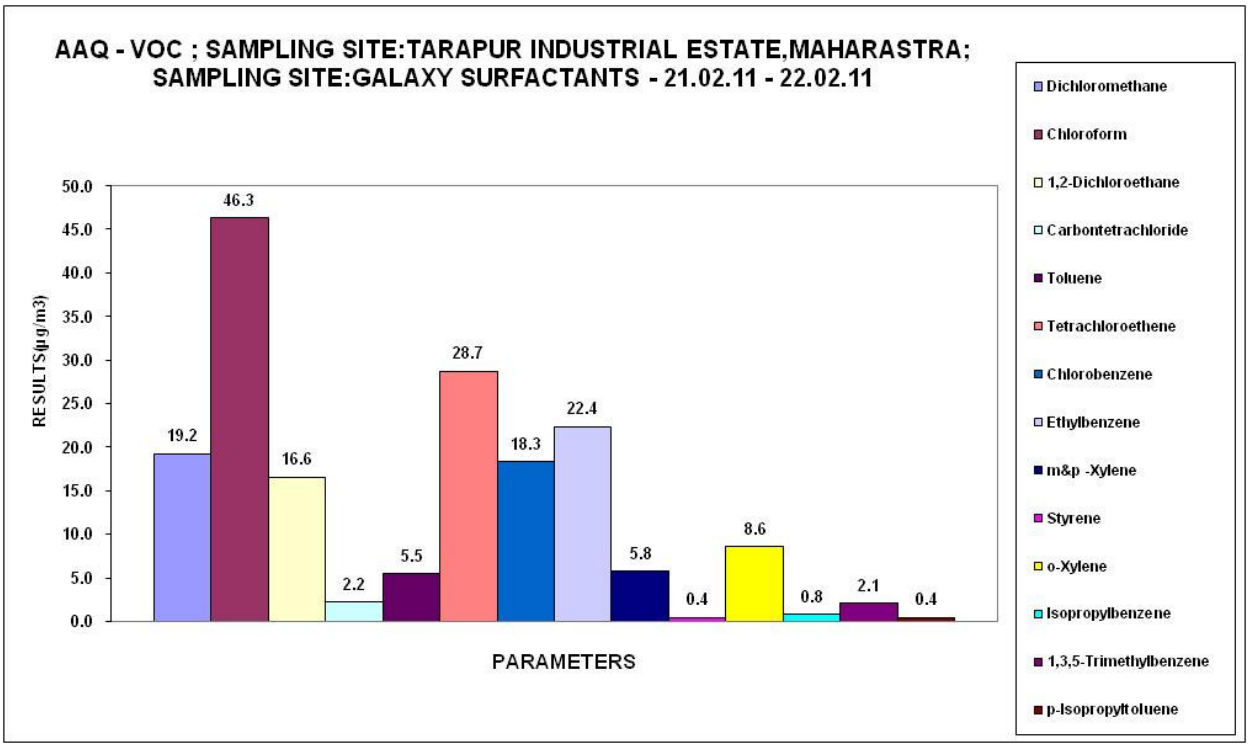

AMBIENT AIR QUALITY- VOC
SAMPLING SITE: KUMBAWALI NAKA POLICE CHOCKI
21.02.11 TO 22.02.11
74%
4%
0%
3%
1%
1%
2%
1%
2%
0%
2%
1%
3%
2%
Chloromethane
Dichloromethane
Chloroform
Tetrachloroethene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
1,2,4-Trimethylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2- Dichlorobenzene
n-Butylbenzene
Napthalene

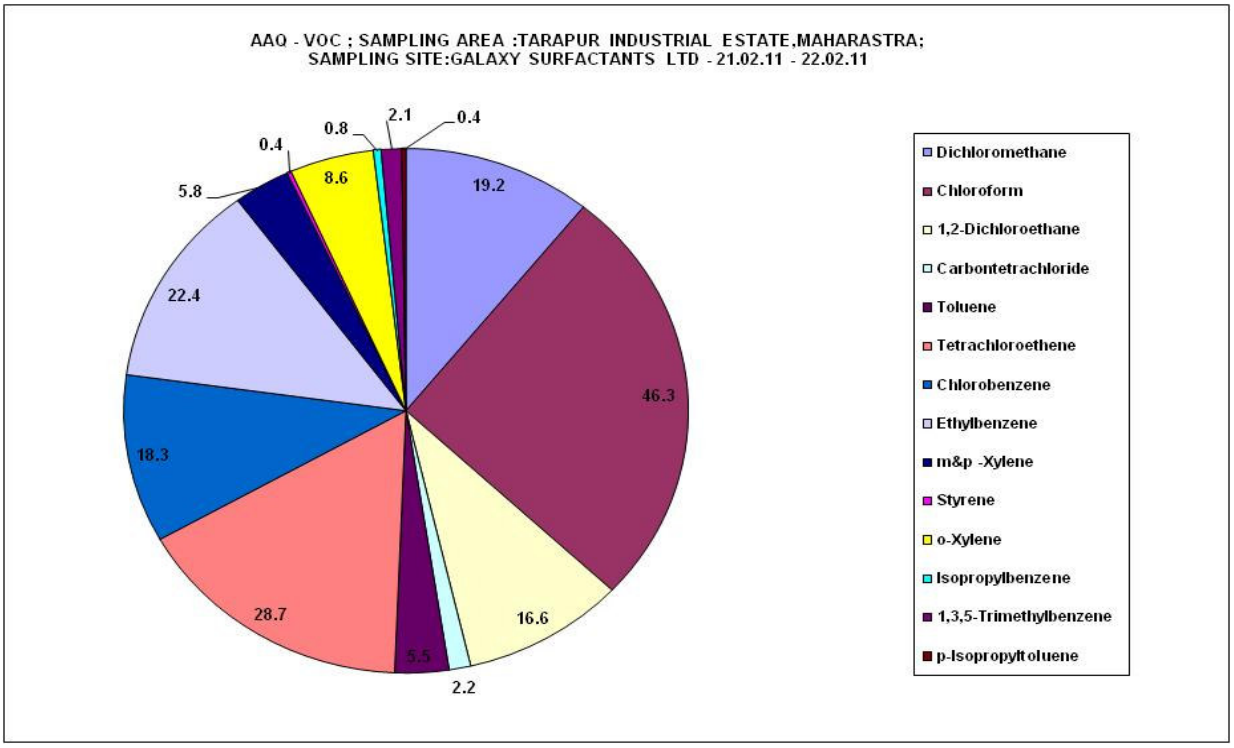
Station 3: Premises of M/s Galaxy Surfactants, G-59 (G-Zone) in South direction of industrial area.

The AAQ station-3 is identified as cross-wind station in southern direction as per prevailing wind direction at the time of the study.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: TARAPUR INDUSTRIAL ESTATE,MAHARASTRA				
	SAMPLING SITE:GALAXY SURFACTANTS LTD - 21.02.11 TO 22.02.11				
	PARAMETERS	TIME:12.00-20.00	TIME:20:10-04:10	TIME:04:10-12:10	AVERAGE
		RESULTS (µg/m3)			
1	Dichloromethane	BDL	57.7	BDL	19.2
2	Chloroform	109.4	7.8	21.7	46.3
3	1,2-Dichloroethane	BDL	49.7	BDL	16.6
4	Carbontetrachloride	6.6	BDL	BDL	2.2
5	Toluene	11.1	BDL	5.3	5.5
6	Tetrachloroethene	49.9	BDL	36.3	28.7
7	Chlorobenzene	34.8	BDL	20.2	18.3
8	Ethylbenzene	32.4	5.3	29.3	22.4
9	m&p -Xylene	6.1	BDL	11.2	5.8
10	Styrene	1.3	BDL	BDL	0.4
11	o-Xylene	19.7	BDL	6.1	8.6
12	Isopropylbenzene	2.4	BDL	BDL	0.8
13	1,3,5-Trimethylbenzene	BDL	BDL	6.2	2.1
TOTAL VOC =		274.7	120.4	136.5	177.2

13 VOCs are found in this location in which Chloroform, Tetrachloroethane, Chlorobenzene and Dichloromethane is detected with maximum concentration out of 13 detected VOCs.


AAQ - VOC : SAMPLING SITE:TARAPUR INDUSTRIAL ESTATE,MAHARASTRA;
SAMPLING SITE:GALAXY SURFACTANTS - 21.02.11 - 22.02.11
RESULTS(µg/m3)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
19.2
46.3
16.6
2.2
5.5
28.7
18.3
22.4
5.8
0.4
8.6
0.8
2.1
0.4
PARAMETERS
Dichloromethane
Chloroform
1,2-Dichloroethane
Carbontetrachloride
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene
Isopropylbenzene
1,3,5-Trimethylbenzene
p-Isopropyltoluene

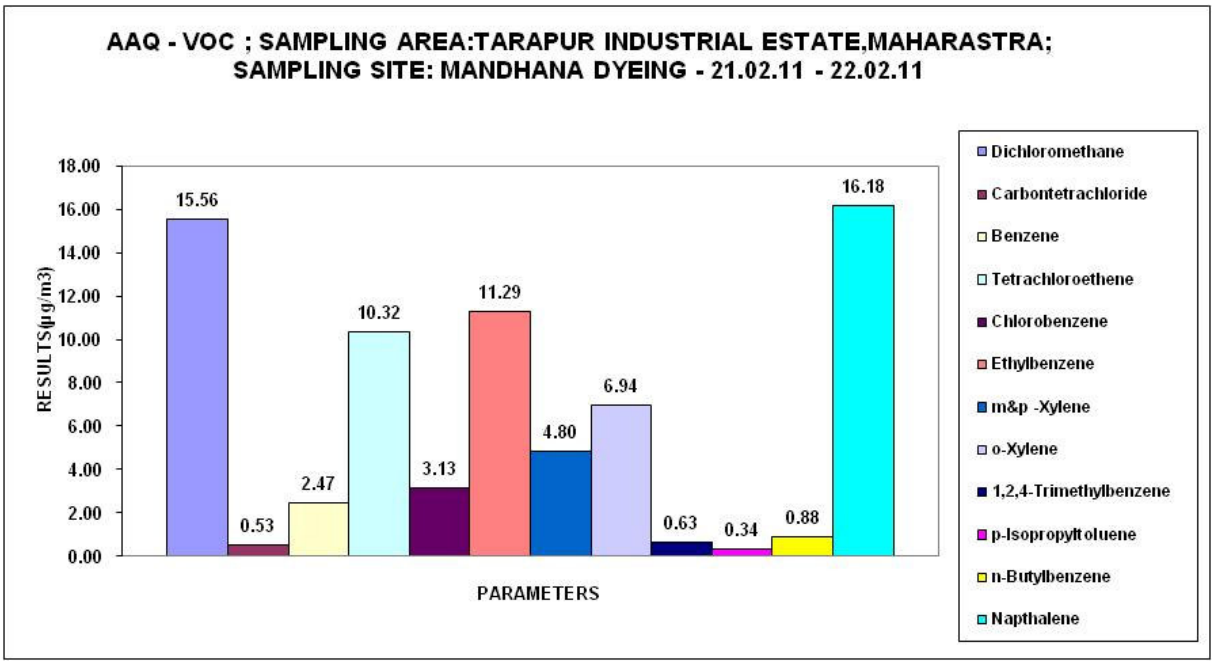

AAQ - VOC ; SAMPLING AREA :TARAPUR INDUSTRIAL ESTATE,MAHARASTRA;
SAMPLING SITE:GALAXY SURFACTANTS LTD - 21.02.11 - 22.02.11
19.2
46.3
16.6
2.2
5.5
28.7
18.3
22.4
5.8
0.4
8.6
0.8
2.1
0.4
Dichloromethane
Chloroform
1,2-Dichloroethane
Carbontetrachloride
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene
Isopropylbenzene
1,3,5-Trimethylbenzene
p-Isopropyltoluene

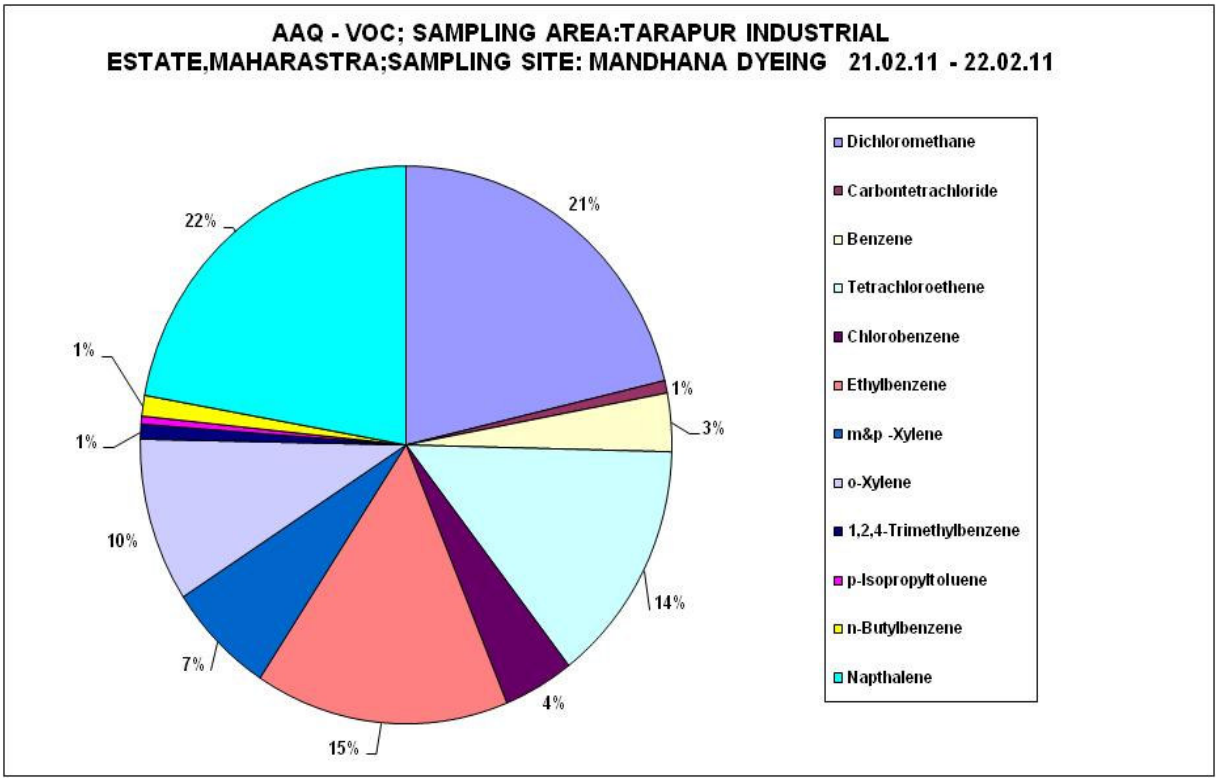
Station 4: Premises of M/s Mandhana Dyeing, E-25 (E-Zone) in the North direction of industrial area.

The AAQ station-4 is identified as cross-wind station in northern direction as per prevailing wind direction at the time of the study.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: TARAPUR INDUSTRIAL ESTATE,MAHARASTRA				
	SAMPLING SITE:MANDHANA DYEING - 21.02.11 TO 22.02.11				
	PARAMETERS	TIME:02.30-10.00	TIME:10.30-06.30	TIME:06.30-02.30	AVERAGE
		RESULTS (µg/m3)			
1	Dichloromethane	BDL	46.67	BDL	15.56
2	Carbontetrachloride	BDL	BDL	1.58	0.53
3	Benzene	BDL	7.42	BDL	2.47
4	Tetrachloroethene	3.62	BDL	27.34	10.32
5	Chlorobenzene	BDL	BDL	9.40	3.13
6	Ethylbenzene	BDL	BDL	33.87	11.29
7	m&p -Xylene	BDL	BDL	14.41	4.80
8	o-Xylene	BDL	BDL	20.82	6.94
9	1,2,4-Trimethylbenzene	1.88	BDL	BDL	0.63
10	p-Isopropyltoluene	1.01	BDL	BDL	0.34
11	n-Butylbenzene	2.63	BDL	BDL	0.88
12	Napthalene	48.54	BDL	BDL	16.18
TOTAL VOC =		57.69	54.08	107.42	73.06

12 VOCs are found in this location in which Dichloromethane, Tetrachloroethane, Ethylbenzene and Naphthalene is detected with maximum concentration out of 12 detected VOCs.


AAQ - VOC ; SAMPLING AREA:TARAPUR INDUSTRIAL ESTATE,MAHARASTRA;
SAMPLING SITE: MANDHANA DYEING - 21.02.11 - 22.02.11
RESULTS(µg/m3)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
15.56
0.53
2.47
10.32
3.13
11.29
4.80
6.94
0.63
0.34
0.88
16.18
PARAMETERS
Dichloromethane
Carbontetrachloride
Benzene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
1,2,4-Trimethylbenzene
p-Isopropyltoluene
n-Butylbenzene
Napthalene

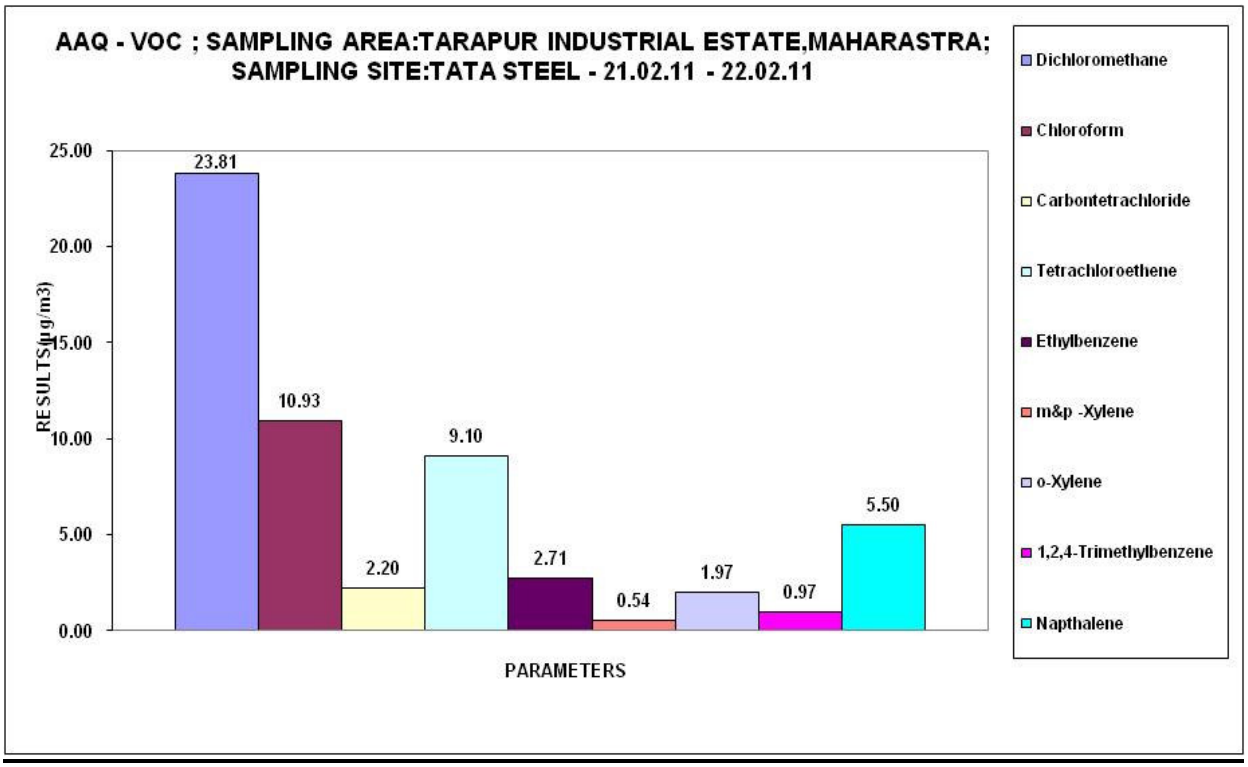

AAQ - VOC; SAMPLING AREA:TARAPUR INDUSTRIAL
ESTATE,MAHARASTRA;SAMPLING SITE: MANDHANA DYEING 21.02.11 - 22.02.11
21%
1%
3%
14%
4%
15%
7%
10%
1%
1%
22%
Dichloromethane
Carbontetrachloride
Benzene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
1,2,4-Trimethylbenzene
p-Isopropyltoluene
n-Butylbenzene
Napthalene

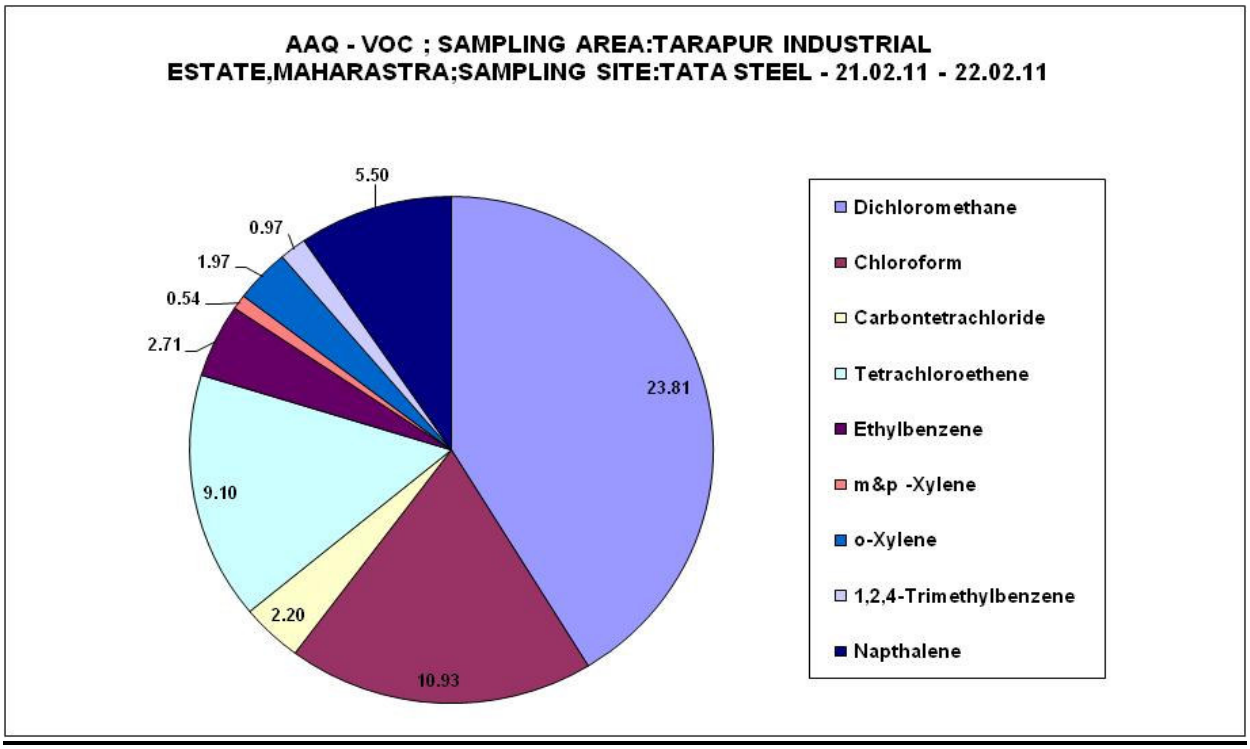
Station 5: Premises of Tata Steel, A-6 (A-Zone) (almost in the centre of industrial area).

The AAQ station-5 is identified as centre of the industrial estate. 17 VOCs in first day and 15 VOCs in second day of monitoring found at the location.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: TARAPUR INDUSTRIAL ESTATE,MAHARASTRA				
	SAMPLING SITE:TATA STEEL - 21.02.11 TO 22.02.11				
	PARAMETERS	TIME:03.40-11.40	TIME:11.40-07.40	TIME:07.40-03.40	AVERAGE
		RESULTS (µg/m3)			
1	Dichloromethane	BDL	71.42	BDL	23.81
2	Chloroform	BDL	4.58	28.22	10.93
3	Carbontetrachloride	1.71	BDL	4.87	2.20
4	Tetrachloroethene	13.62	BDL	13.68	9.10
5	Ethylbenzene	6.70	BDL	1.42	2.71
6	m&p -Xylene	0.31	BDL	1.30	0.54
7	o-Xylene	BDL	BDL	5.90	1.97
8	1,2,4-Trimethylbenzene	BDL	BDL	2.90	0.97
9	Napthalene	16.49	BDL	BDL	5.50
TOTAL VOC =		38.83	76.00	58.30	57.71

9 VOCs are detected in this location in which Dichloromethane was found to have maximum concentration the second cycle of monitoring followed by Chloroform, Tetrachloroethane, and Naphthalene.


AAQ - VOC ; SAMPLING AREA:TARAPUR INDUSTRIAL ESTATE,MAHARASTRA; SAMPLING SITE:TATA STEEL - 21.02.11 - 22.02.11
RESULTS(µg/m3)
25.00
20.00
15.00
10.00
5.00
0.00
23.81
10.93
2.20
9.10
2.71
0.54
1.97
0.97
5.50
PARAMETERS
Dichloromethane
Chloroform
Carbontetrachloride
Tetrachloroethene
Ethylbenzene
m&p -Xylene
o-Xylene
1,2,4-Trimethylbenzene
Napthalene


AAQ - VOC ; SAMPLING AREA:TARAPUR INDUSTRIAL ESTATE,MAHARASTRA;SAMPLING SITE:TATA STEEL - 21.02.11 - 22.02.11
5.50
0.97
1.97
0.54
2.71
23.81
9.10
2.20
10.93
Dichloromethane
Chloroform
Carbontetrachloride
Tetrachloroethene
Ethylbenzene
m&p -Xylene
o-Xylene
1,2,4-Trimethylbenzene
Napthalene

AMBIENT AIR QUALITY MONITORING ANALYSIS REPORT: TARAPUR

(21/02/11 - 22/02/11)

24 hours' average concentration of total VOCs at each location with average of each cycle is depicted in following Table for the ease of comparison.

Station No	Sampling Locations	TVOCs Concentrations (micro gram / cubic meters)		
1	Premises of Dahanu - Palghar Sports Club in the East direction of industrial area. **(21/02/11 - 22/02/11)**	145.0 (15:00 Hrs - 23:00Hrs)	1056.0 (23:00 Hrs - 07:00 Hrs)	119.0 (07:00 Hrs - 15:00Hrs)
		Average Concentration : 440.0		
2	Premises of Police Chowki, Near Kumbhawali Naka (T-Zone) in the West of industrial area. **(21/02/11 - 22/02/11)**	18.0 (16:30 Hrs - 00:30Hrs)	496.0 (00:30 Hrs - 08:30Hrs)	137.0 (08:30 Hrs - 16:30Hrs)
		Average Concentration : 217.0		
3	Premises of M/s Galaxy Surfactants, G-59 (G-Zone) in South direction of industrial area. **(21/02/11 - 22/02/11)**	275.0 (12:00 Hrs - 20:00Hrs)	120.4 (20:00 Hrs - 04:00Hrs)	136.5 (04:00 Hrs - 12:00Hrs)
		Average Concentration : 177.2		
4	Premises of M/s Mandhana Dyeing, E-25 (E-Zone) in the North direction of industrial area. **(21/02/11 - 22/02/11)**	58.0 (14:30 Hrs - 22:30Hrs)	54.0 (22:30 Hrs - 06:30Hrs)	107.4 (06:30 Hrs - 14:30Hrs)
		Average Concentration : 73.0		
5	Premises of Tata Steel, A-6 (A-Zone) (almost in the centre of industrial area). **(21/02/11 - 22/02/11)**	39.0 (15:40 Hrs - 23:40Hrs)	76.0 (23:40 Hrs - 07:40Hrs)	58.0 (07:40 Hrs - 15:40Hrs)
		Average Concentration : 58.0		

A A Q M Station in up wind direction	:	Station-1
A A Q M Station in down wind direction	:	Station-2 & 4
A A Q M Station in Cross wind direction	:	Station-3 & 5

Land Use Classification	Industrial Zone
Sky Conditions	Sunny Sky
Ambient Temperature	22°C to 32°C
Predominant Wind Directions	South East to North West and North to South

Sampling and Analysis Methodology Adopted: EPA TO-17

Change in the concentration of VOCs observed in each cycle of the entire 24 hours monitoring at almost all stations. That may due to the change in batch process steps of the industries, weekly shutdown, and maintenance/repair in the plants/storages/machineries could be the probable causes of the same. Dichloromethane, Chloroform, Tetrachloroethane, Xylene, Ethyl Benzene, Chlorobenzene, Naphthalene, Carbon Tetrachloride are having pre-dominant presence among other VOCs at these locations.

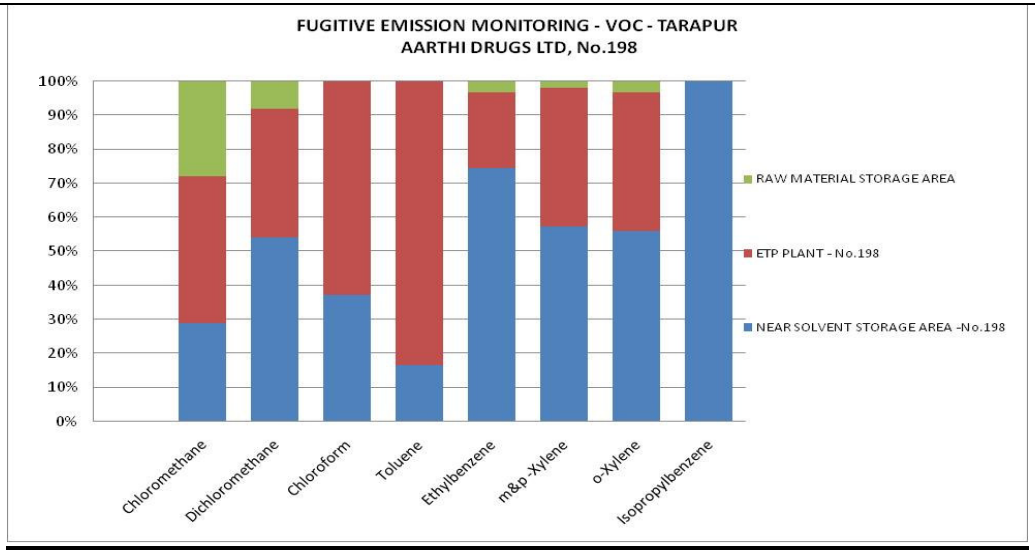
4.5 Result of Monitoring at Industries:

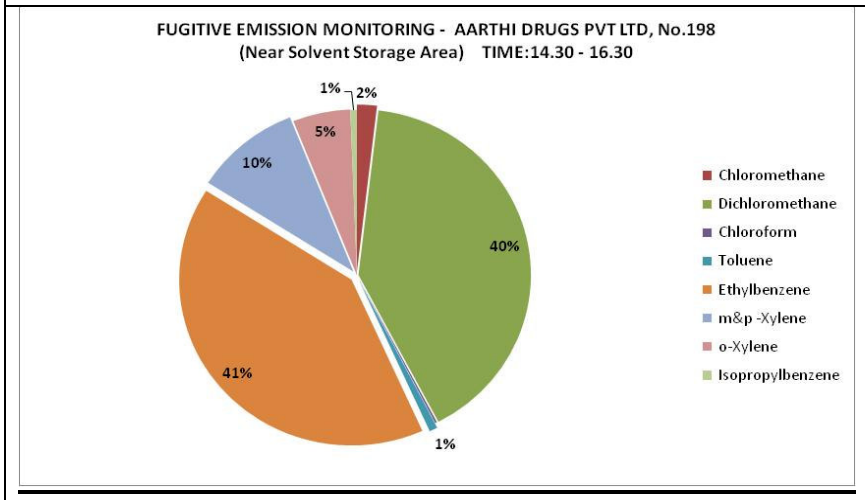
4.5.1 M/s Aarti Drugs Ltd., (Plot No. N – 198)

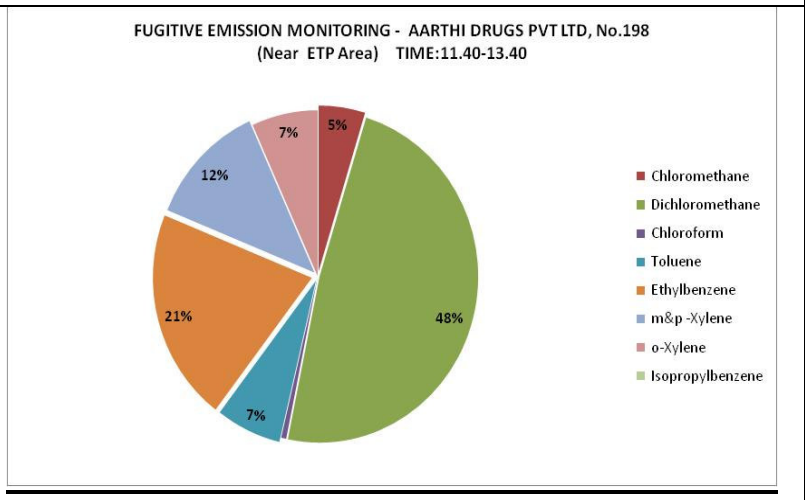
- Bulk Drug Industry
- Major Products: Nimusulide, Tinadazole, Imadazole
- Major Solvents: Monochloro Benzene, Xylene, MIBK etc.,
- Date of sampling : 22.02.11

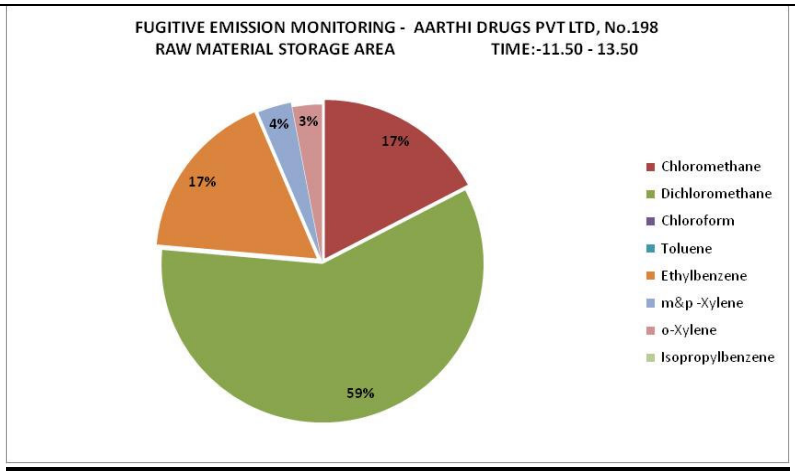
Samples of fugitive emissions and wastewater were collected from the unit and analysed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be in the range of 584 to 5665µg/m^3. The highest concentration was found at the location near solvent storage area followed by ETP where evaporation from effluent streams takes place at higher rates especially in aeration of the effluent.

FUGITIVE EMISSION MONITORING - VOC (TARAPUR) – Results in [µg/m3]			
SAMPLING SITE:AARTHI DRUGS LTD - 22.02.11			
PARAMETERS	**NEAR SOLVENT STORAGE AREA -No.198 TIME:14.30-16.30**	**ETP PLANT - No.198 TIME:11.40-13.40**	**RAW MATERIAL STORAGE AREA TIME:-11.50 - 13.50**
Chloromethane	105.0	156.4	101.0
Dichloromethane	2291.3	1602.4	345.3
Chloroform	10.0	16.8	BDL
Toluene	43.7	220.8	BDL
Ethylbenzene	2308.3	686.3	100.7
m&p -Xylene	565.0	401.0	19.7
o-Xylene	306.0	222.5	17.3
Isopropylbenzene	35.3	BDL	BDL
TOTAL VOC =	**5664.7**	**3306.2**	**584.1**


FUGITIVE EMISSION MONITORING - VOC - TARAPUR
AARTHI DRUGS LTD, No.198
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Chloromethane
Dichloromethane
Chloroform
Toluene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene
RAW MATERIAL STORAGE AREA
ETP PLANT - No.198
NEAR SOLVENT STORAGE AREA -No.198


FUGITIVE EMISSION MONITORING - AARTHI DRUGS PVT LTD, No.198
(Near Solvent Storage Area) TIME:14.30 - 16.30
1%
2%
5%
10%
40%
41%
1%
Chloromethane
Dichloromethane
Chloroform
Toluene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene

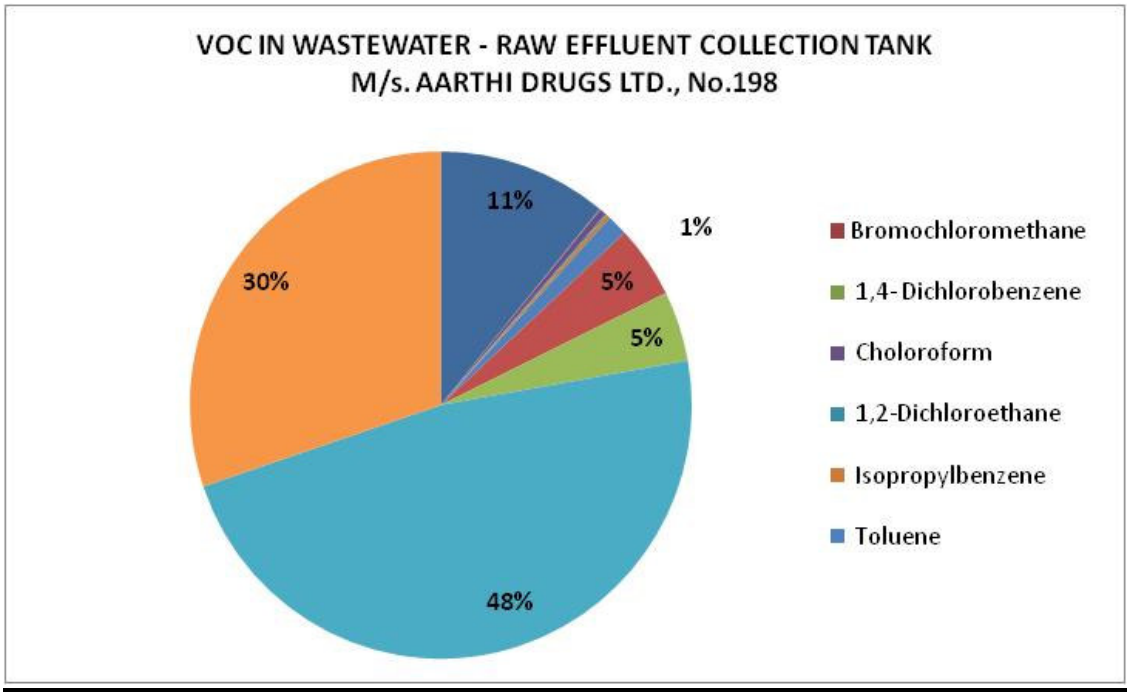

FUGITIVE EMISSION MONITORING - AARTHI DRUGS PVT LTD, No.198
(Near ETP Area) TIME:11.40-13.40
5%
7%
12%
21%
7%
48%
Chloromethane
Dichloromethane
Chloroform
Toluene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene



4.5.2 EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from equalization tank of ETP was found to be 8290.4 µg/l. The higher concentration may be due to improper separation of intermediate/solvents/products at different process stages, which also affects the treatment efficiency of the ETP.

VOLATILE ORGANIC COMPOUND (EFFLUENT WATER)	
SAMPLING AREA :TARAPUR MAHARASTRA	
SAMPLING SITE:AARTHI DRUGS LTD., No198 -22.02.11	
LOCATION:RAW EFFLUENT COLLECTION TANK	
PARAMETERS	**RESULTS (µg/l)**
Chlorobenzene	905.1
Bromochloromethane	3.4
1,4- Dichlorobenzene	1.7
Choloroform	35.0
1,2-Dichloroethane	9.2
Isopropylbenzene	20.5
Toluene	110.5
o -Xylene	383.2
m&p -Xylene	369.6
1,1,2-Trichloroethane	1.5
Dichloromethane	3946.9
1,1,2,2- Tetrachloroethane	2503.8
TOTAL VOC =	**8290.4**

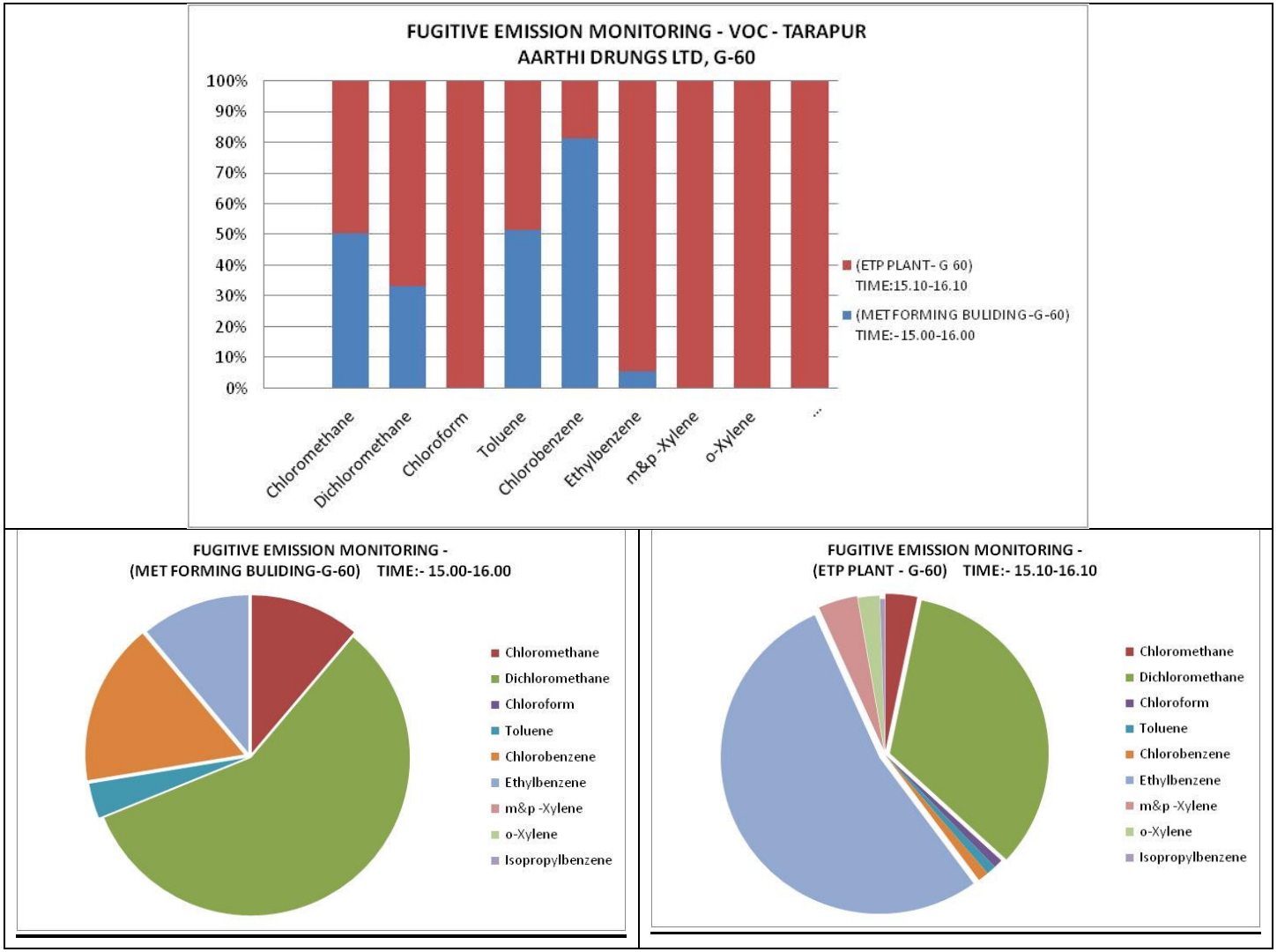

VOC IN WASTEWATER - RAW EFFLUENT COLLECTION TANK
M/s. AARTHI DRUGS LTD., No.198
11%
1%
5%
5%
30%
48%
Bromochloromethane
1,4-Dichlorobenzene
Choloroform
1,2-Dichloroethane
Isopropylbenzene
Toluene

4.5.3 M/s Aarti Drugs Ltd, Plot No. G - 60

FUGITIVE EMISSION MONITORING :

Samples of fugitive emissions and wastewater were collected from the unit and analysed for VOCs. The concentrations of VOCs in fugitive emission monitoring samples were found to be in the range of 941 to 3207µg/m^3. The highest concentration was found at Near ETP plant area.

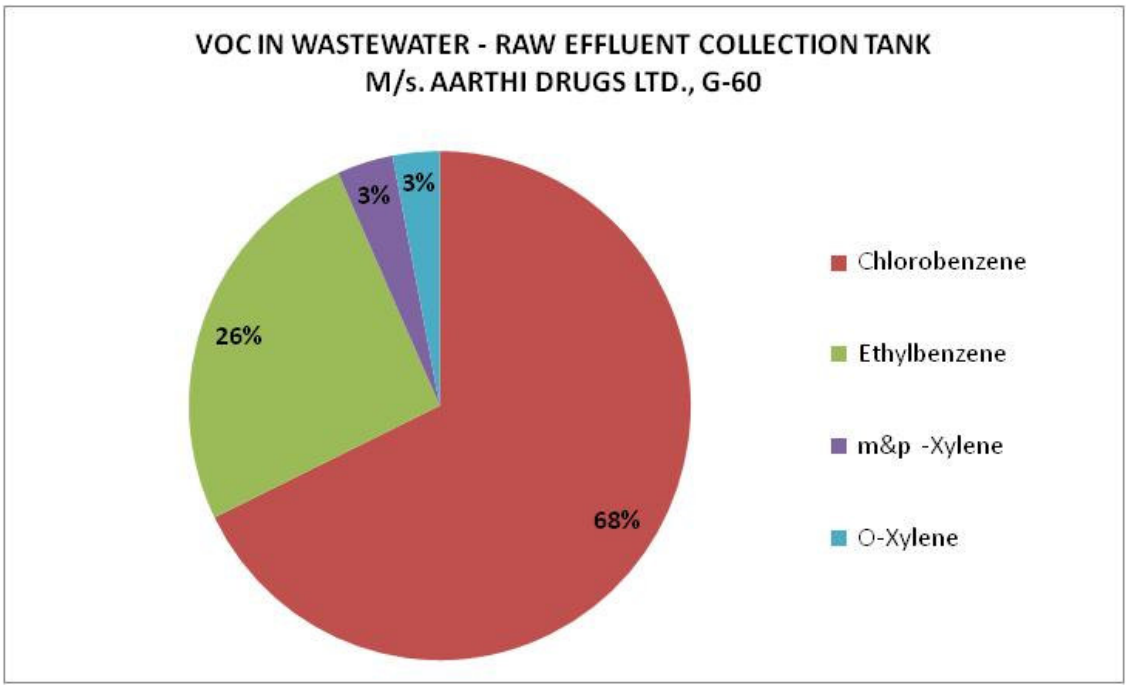
FUGITIVE EMISSION MONITORING - VOC (TARAPUR) - RESULTS (µg/m3)		
SAMPLING SITE:AARTHI DRUGS LTD, G-60 - 22.02.11		
PARAMETERS	**(MET FORMING BULIDING-G-60) TIME:- 15.00-16.00**	**(ETP PLANT- G 60) TIME:15.10-16.10**
Chloromethane	104.7	103.0
Dichloromethane	543.0	1080.0
Chloroform	BDL	29.3
Toluene	33.7	31.7
Chlorobenzene	156.0	35.3
Ethylbenzene	104.0	1712.7
m&p -Xylene	BDL	128.0
o-Xylene	BDL	70.0
Isopropylbenzene	BDL	16.7
TOTAL VOC =	**941.3**	**3206.7**


FUGITIVE EMISSION MONITORING - VOC - TARAPUR
AARTHI DRUNGS LTD, G-60
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Chloromethane
Dichloromethane
Chloroform
Toluene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
(ETP PLANT- G 60) TIME:15.10-16.10
(MET FORMING BULIDING-G-60) TIME:- 15.00-16.00
FUGITIVE EMISSION MONITORING - (MET FORMING BULIDING-G-60) TIME:- 15.00-16.00
Chloromethane
Dichloromethane
Chloroform
Toluene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene
FUGITIVE EMISSION MONITORING - (ETP PLANT - G-60) TIME:- 15.10-16.10
Chloromethane
Dichloromethane
Chloroform
Toluene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene

4.5.4 EFFLUENT SAMPLE ANALYSIS:

The concentration of VOCs in effluent sample taken from collection tank of ETP was found to be 58.4µg/l. comparatively it shows lower concentration may be due to fresh effluent and pumped out all the collected effluent during sampling.

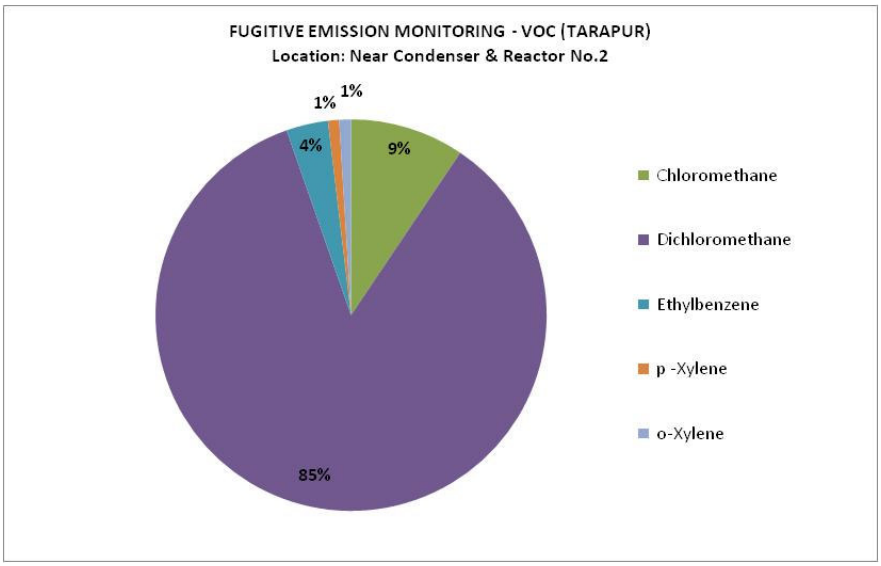
VOLATILE ORGANIC COMPOUND - WASTEWATER	
SAMPLING SITE:AARTHI DRUGS LTD., G 60 - 22.02.11	
LOCATION:RAW EFFLUENT COLLECTION TANK	
PARAMETERS	**RESULTS (µg/l)**
Chlorobenzene	39.5
Ethylbenzene	15.0
m&p -Xylene	2.1
O-Xylene	1.8
TOTAL VOC =	**58.4**



4.5.5 M/s. Nirbhay Rasayan Pvt Ltd.,

Sample of fugitive emissions was collected from the unit and analysed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be 1127.4µg/m^3 near plant reactor area in which Dichloromethane is found to higher concentration compared to other VOCs. The unit is comparatively smaller than above bulk-drug units and having limited use of solvent in the process.

FUGITIVE EMMISION MONITORING - VOC(TARAPUR)	
SAMPLING LOCATION:NEAR CONDENSER& REACTION No.2	
SAMPLING SITE:NIRBHAY RASYAN (P) LTD - 22.02.11	
PARAMETERS	TIME:4.00 - 6.00
	RESULTS(µg/m3)
Chloromethane	106.33
Dichloromethane	960.7
Ethylbenzene	39
p -Xylene	10.33
o-Xylene	11
TOTAL VOC =	**1127.36**

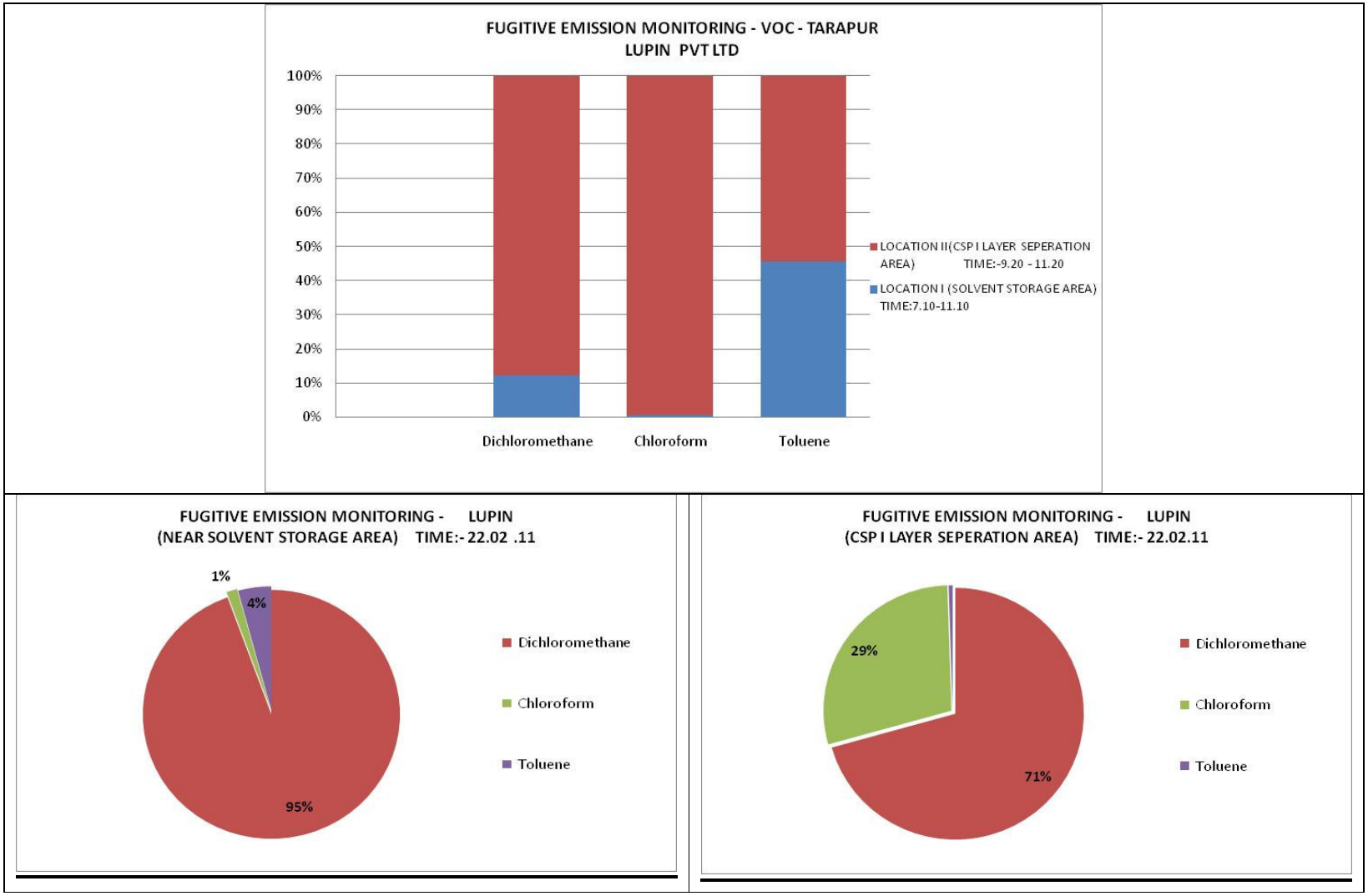


4.5.6 M/s Lupin Ltd:

FUGITIVE EMISSION ANALYSIS:

Samples of fugitive emissions and wastewater were collected from the unit and analysed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be in the range of 883 to 8585µg/m^3. The highest concentration was found at the CSP 1 Layer Separation Area in which the maximum contribution is Dichloromethane and the same is used by the industry.

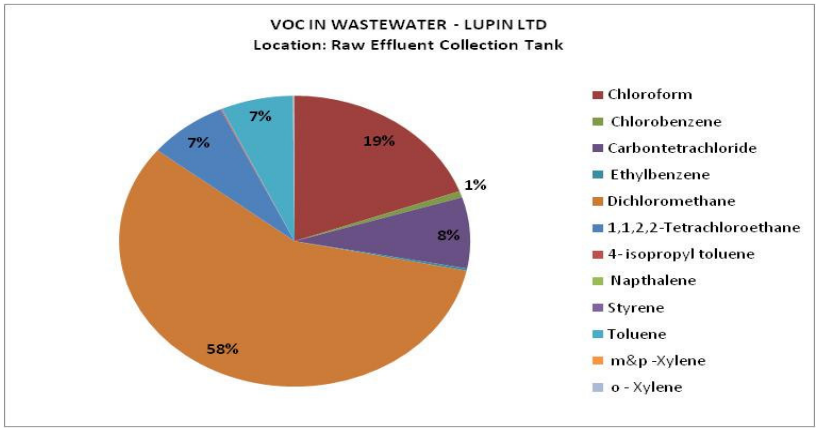
FUGITIVE EMMISION MONITORING - VOC (TARAPUR) RESULTS (µg/m3)		
SAMPLING SITE:LUPIN (P) LTD - 22.02.11		
PARAMETERS	LOCATION I (SOLVENT STORAGE AREA) TIME:7.10-11.10	LOCATION II(CSP I LAYER SEPERATION AREA) TIME:-9.20 - 11.20
Dichloromethane	834.0	6067.0
Chloroform	12.0	2474.0
Toluene	37.0	44.0
TOTAL VOC	**883.0**	**8585.0**


FUGITIVE EMISSION MONITORING - VOC - TARAPUR
LUPIN PVT LTD
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Dichloromethane
Chloroform
Toluene
LOCATION II(CSP I LAYER SEPERATION AREA) TIME:-9.20 - 11.20
LOCATION I (SOLVENT STORAGE AREA) TIME:7.10-11.10
FUGITIVE EMISSION MONITORING - LUPIN
(NEAR SOLVENT STORAGE AREA) TIME:- 22.02 .11
1%
4%
95%
Dichloromethane
Chloroform
Toluene
FUGITIVE EMISSION MONITORING - LUPIN
(CSP I LAYER SEPERATION AREA) TIME:- 22.02.11
29%
71%
Dichloromethane
Chloroform
Toluene

4.5.7 EFFLUENT SAMPLE ANALYSIS:

The concentration of VOCs in effluent sample taken from Raw effluent collection tank of ETP was found to be 9447µg/l in which Dichloromethane is the highest contribution followed by Chloroform compared to the other detected VOCs. The higher concentration may be due to improper separation of intermediate/solvents/products at different process stages, which also affects the treatment efficiency of the ETP. The higher concentration reflects the scope for better recovery of solvents and plugging the sources of loss.

VOLATILE ORGANIC COMPOUND - (EFFLUENT WATER)	
SAMPLING SITE:LUPIN LTD - 22.02.11	
LOCATION:RAW EFFLUENT COLLECTION TANK	
PARAMETERS	**RESULTS (µg/l)**
Chloroform	1834.5
Chlorobenzene	66.8
Carbontetrachloride	744.2
Ethylbenzene	24.6
Dichloromethane	5429.2
1,1,2,2-Tetrachloroethane	691.7
4- isopropyl toluene	8.7
Napthalene	2.3
Styrene	4.3
Toluene	625.7
m&p -Xylene	4.7
o - Xylene	10.4
TOTAL VOC =	**9447.2**

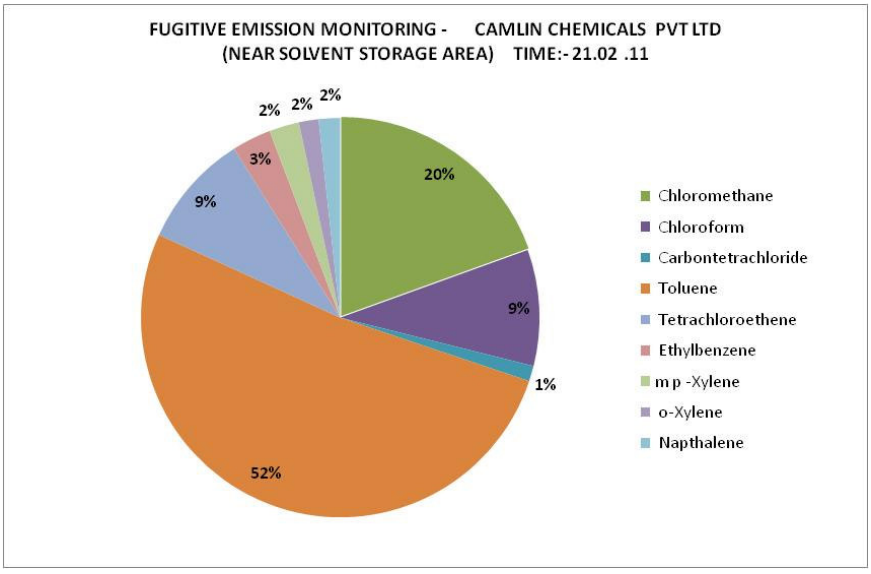


4.5.8 M/s Camlin Chemical Ltd:

FUGITIVE EMISSION MONITORING ANALYSIS:

Samples of fugitive emissions and wastewater were collected from the unit and analysed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be 545.5µg/m^3 in which Toluene and Chloromethane was detected maximum in this location compared to other VOCs.

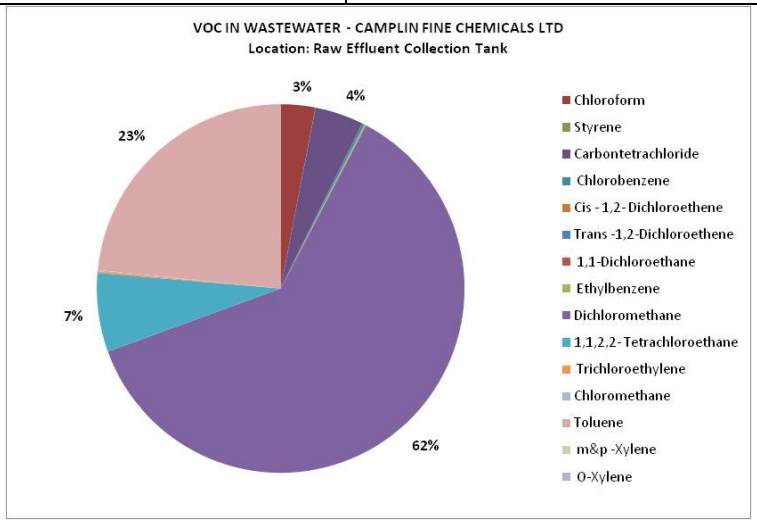
FUGITIVE EMMISION MONITORING - VOC (TARAPUR)	
SAMPLING LOCATION:SOLVENT STORAGE AREA	
SAMPLING SITE:CAMLIN FINE CHEMICALS (P) LTD - 21.02.11	
PARAMETERS	TIME:5.15 - 9.15 ; RESULTS(µg/m3)
Chloromethane	106.3
Chloroform	51.3
Carbontetrachloride	6.8
Toluene	281.8
Tetrachloroethene	50.4
Ethylbenzene	17.3
m &p -Xylene	13.3
o-Xylene	8.7
Napthalene	9.5
TOTAL VOC =	**545.5**



4.5.9 EFFLUENT SAMPLE ANALYSIS:

The concentration of VOCs in effluent sample taken from Raw effluent collection tank of ETP was found to be 13067µg/l in which Dichloromethane, Toluene, 1,1,2,2-Tetrachloroethane, Carbontetrachloride and Chloroform is the highest contribution compared to the other detected VOCs. The higher concentration may be due to improper separation of intermediate/solvents/products at different process stages, which also affects the treatment efficiency of the ETP.

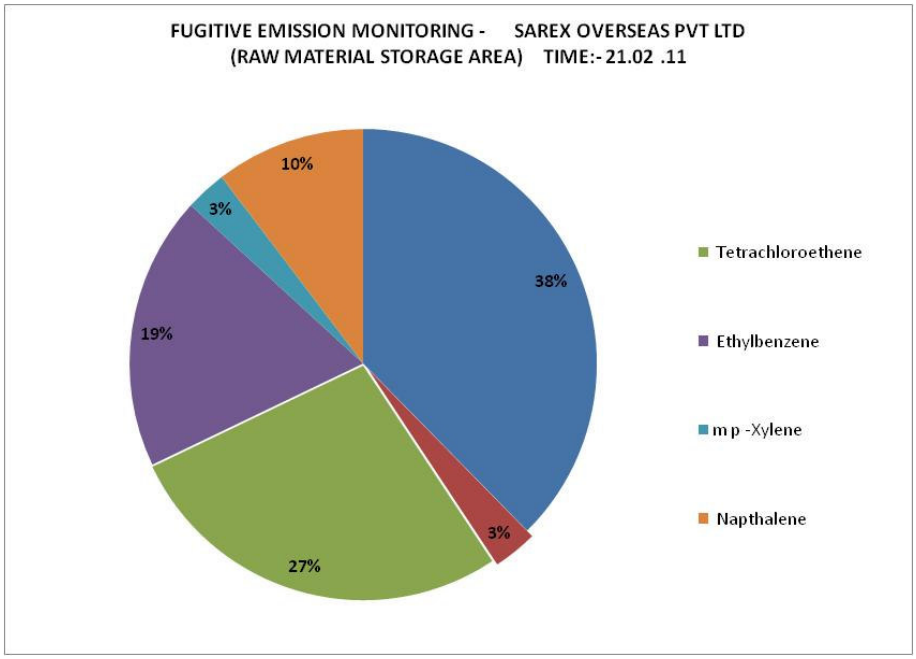
VOLATILE ORGANIC COMPOUND 2110011998 (EFFLUENT WATER)	
SAMPLING SITE:CAMILIN FINE CHEMICALS 21.02.11	
LOCATION:RAW EFFLUENT COLLECTION TANK	
PARAMETERS	**RESULTS (µg/l)**
Chloroform	396.2
Styrene	1.9
Carbontetrachloride	558.1
Chlorobenzene	27.2
Cis - 1,2- Dichloroethene	5.1
Trans -1,2-Dichloroethene	3.9
1,1-Dichloroethane	1.8
Ethylbenzene	11.1
Dichloromethane	8068.3
1,1,2,2- Tetrachloroethane	903.3
Trichloroethylene	19.7
Chloromethane	13.1
Toluene	3052.5
m&p -Xylene	3.0
O-Xylene	2.0
TOTAL VOC =	**13067.1**



4.5.10 M/s Sarex Overseas Ltd:

Sample of fugitive emissions sample was collected from the unit and analyzed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be 91.8µg/m^3.

FUGITIVE EMMISION MONITORING - VOC(TARAPUR)	
SAMPLING LOCATION:RAW MATERIAL STORAGE AREA	
SAMPLING SITE:SAREX OVER SEAS(P) LTD - 21.02.11	
PARAMETERS	TIME:16.00 - 17.00
	RESULTS(µg/m3)
Chloroform	34.5
Carbontetrachloride	2.8
Tetrachloroethene	25.0
Ethylbenzene	17.3
m &p -Xylene	2.6
Napthalene	9.5
TOTAL VOC =	**91.8**



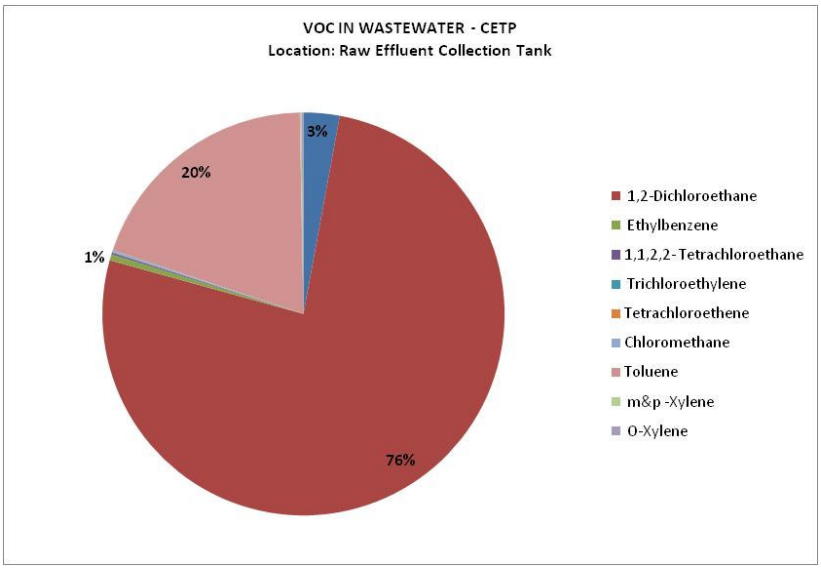
4.6 Results of Monitoring at CETPs:

Common Effluent Treatment Plant, Tarapur:

CETP – Collection Tank

The concentration of the VOCs in sample collected from CETP's raw effluent collection tank (i.e. effluent receiving sump) was found to be 3689µg/l. The concentrations of 1,2 Dichloroethane was found to be very high as compared to other detected VOCs.

VOLATILE ORGANIC COMPOUND 2110011999 (EFFLUENT WATER)	
SAMPLING SITE:CETP - 22.02.11	
LOCATION:RAW EFFLUENT COLLECTION TANK	
PARAMETERS	**RESULTS (µg/l)**
Chlorobenzene	106.77
1,2-Dichloroethane	2818.85
Ethylbenzene	18.13
1,1,2,2- Tetrachloroethane	5.01
Trichloroethylene	2.18
Tetrachloroethene	1.18
Chloromethane	4.46
Toluene	722.18
m&p -Xylene	4.79
O-Xylene	6
TOTAL VOC =	**3689.55**

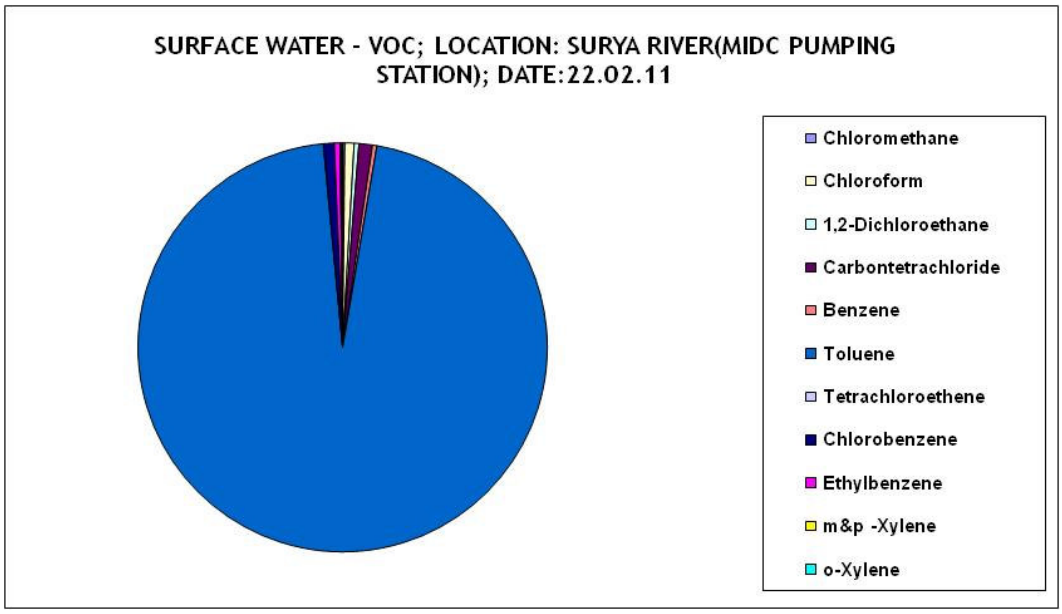


4.7 Results of Surface Water Monitoring:

Surya River (MIDC Pumping Station)

The concentration of the VOCs in sample collected from surface water of Surya River was found to be 3560µg/l. The concentration of Toluene was found to be very high as compared to other detected VOCs.

SURFACE WATER -VIOC (2110011994)	
SAMPLING SITE: SURYA RIVER(MIDC PUMPING STATION) SAMPLING AREA:TARAPUR INDUSTRIAL ESTATE	
LOCATION:SURYA RIVER(MIDC PUMPING STATION) ; DATE:22.02.2011	
PARAMETERS	**RESULTS (µg/l)**
Chloromethane	5.7
Chloroform	26.3
1,2-Dichloroethane	13.3
Carbontetrachloride	37.9
Benzene	12.4
Toluene	3410.8
Tetrachloroethene	1.0
Chlorobenzene	29.4
Ethylbenzene	16.3
m&p -Xylene	3.7
o-Xylene	3.2
TOTAL VOC =	**3560.0**

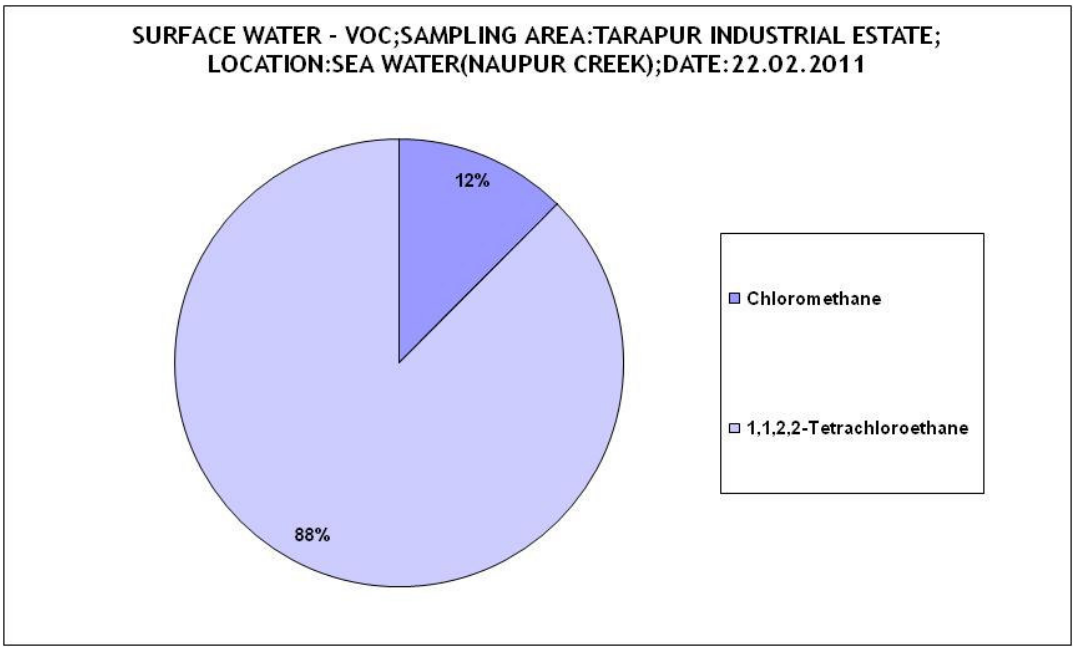


4.8 Results of Surface Water Monitoring:

SEA WATER(NAUPUR CREEK)

The concentration of the VOCs in sample collected from Sea Water in the Naupur Creek was found to be 5.7µg/l. The concentration of VOCs in this particular location was very low.

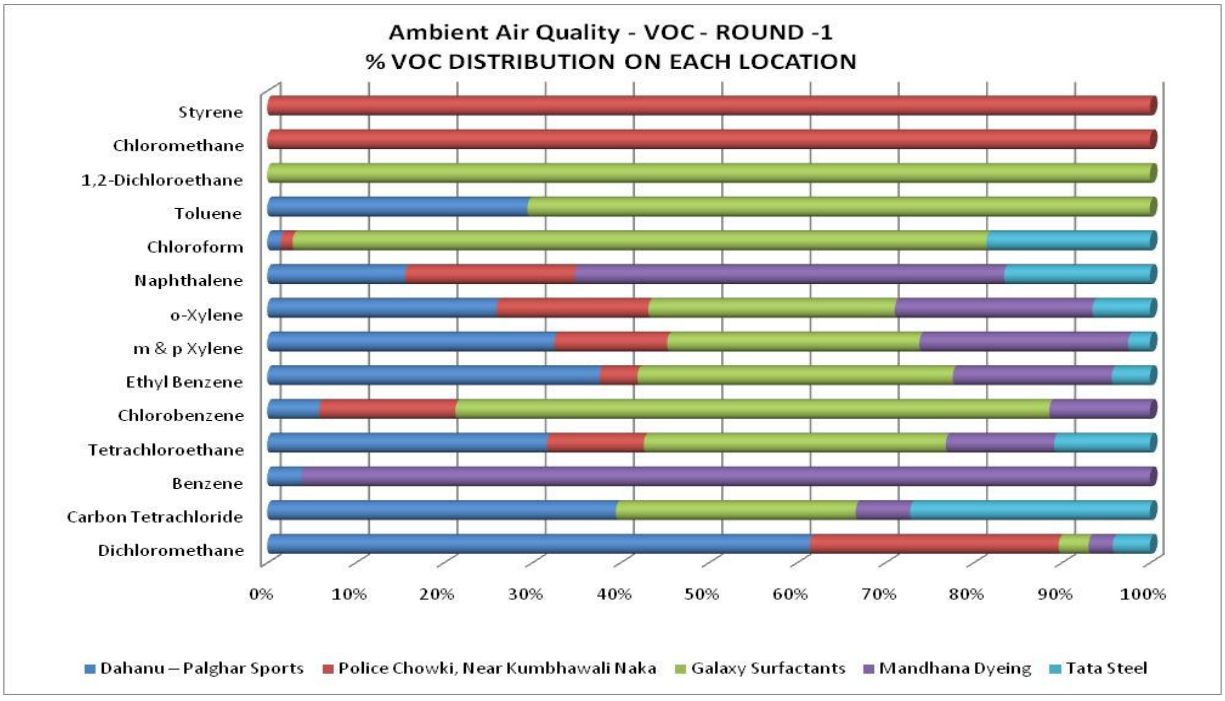
SURFACE WATER -VIOC (2110011993)	
SAMPLING SITE:SEA WATER(NAUPUR CREEK); SAMPLING AREA:TARAPUR INDUSTRIAL ESTATE	
LOCATION:SEA WATER(NAUPUR CREEK) ; DATE:22.02.2011	
PARAMETERS	**RESULTS (µg/l)**
Chloromethane	0.7
1,1,2,2-Tetrachloroethane	5.0
TOTAL VOC =	**5.7**

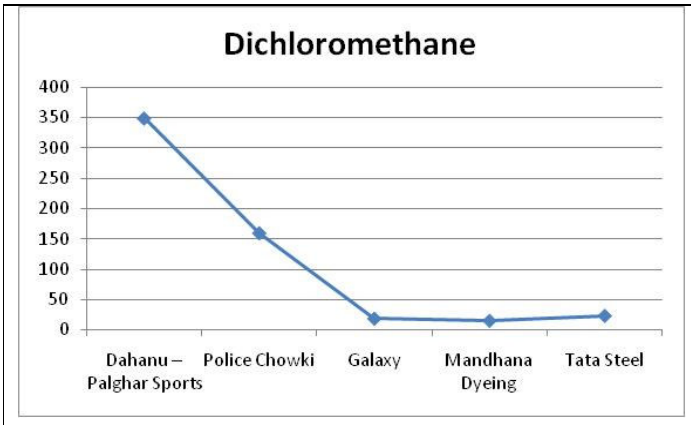


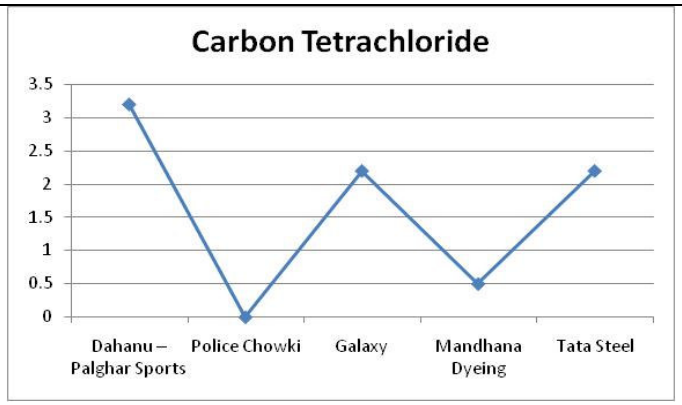
4.9 Observation and Findings on TARAPUR Industrial Area

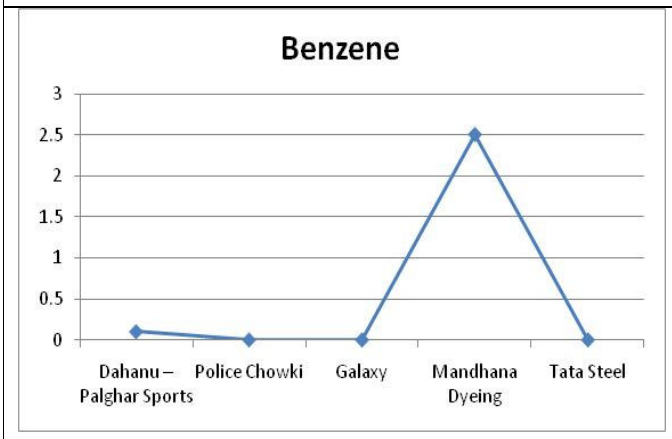
- The order of the pollutant in Ambient Air is Dichloromethane, Chloroform, Tetrachloroethane, Xylene, Ethylbenzene, Naphthalene, Chlorobenzene and Carbon tetrachloride and the presence of these compounds was observed at almost all the monitored locations.
- Concentration of Dichloromethane, Tetrachlolorethane, Ethylbenzene and Chlorobenzene and Chloroform observed to be more in almost all the locations among the VOCs detected whereas at some cycle of monitoring and few locations Toluene, Carbon tetrachloride and Styrene were also found with more concentration.
- The probable places of loss of VOCs are Centrifuging, filtration, glands, charging material into the reactors, solvent storage area, distillation and ETP area.
- Total 17 VOCs including 14 highly toxic and suspected carcinogenic compounds are found during monitoring at Tarapur.
- The total VOCs concentration was measured at all locations, in the range of 58 ug/m3 – minimum at Station-5 (Tata Steel, A-6 in Centre of the Industrial Estate) to 440 ug/m3 – maximum at Station - 1 (Dahanu-Palghar Sports Club in east direction and also up-wind location)
- ATD method found to have reported many compounds which are relevant to the industries used solvents and some have no relevance to solvents used in industries, because of may be the impurities in their used solvents.
- Average concentration of predominant and total VOCs found in each locations and the % distribution of individual VOCs in each locations is depicted in the following table and chart.

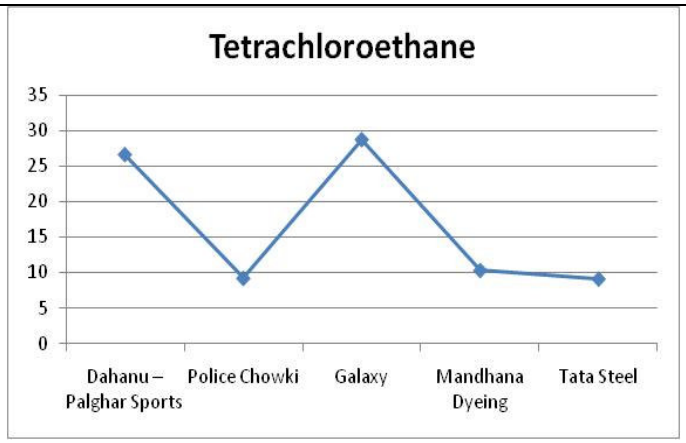
AMBIENT AIR QUALITY - VOC					
PRESENCE OF VOC IN PARAMETER WISE FOR ALL LOCATIONS					
Parameter	**Dahanu - Palghar Sports**	**Police Chowki, Near Kumbhawali Naka**	**Galaxy Surfactants**	**Mandhana Dyeing**	**Tata Steel**
Dichloromethane	349	160	19.2	15.6	23.8
Carbon Tetrachloride	3.2	BDL	2.2	0.5	2.2
Benzene	0.1	BDL	BDL	2.5	BDL
Tetrachloroethane	26.6	9.2	28.7	10.3	9.1
Chlorobenzene	1.6	4.2	18.3	3.1	BDL
Ethyl Benzene	23.6	2.7	22.4	11.3	2.7
m & p Xylene	6.6	2.6	5.8	4.8	0.5
o-Xylene	8	5.3	8.6	6.9	2
Naphthalene	5.2	6.4	BDL	16.2	5.5
Chloroform	0.9	0.8	46.3	BDL	10.9
Toluene	2.3	BDL	5.5	BDL	BDL
1,2-Dichloroethane	BDL	BDL	16.6	BDL	BDL
Chloromethane	BDL	4.8	BDL	BDL	BDL
Styrene	BDL	5.8	BDL	BDL	BDL

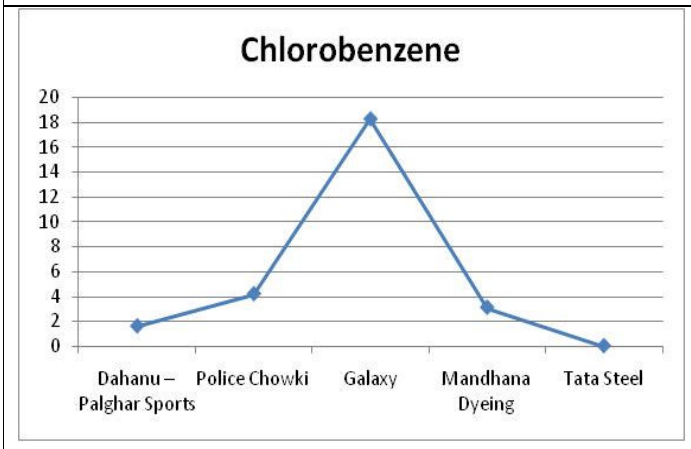


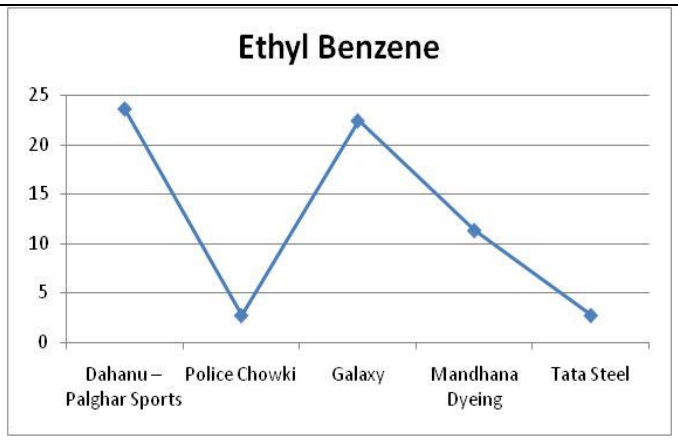

Dichloromethane
400
350
300
250
200
150
100
50
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel

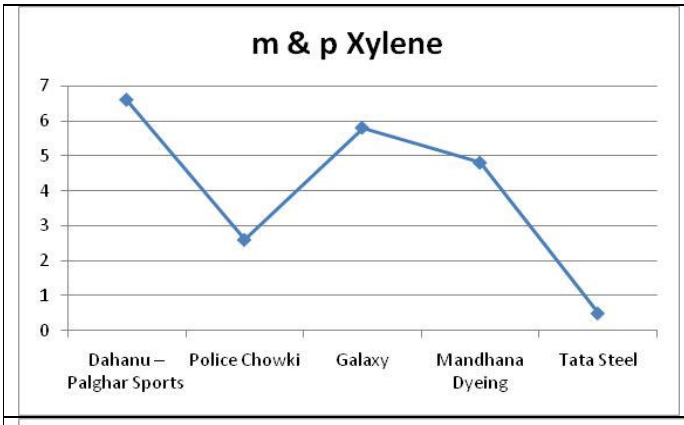

Carbon Tetrachloride
3.5
3
2.5
2
1.5
1
0.5
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel

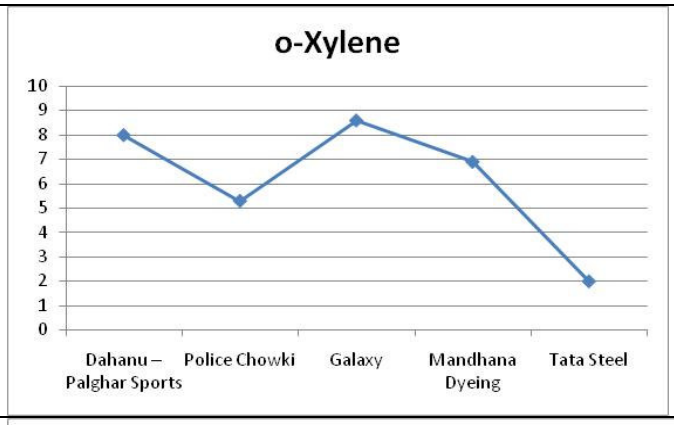

Benzene
3
2.5
2
1.5
1
0.5
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel

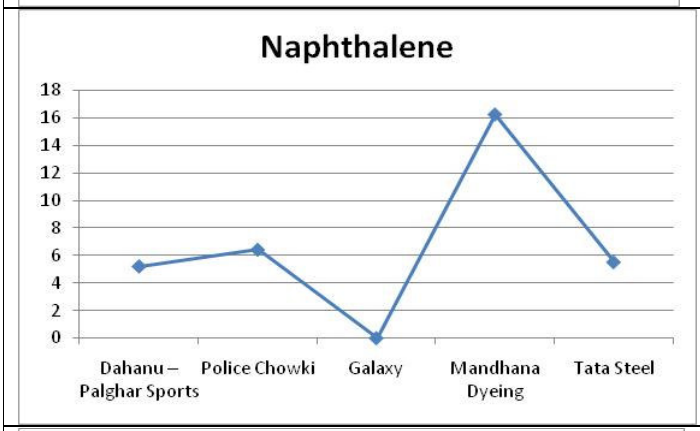

Tetrachloroethane
35
30
25
20
15
10
5
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel


Chlorobenzene
20
18
16
14
12
10
8
6
4
2
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel


Ethyl Benzene
25
20
15
10
5
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel


m & p Xylene
7
6
5
4
3
2
1
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel


o-Xylene
10
9
8
7
6
5
4
3
2
1
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel


Naphthalene
18
16
14
12
10
8
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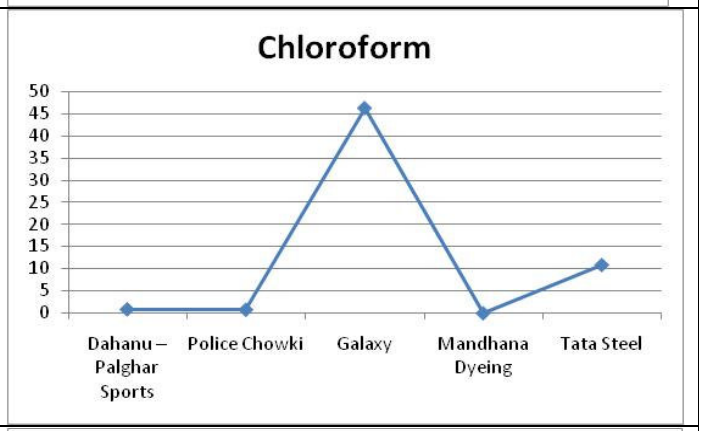
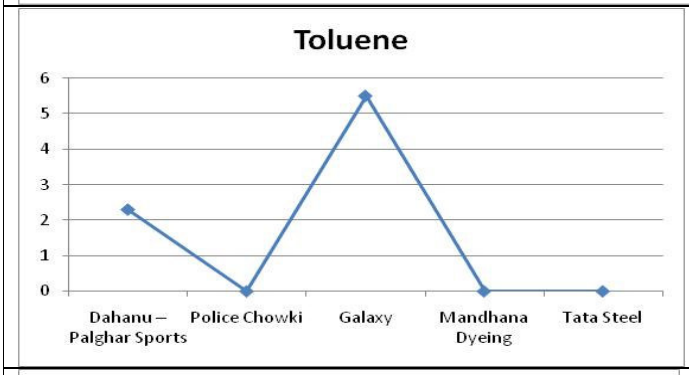
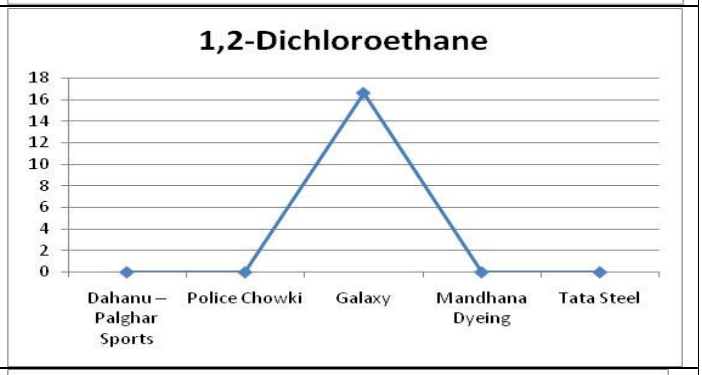
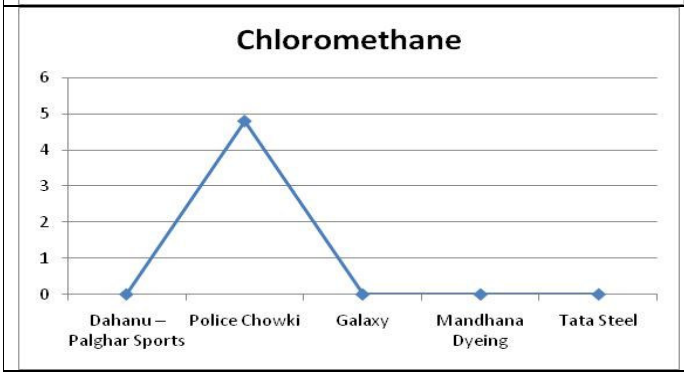
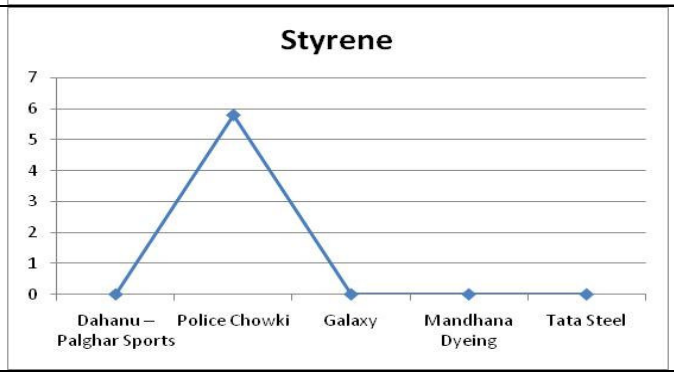
4
2
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel


Chloroform
50
45
40
35
30
25
20
15
10
5
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel


Toluene
6
5
4
3
2
1
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel


1,2-Dichloroethane
18
16
14
12
10
8
6
4
2
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel


Chloromethane
6
5
4
3
2
1
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel


Styrene
7
6
5
4
3
2
1
0
Dahanu – Palghar Sports
Police Chowki
Galaxy
Mandhana Dyeing
Tata Steel

- The Benzene concentration in all AAQM stations was found well below within the prescribed national standard of 5µg/m^3
- The samples collected from industries for VOC analysis with which except effluent sample of M/s.Camlin Fine Chemicals, all are detected some VOCs. Mostly the concentration of VOCs found to be more in wastewater samples against the samples collected for fugitive emission. The reasons for comparatively less concentration of fugitive & Hazardous waste could be fast dispersion/dilution of fugitive emissions and loss of VOCs due to evaporation in stored hazardous waste.
- The presence of solvents (VOCs) in the wastewater samples may be due to improper separation of intermediates/products/solvents at different unit process operations, which result in to high organic load in wastewater and difficulty in treatment.
- Generation of Hazardous waste can be minimized by better operating methods and systems as well as solvent recovery with effective condensation with which the concentration of VOC dispersing to atmosphere can be reduced.
- Normally the wastewater generated by the industries contains high VOCs and the industries are doing only primary treatment. During these processes some percentage of VOCs are dispersed into the atmosphere. After primary treatment the industries are pumping their effluent to CETP for further treatments. In CETP during aeration process, most of the VOCs are vaporized and dispersed into the atmosphere. These VOCs are directly impacting the Ambient VOCs concentration.
- Few Industries are following Zero effluents discharge.
- Chlorinated compounds escape at the higher rate in to the atmosphere which may increase the ground level ozone concentration.
- Companies change the products with respect to demand in the market accordingly the solvent type and quantity will also vary. Due to these variations the concentrations of VOC in AAQ, Fugitive, wastewater and solid waste may vary.

- Presence of VOCs in wastewater affects the ambient air quality, efficiency of the effluent treatment system and the quality of the final receiving body. VOCs (Solvents) are emitted in to the environment during various treatment unit operations particularly during aeration in equalization tanks and aeration tanks.
- In case of CETP at Tarapur, the concentrations of Dichloromethane and Toluene were found to be very high as compared to other VOCs present in the influent. Higher concentration of Chlorobenzene and Toluene found in the effluent sample collected from Sump No.03 of MIDC, which receives effluent from N-zone having chemical industries in predominance. It is observed that substantial amount of VOCs are finding their way in to Sea with effluent discharge from Tarapur industrial estate.

VOC PROJECT REPORT ON NAVI MUMBAI INDUSTRIAL AREA

CHAPTER – V

5.0 ABOUT NAVI MUMBAI INDUSTRIAL AREA:

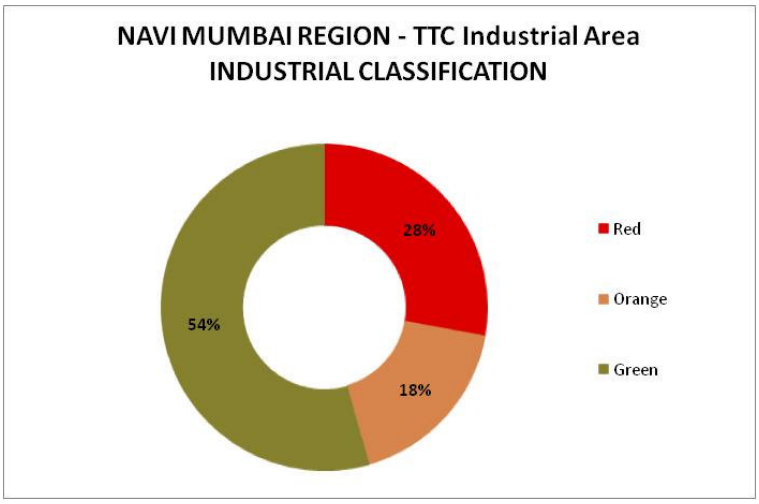
Industry classification:

The TTC-MIDC is one of the biggest industrial zones in India. This industrial cluster consists of mainly Chemical, Textile, and Bulk-drug manufacturing Units and also has IT
Parks.

Type of Industries	No. of Industries
Highly Polluted Industries (Under CREP -17 categories).	23
Red Category Industries (54 categories)	548
Orange and Green Category Industries	1478
Grossly Polluted Industries	Nil

Category- wise list of industries are shown as below.

Type	Large	Medium	Small	Total
Red	44	27	500	571
Orange	18	16	329	363
Green	05	07	1103	1115
Total	67	50	1932	2049



5.1 CETP at TTC MIDC, Pawane:

CETP at TTC was established on November 1997 and is designed to handle 12 MLD of effluent. This CETP is upgraded to enhance the total capacity upto 27 MLD. There are 425 small scale user members, 55 medium / large scale user members and 1905 non user associate members to the CETP. Treated and partially treated effluent is collected through closed underground pipeline network and brought to CETP. After secondary treatment effluent is discharged through a closed pipeline of length 3.5 Kms. by means of gravity into the Trans Thane Creek through submerged outfall. The sludge generation from the CETP is about 5 MT/Day and is disposed at CHWTSDF at TTCWMA.

Industrial effluent : Out of 571 effluent generating industries, major units are textile, chemical and bulk drugs, pharmaceuticals, dyes, pesticides, etc. The partly treated effluent of the SSI units and fully treated Effluent of MSI/ LSI units is carried through MIDC pipe line to CETP, along with the domestic effluent (sewage) of some Industries and some of the residential areas which are in the MIDC zone.
Most of the area of TTC MIDC is covered with MIDC drainage system which carries effluent of the industries to CETP for further treatment and disposal. Little part of TTC MIDC Area particularly at Digha, Airoli, and part of Mahape is not connected with the MIDC drainage system due to topography.

CETP at TTC Pawane

Treated effluent from all the industries is received at CETP through conduit pipe line. This effluent is further treated at CETP. As per the guidelines of NIO, treated effluent is discharged into TTC Creek through closed pipeline. For this purpose MIDC has provided close pipe line upto disposal point. Total length of pipe line is 7.1 km with diameter of 900 mm. About 4 km part of the pipe is on land, another portion of 2 km is tidal zone and remaining 1.1 km is in the submerge zone. Effluent is discharged through gravity and quantity of effluent is 26 MLD.

5.2 Location of the Sampling:

The meteorological parameters have been studied and accordingly prevailing wind direction is North East to South West and sometimes North to South (during sea and land breeze the wind direction is vice versa) with minimum temperature of 23°C and Maximum 32°C. The relative humidity was found in the range of 50 – 65% and wind speed is ranging from 0.8m/sec to 2.5 m/s.

Following industries were selected for VOC monitoring:

Down Wind : (1) Premises of Viking Exports Pvt Ltd., in the South East direction of industrial area.

Cross Wind : (2) Premises of Expanded Polymer Systems Pvt Ltd., in the North East of industrial area.

Up Wind : (3) Premises of M/s Sandoz India Pvt Ltd., in the North West direction of industrial area.

Cross Wind : (4) Premises of M/s Regenza India Pvt Ltd., in the South West direction of industrial area.

5.3 RESULTS AND DISCUSSIONS:

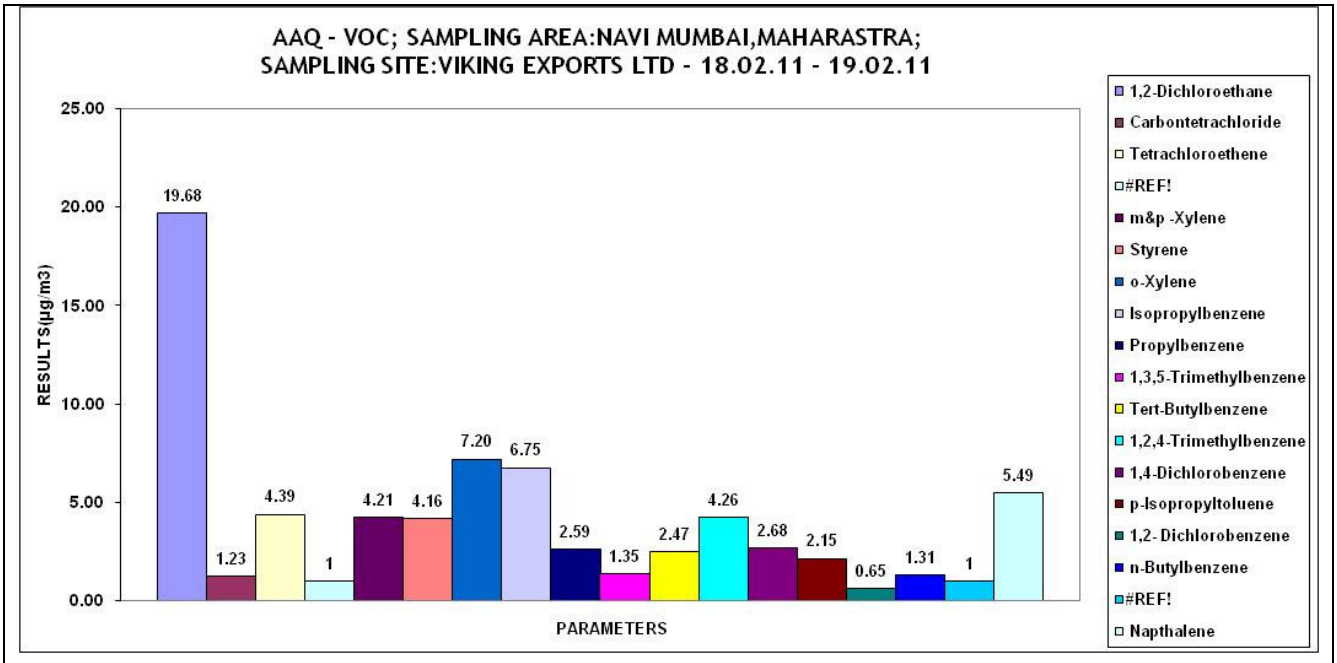
5.3.1 Results & Discussion for Ambient Air Quality Monitoring at Navi Mumbai:-

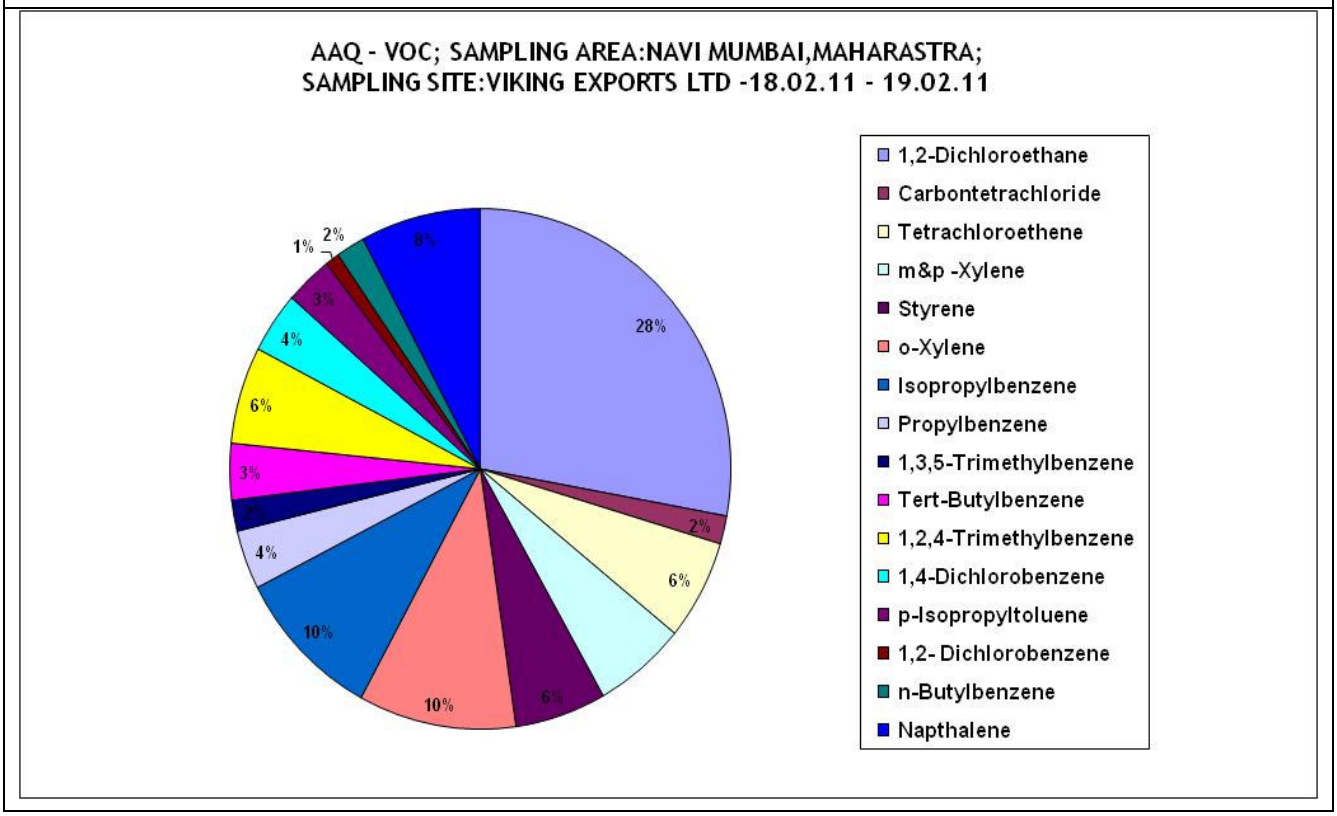
Station 1: Premises of Viking Exports Ltd., in the South East direction of industrial area.

This station is located in cross-wind direction of the industrial estate. 17 VOCs are detected in this location. The AAQM Station-1 was identified as down-wind station as per the prevailing wind direction at the time of the study. The wind direction was North East to South West. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 70%. Approximate height from ground level is 20 feet.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: NAVI MUMBAI,MAHARASTRA				
	SAMPLING SITE:VIKING EXPORTS LTD - 18.02.11 TO 19.02.11				
	PARAMETERS	TIME:12.30-20.30	TIME:20.30-04.30	TIME:04.30-12.30	AVERAGE
		RESULTS (µg/m3)			
1	1,2-Dichloroethane	BDL	BDL	59.05	19.68
2	Carbon Tetrachloride	1.62	1.09	0.97	1.23
3	Tetrachloroethene	6.27	BDL	6.89	4.39
5	m&p -Xylene	8.71	1.10	2.82	4.21
6	Styrene	12.48	BDL	BDL	4.16
7	o-Xylene	13.44	3.04	5.12	7.20
8	Isopropyl benzene	15.57	1.48	3.20	6.75
9	Propyl benzene	4.06	BDL	3.71	2.59
10	1,3,5-Trimethylbenzene	1.89	BDL	2.18	1.35
11	Tert-Butyl benzene	2.92	1.01	3.47	2.47
12	1,2,4-Trimethylbenzene	2.48	1.20	9.09	4.26
13	1,4-Dichlorobenzene	BDL	BDL	8.03	2.68
14	p-Isopropyl toluene	2.51	0.85	3.08	2.15
15	1,2- Dichlorobenzene	BDL	BDL	1.94	0.65
16	n-Butyl benzene	3.93	BDL	BDL	1.31
17	Naphthalene	3.94	BDL	12.52	5.49
TOTAL VOC =		80.16	9.77	122.46	70.80

Only seven VOC was found common in all the cycles of monitoring out of the total detected 17 VOCs. Concentration of 1,2-Dichloroethane was found to be highest in third cycle of monitoring, however the concentration of Tetrachloroethane, Isopropyl benzene, o-Xylene is also found to be maximum in this location.


AAQ - VOC; SAMPLING AREA:NAVI MUMBAI,MAHARASTRA;
SAMPLING SITE:VIKING EXPORTS LTD - 18.02.11 - 19.02.11
RESULTS(µg/m3)
25.00
20.00
15.00
10.00
5.00
0.00
19.68
1.23
4.39
1
4.21
4.16
7.20
6.75
2.59
1.35
2.47
4.26
2.68
2.15
0.65
1.31
1
5.49
PARAMETERS
1,2-Dichloroethane
Carbontetrachloride
Tetrachloroethene
#REF!
m&p -Xylene
Styrene
o-Xylene
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2- Dichlorobenzene
n-Butylbenzene
#REF!
Napthalene

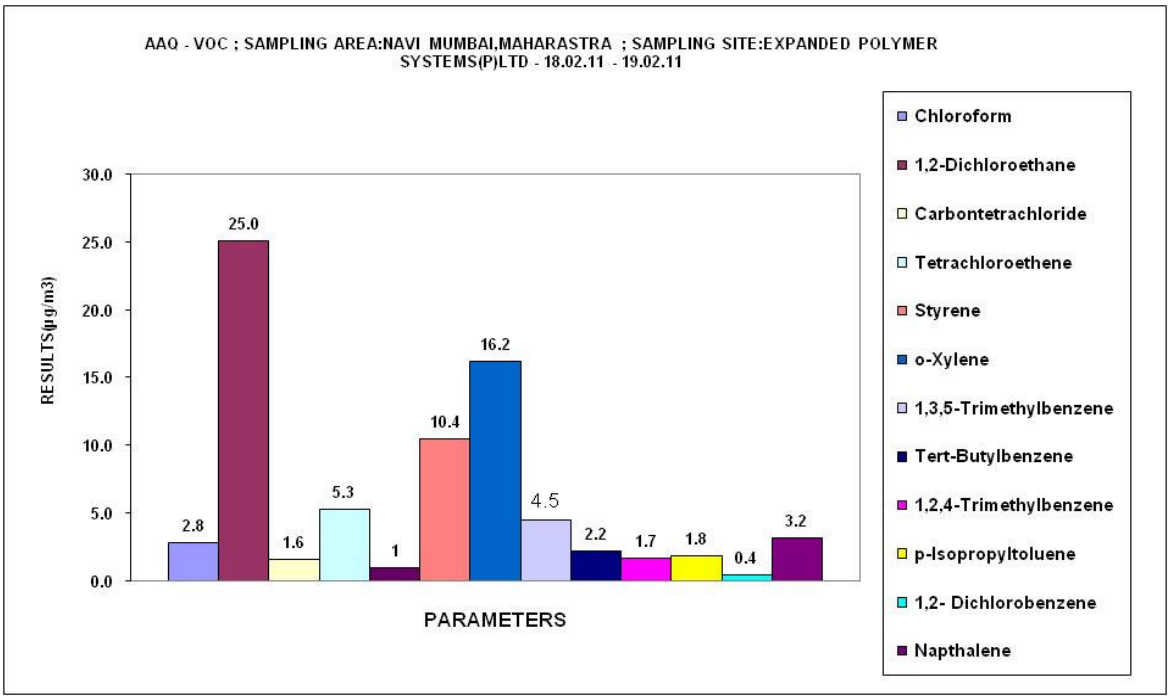

AAQ - VOC; SAMPLING AREA:NAVI MUMBAI,MAHARASTRA;
SAMPLING SITE:VIKING EXPORTS LTD -18.02.11 - 19.02.11
28%
2%
6%
6%
10%
10%
6%
4%
2%
3%
6%
3%
4%
1%
2%
6%
1,2-Dichloroethane
Carbontetrachloride
Tetrachloroethene
m&p -Xylene
Styrene
o-Xylene
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2- Dichlorobenzene
n-Butylbenzene
Napthalene

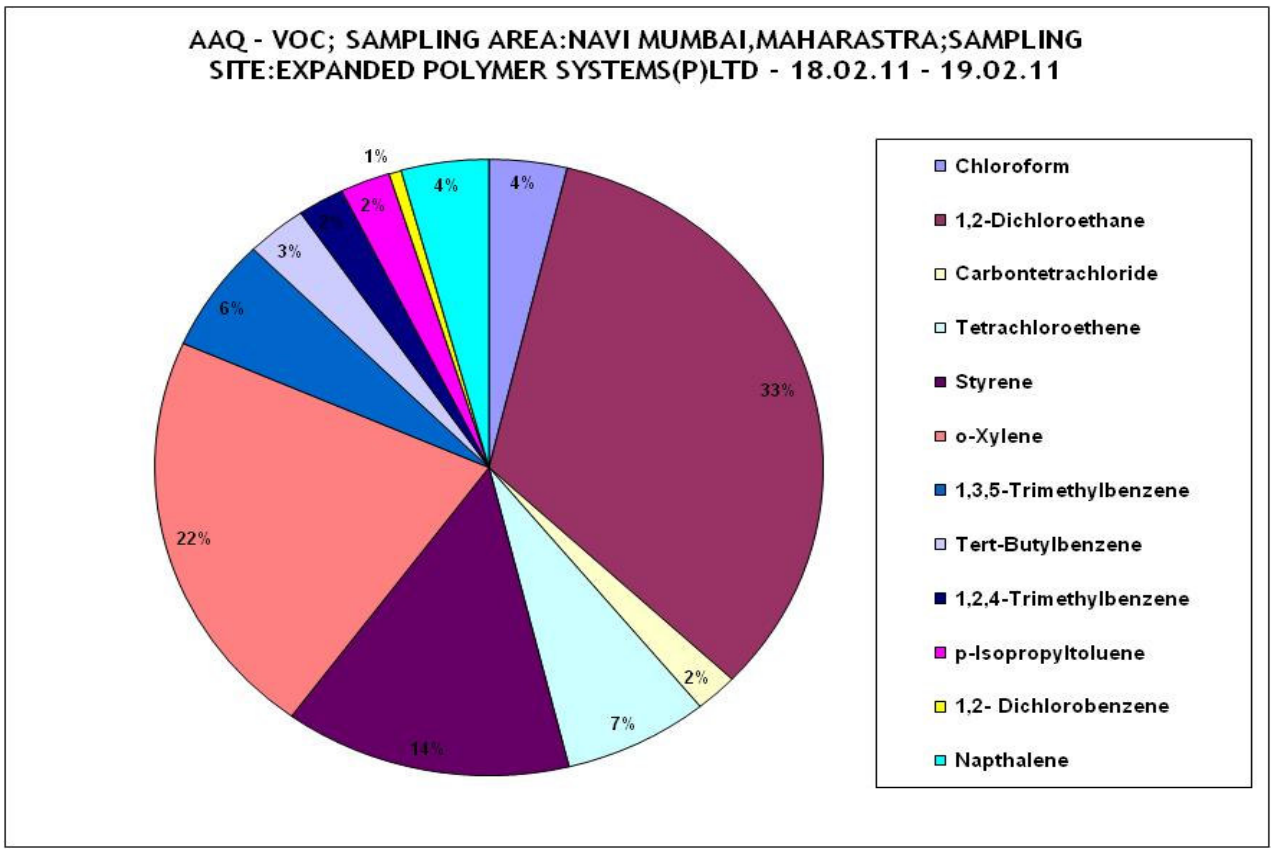
Station 2: Premises of Expanded Polymer Systems Pvt Ltd., in the North East of industrial area.

The AAQ station-2 is identified as up-wind station as per prevailing wind direction at the time of the study. 12 VOCs are detected in this location. The wind direction was North East to South West. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 75%. Approximate height from ground level is 15 feet.

S.No	AMBIENT AIR QUALITY - VOC SAMPLING AREA: NAVI MUMBAI,MAHARASTRA SAMPLING SITE:EXPANDED POLYMER SYSTEMS(p)LTD - 18.02.11 TO 19.02.11				
	PARAMETERS	TIME:16.00-24.00	TIME:00.10-08.10	TIME:08.10-16.10	AVERAGE
		RESULTS (µg/m3)			
1	Chloroform	BDL	BDL	8.5	2.8
2	1,2-Dichloroethane	BDL	75.1	BDL	25.0
3	Carbontetrachloride	BDL	1.1	3.6	1.6
4	Tetrachloroethene	2.9	4.7	8.3	5.3
5	Styrene	BDL	31.3	BDL	10.4
6	o-Xylene	BDL	16.2	32.5	16.2
7	1,3,5-Trimethylbenzene	0.5	8.8	4.0	4.5
8	Tert-Butylbenzene	0.7	2.8	3.1	2.2
9	1,2,4-Trimethylbenzene	BDL	2.3	2.8	1.7
10	p-Isopropyltoluene	0.7	2.2	2.6	1.8
11	1,2- Dichlorobenzene	BDL	1.3	BDL	0.4
12	Napthalene	BDL	9.5	BDL	3.2
TOTAL VOC =		4.9	155.4	65.3	75.2

1,2 -Dichloroethane and Styrene is found maximum concentration in the second cycle in this location followed by Tetrachloroethane, Naphthalene, o-Xylene and Trimethyl benzene.


AAQ - VOC ; SAMPLING AREA:NAVI MUMBAI,MAHARASTRA ; SAMPLING SITE:EXPANDED POLYMER SYSTEMS(P)LTD - 18.02.11 - 19.02.11
RESULTS(µg/m3)
30.0
25.0
20.0
15.0
10.0
5.0
0.0
2.8
25.0
1.6
5.3
1
10.4
16.2
4.5
2.2
1.7
1.8
0.4
3.2
PARAMETERS
Chloroform
1,2-Dichloroethane
Carbontetrachloride
Tetrachloroethene
Styrene
o-Xylene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
p-Isopropyltoluene
1,2- Dichlorobenzene
Napthalene

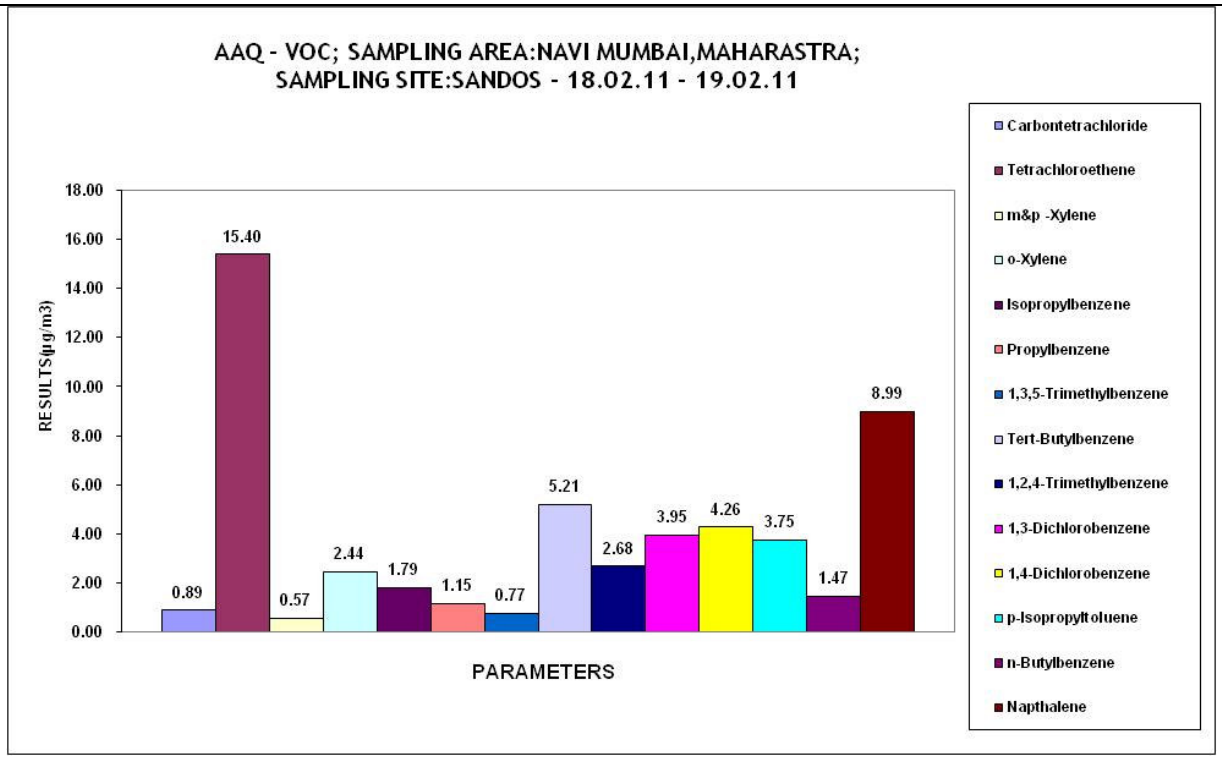

AAQ - VOC; SAMPLING AREA:NAVI MUMBAI,MAHARASTRA;SAMPLING SITE:EXPANDED POLYMER SYSTEMS(P)LTD - 18.02.11 - 19.02.11
4%
33%
2%
7%
14%
22%
6%
3%
2%
1%
4%
Chloroform
1,2-Dichloroethane
Carbontetrachloride
Tetrachloroethene
Styrene
o-Xylene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
p-Isopropyltoluene
1,2- Dichlorobenzene
Napthalene

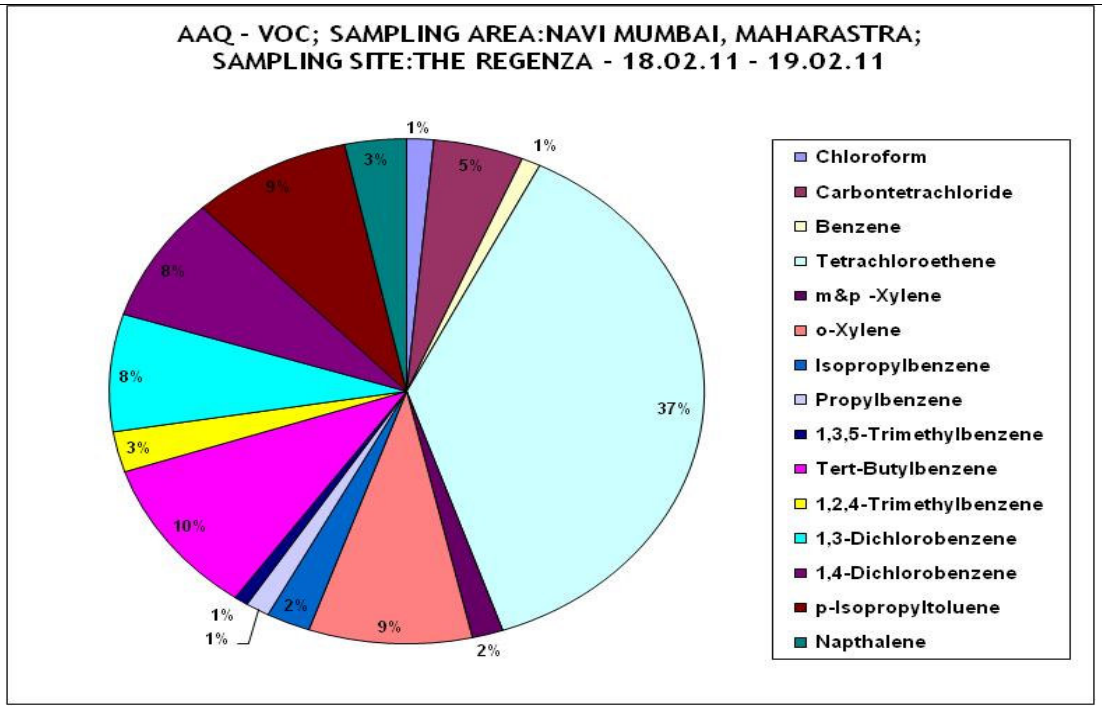
Station 3: Premises of M/s Sandoz India Ltd is in North West direction of industrial area.

The AAQ station-3 is identified as cross-wind station in North West direction as per prevailing wind direction at the time of the study.

S.No	AMBIENT AIR QUALITY – VOC SAMPLING AREA: NAVI MUMBAI,MAHARASTRA SAMPLING SITE:SANDOZ - 18.02.11 TO 19.02.11				
	PARAMETERS	TIME:16.30-00.30	TIME:00.30-08.30	TIME:08.30-16.30	AVERAGE
		RESULTS (µg/m3)			
1	Carbontetrachloride	BDL	BDL	2.66	0.89
2	Tetrachloroethene	BDL	BDL	46.20	15.40
3	m&p -Xylene	1.71	BDL	BDL	0.57
4	o-Xylene	BDL	BDL	7.33	2.44
5	Isopropylbenzene	1.19	BDL	4.19	1.79
6	Propylbenzene	BDL	BDL	3.44	1.15
7	1,3,5-Trimethylbenzene	0.23	BDL	2.08	0.77
8	Tert-Butylbenzene	1.75	2.56	11.32	5.21
9	1,2,4-Trimethylbenzene	3.39	4.65	BDL	2.68
10	1,3-Dichlorobenzene	BDL	BDL	11.84	3.95
11	1,4-Dichlorobenzene	BDL	BDL	12.79	4.26
12	p-Isopropyltoluene	1.55	BDL	9.69	3.75
13	n-Butylbenzene	BDL	BDL	4.41	1.47
14	Napthalene	BDL	BDL	26.98	8.99
TOTAL VOC =		9.82	7.20	142.93	53.32

14 VOCs are found in this location in which Tetrachloroethane, Dichlorobenzene and Naphthalene is detected with maximum concentration out of 14 detected VOCs.


AAQ - VOC; SAMPLING AREA:NAVI MUMBAI,MAHARASTRA;
SAMPLING SITE:SANDOS - 18.02.11 - 19.02.11
RESULTS(µg/m3)
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.89
15.40
0.57
2.44
1.79
1.15
0.77
5.21
2.68
3.95
4.26
3.75
1.47
8.99
PARAMETERS
Carbontetrachloride
Tetrachloroethene
m&p -Xylene
o-Xylene
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
n-Butylbenzene
Napthalene

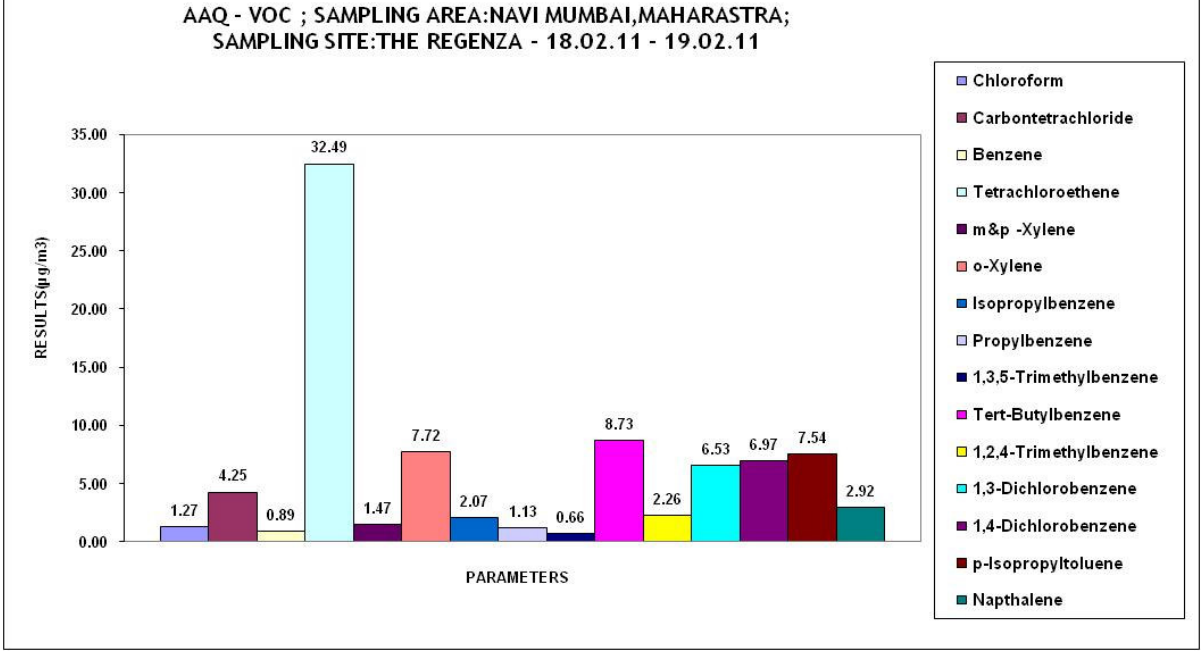

AAQ - VOC; SAMPLING AREA:NAVI MUMBAI, MAHARASTRA;
SAMPLING SITE:THE REGENZA - 18.02.11 - 19.02.11
1%
1%
5%
37%
2%
9%
2%
1%
1%
10%
3%
8%
8%
9%
3%
Chloroform
Carbontetrachloride
Benzene
Tetrachloroethene
m&p -Xylene
o-Xylene
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
Napthalene

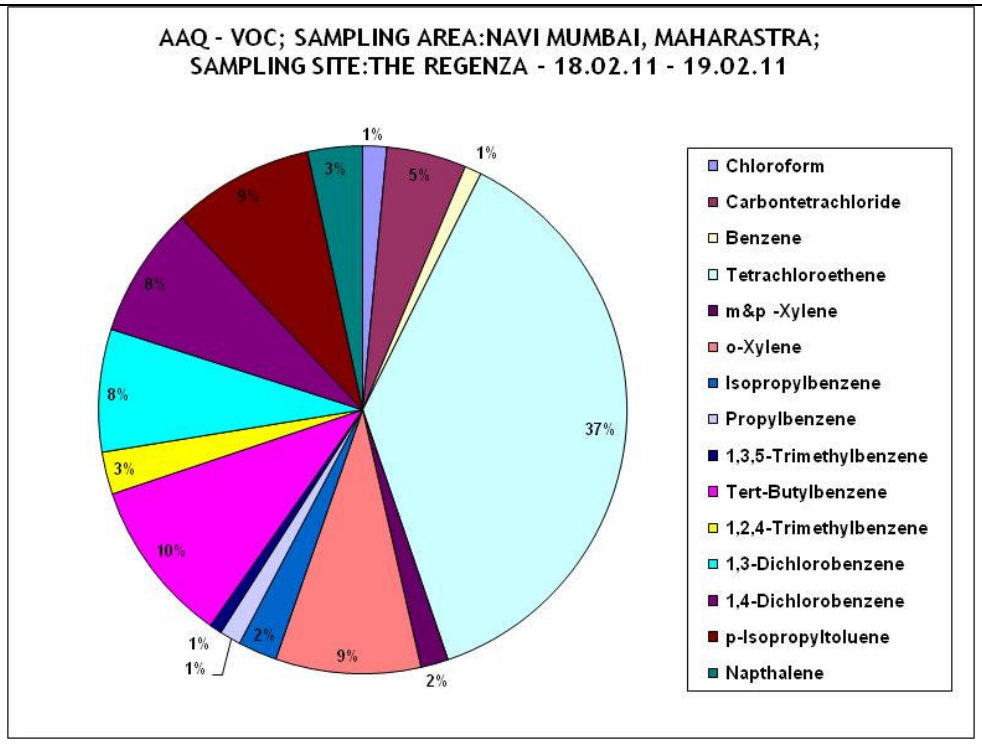
Station 4: Premises of M/s Regenza in the South West direction of industrial area.

The AAQ station-4 is identified as Down-wind station in South West direction as per prevailing wind direction at the time of the study.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: NAVI MUMBAI,MAHARASTRA				
	SAMPLING SITE:THE REGENZA - 18.02.11 TO 19.02.11				
	PARAMETERS	TIME:19.00-03.00	TIME:03.00-11.00	TIME:11.00-19.00	AVERAGE
		RESULTS (µg/m3)			
1	Chloroform	1.47	BDL	2.34	1.27
2	Carbontetrachloride	7.64	1.09	4.01	4.25
3	Benzene	BDL	BDL	2.68	0.89
4	Tetrachloroethene	9.61	3.45	84.42	32.49
5	m&p -Xylene	BDL	BDL	4.41	1.47
6	o-Xylene	BDL	BDL	23.16	7.72
7	Isopropylbenzene	BDL	BDL	6.22	2.07
8	Propylbenzene	BDL	BDL	3.39	1.13
9	1,3,5-Trimethylbenzene	BDL	BDL	1.98	0.66
10	Tert-Butylbenzene	2.47	10.35	13.37	8.73
11	1,2,4-Trimethylbenzene	3.39	3.38	BDL	2.26
12	1,3-Dichlorobenzene	BDL	BDL	19.59	6.53
13	1,4-Dichlorobenzene	BDL	BDL	20.91	6.97
14	p-Isopropyltoluene	2.14	8.919	11.56	7.54
15	Napthalene	BDL	BDL	8.75	2.92
TOTAL VOC =		26.72	27.19	206.81	86.91

15 VOCs are found in this location in which Tetrachloroethane, o-Xylene and Dichlorobenzene is detected with maximum concentration out of 15 detected VOCs.


AAQ - VOC ; SAMPLING AREA:NAVI MUMBAI,MAHARASTRA;
SAMPLING SITE:THE REGENZA - 18.02.11 - 19.02.11
RESULTS(µg/m3)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1.27
4.25
0.89
32.49
1.47
7.72
2.07
1.13
0.66
8.73
2.26
6.53
6.97
7.54
2.92
PARAMETERS
Chloroform
Carbontetrachloride
Benzene
Tetrachloroethene
m&p -Xylene
o-Xylene
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
Napthalene


AAQ - VOC; SAMPLING AREA:NAVI MUMBAI, MAHARASTRA;
SAMPLING SITE:THE REGENZA - 18.02.11 - 19.02.11
1%
1%
5%
37%
2%
9%
2%
1%
1%
10%
3%
8%
8%
9%
3%
Chloroform
Carbontetrachloride
Benzene
Tetrachloroethene
m&p -Xylene
o-Xylene
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
Napthalene

AMBIENT AIR QUALITY MONITORING ANALYSIS REPORT: TARAPUR

(18/02/11 - 19/02/11)

24 hours' average concentration of total VOCs at each location with average of each cycle is depicted in following Table for the ease of comparison.

Station No	Sampling Locations	TVOCs Concentrations (micro gram / cubic meters)		
1	Premises of Viking Exports Ltd., in the South East direction of industrial area. **(18/02/11 - 19/02/11)**	80.2 (12:30 Hrs - 20:30Hrs)	9.8 (20:30 Hrs - 04:30 Hrs)	122.5 (04:30 Hrs - 12:30Hrs)
		Average Concentration : 70.8		
2	Premises of Expanded Polymer Systems (p) Ltd., in the North East of industrial area. **(18/02/11 - 19/02/11)**	4.9 (16:00 Hrs - 00:00Hrs)	155.4 (00:10 Hrs - 08:10Hrs)	65.3 (08:10 Hrs - 16:10Hrs)
		Average Concentration : 75.2		
3	Premises of M/s Sandoz India Pvt Ltd., in North West direction of industrial area. **(18/02/11 - 19/02/11)**	9.8 (16:30 Hrs - 00:30Hrs)	7.2 (00:30 Hrs - 08:30Hrs)	143.0 (08:30 Hrs - 16:30Hrs)
		Average Concentration : 53.3		
4	Premises of M/s Regenza India Pvt Ltd., in the South West direction of industrial area. **(18/02/11 - 19/02/11)**	26.7 (19:00 Hrs - 03:00Hrs)	27.2 (03:00 Hrs - 11:00Hrs)	206.8 (11:00 Hrs - 19:00Hrs)
		Average Concentration : 86.9		

A A Q M Station in Down wind direction	:	Station-4
A A Q M Station in Cross wind direction	:	Station-1 & 3
A A Q M Station in Up wind direction	:	Station-2

Land Use Classification	Industrial Zone
Sky Conditions	Sunny Sky
Ambient Temperature	22°C to 32°C
Predominant Wind Directions	North East to South West

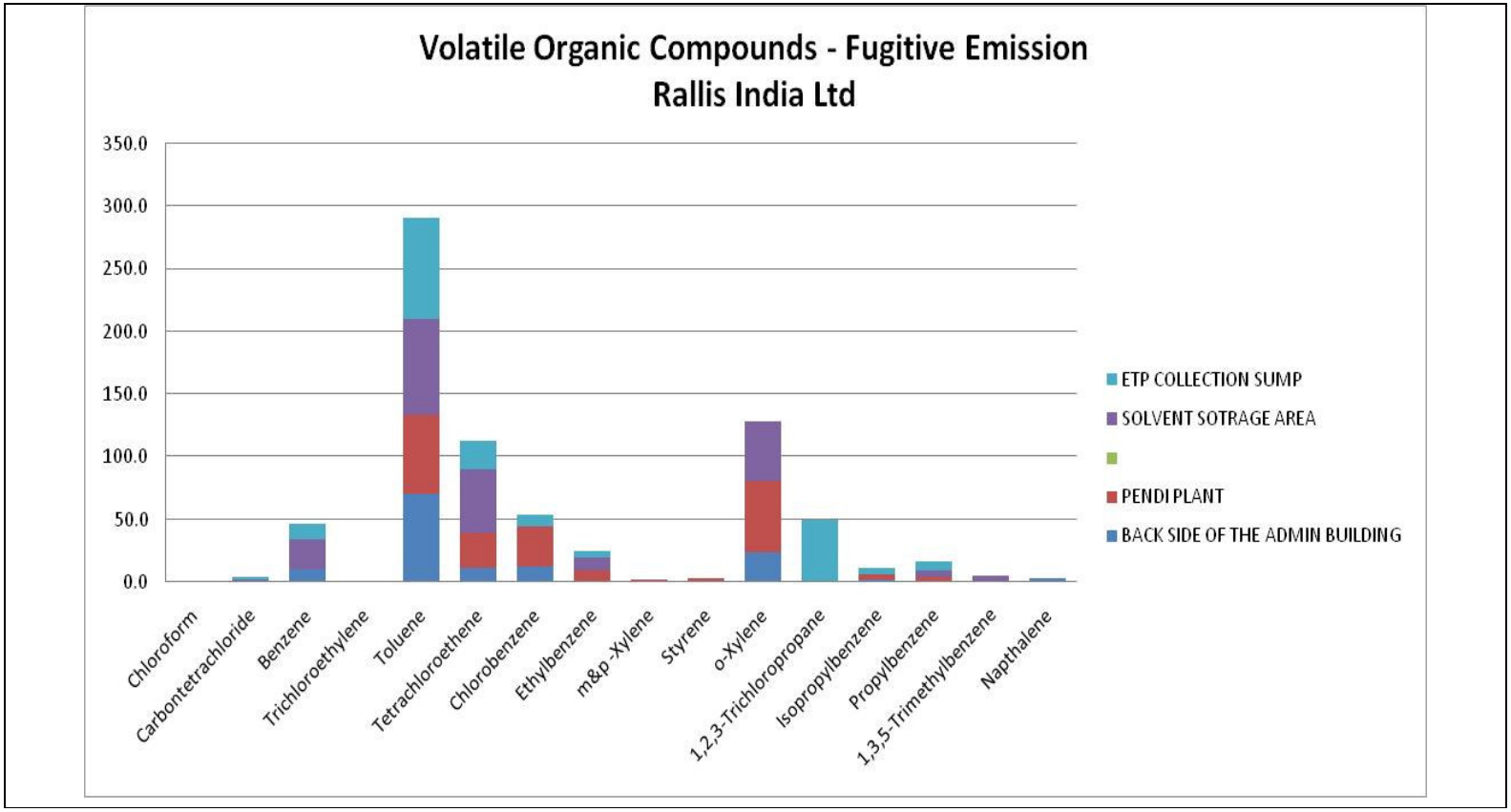
Sampling and Analysis Methodology Adopted: EPA TO-17

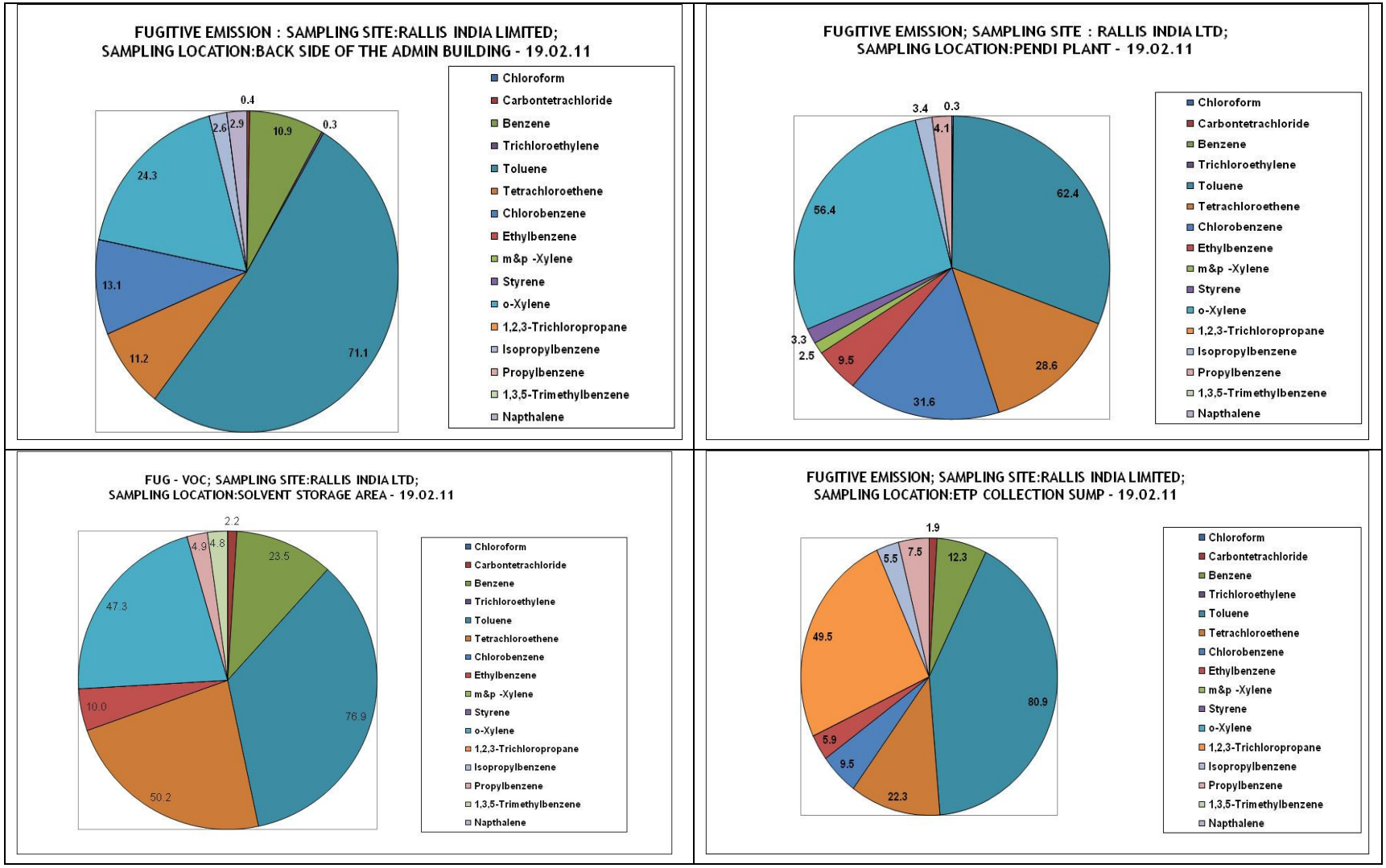
5.4 Result of Monitoring at Industries:

5.4.1 M/s Rallis India Ltd., (Fugitive Emission)

Samples of fugitive emissions and wastewater were collected from the unit and analyzed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be in the range of 136.8 to 219.8µg/m^3. The highest concentration was found at the location near solvent storage area followed by ETP where evaporation from effluent streams takes place at higher rates especially in aeration of the effluent.

S.No	FUGITIVE EMISSION – VOC(Results µg/l)				
	SAMPLING AREA:NAVI MUMBAI,MAHARASTRA				
	SAMPLING SITE:RALLIS INDIA LIMITED; DATE:19.02.11				
	PARAMETERS	BACK SIDE OF THE ADMIN BUILDING	PENDI PLANT	SOLVENT SOTRAGE AREA	ETP COLLECTION SUMP
1	Chloroform	BDL	0.3	BDL	BDL
2	Carbon Tetrachloride	0.4	BDL	2.2	1.9
3	Benzene	10.9	BDL	23.5	12.3
4	Trichloroethylene	0.3	BDL	BDL	BDL
5	Toluene	71.1	62.4	76.9	80.9
6	Tetra Chloroethene	11.2	28.6	50.2	22.3
7	Chloro benzene	13.1	31.6	BDL	9.5
8	Ethylbenzene	BDL	9.5	10.0	5.9
9	m&p –Xylene	BDL	2.5	BDL	BDL
10	Styrene	BDL	3.3	BDL	BDL
11	o-Xylene	24.3	56.4	47.3	BDL
12	1,2,3-Trichloropropane	BDL	BDL	BDL	49.5
13	Isopropylbenzene	2.6	3.4	BDL	5.5
14	Propylbenzene	BDL	4.1	4.9	7.5
15	1,3,5-Trimethylbenzene	BDL	BDL	4.8	BDL
16	Napthalene	2.9	BDL	BDL	BDL
TOTAL VOC =		136.8	202.0	219.8	195.5

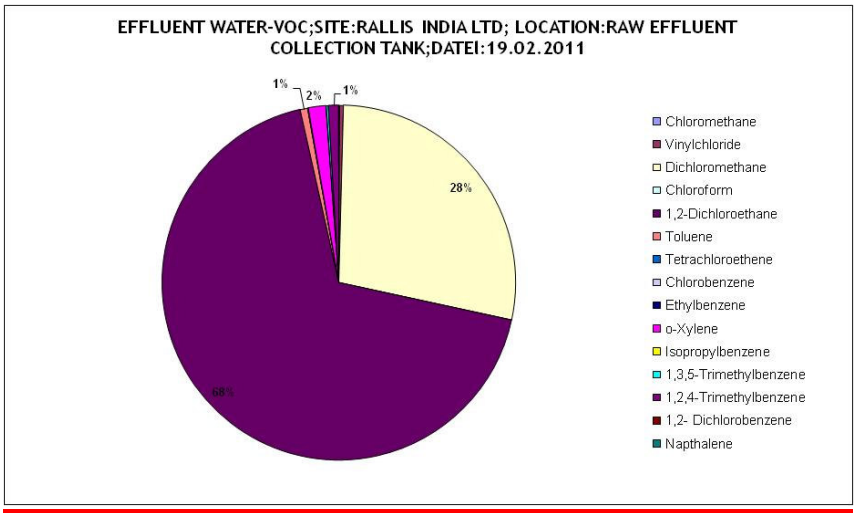

Volatile Organic Compounds - Fugitive Emission
Rallis India Ltd
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Chloroform
Carbontetrachloride
Benzene
Trichloroethylene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p-Xylene
Styrene
o-Xylene
1,2,3-Trichloropropane
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Napthalene
ETP COLLECTION SUMP
SOLVENT SOTRAGE AREA
PENDI PLANT
BACK SIDE OF THE ADMIN BUILDING


FUGITIVE EMISSION : SAMPLING SITE:RALLIS INDIA LIMITED;
SAMPLING LOCATION:BACK SIDE OF THE ADMIN BUILDING - 19.02.11
0.4
2.6
2.9
10.9
0.3
24.3
13.1
11.2
71.1
Chloroform
Carbontetrachloride
Benzene
Trichloroethylene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene
1,2,3-Trichloropropane
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Napthalene
FUGITIVE EMISSION; SAMPLING SITE : RALLIS INDIA LTD;
SAMPLING LOCATION:PENDI PLANT - 19.02.11
3.4
0.3
4.1
62.4
56.4
3.3
2.5
9.5
28.6
31.6
Chloroform
Carbontetrachloride
Benzene
Trichloroethylene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene
1,2,3-Trichloropropane
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Napthalene
FUG - VOC; SAMPLING SITE:RALLIS INDIA LTD;
SAMPLING LOCATION:SOLVENT STORAGE AREA - 19.02.11
2.2
4.9
4.8
23.5
47.3
10.0
50.2
76.9
Chloroform
Carbontetrachloride
Benzene
Trichloroethylene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene
1,2,3-Trichloropropane
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Napthalene
FUGITIVE EMISSION; SAMPLING SITE:RALLIS INDIA LIMITED;
SAMPLING LOCATION:ETP COLLECTION SUMP - 19.02.11
1.9
5.5
7.5
12.3
49.5
5.9
9.5
22.3
80.9
Chloroform
Carbontetrachloride
Benzene
Trichloroethylene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene
1,2,3-Trichloropropane
Isopropylbenzene
Propylbenzene
1,3,5-Trimethylbenzene
Napthalene

5.4.2 EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from collection tank of ETP was found to be 32229µg/l in which 1,2-Dichloroethane was found very high concentration of 21945µg/l followed by dichlormethane, Xylene and other compounds. The higher concentration may be due to improper separation of intermediate/solvents/products at different process stages, which also affects the treatment efficiency of the ETP.

S.NO	EFFLUENT WATER -VOC SAMPLING SITE:RALLIS INDIA LTD;SAMPLING AREA:NAVI MUMBAI LOCATION:RAW EFFLUENT COLLECTION TANK ; DATE:19.02.2011 PARAMETERS	RESULTS (µg/l)
1	Chloromethane	21.0
2	Vinylchloride	113.7
3	Dichloromethane	9015.6
4	Chloroform	1.1
5	1,2-Dichloroethane	21945.0
6	Toluene	221.0
7	Tetrachloroethene	0.8
8	Chlorobenzene	17.6
9	Ethylbenzene	1.0
10	o-Xylene	517.3
11	Isopropylbenzene	6.2
12	1,3,5-Trimethylbenzene	62.5
13	1,2,4-Trimethylbenzene	300.7
14	1,2- Dichlorobenzene	1.6
15	Napthalene	4.0
TOTAL VOC		**32229.0**

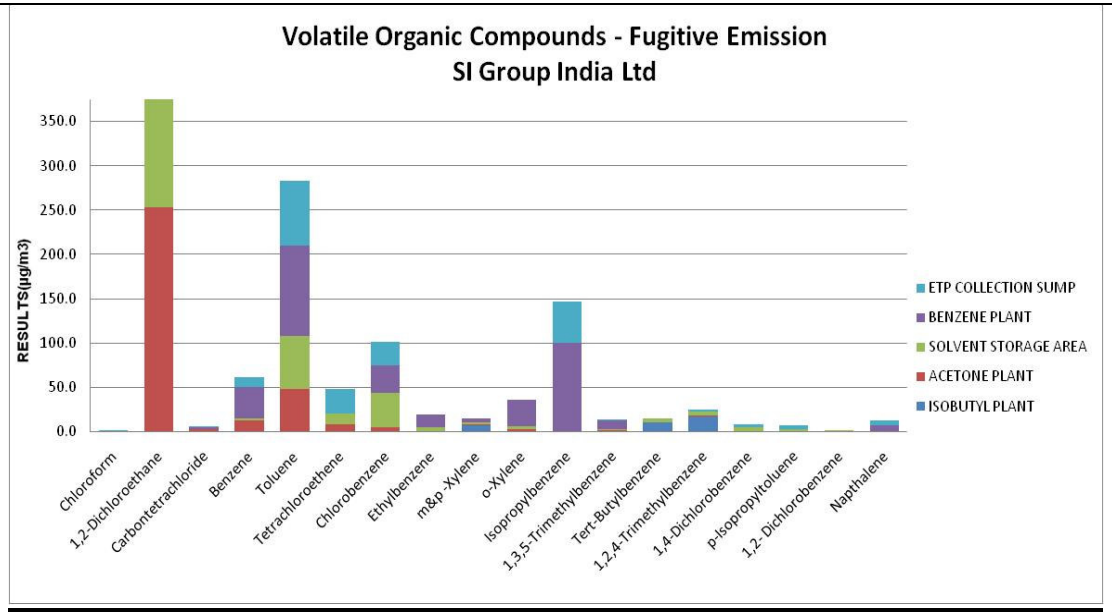


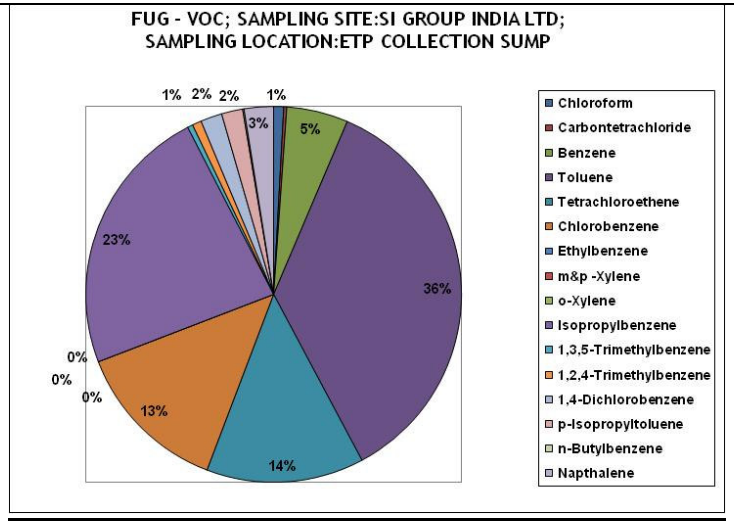
5.4.3 M/s SI Group India Ltd.,

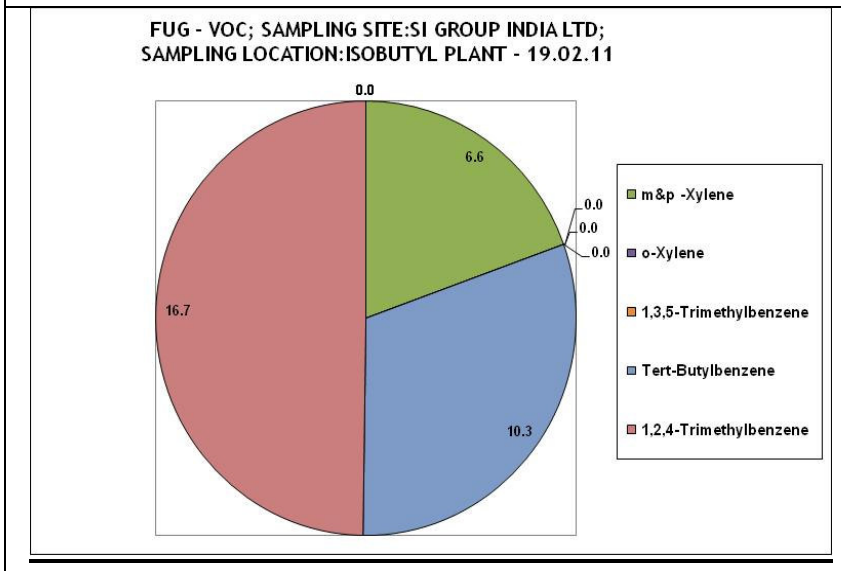
FUGITIVE EMISSION MONITORING:

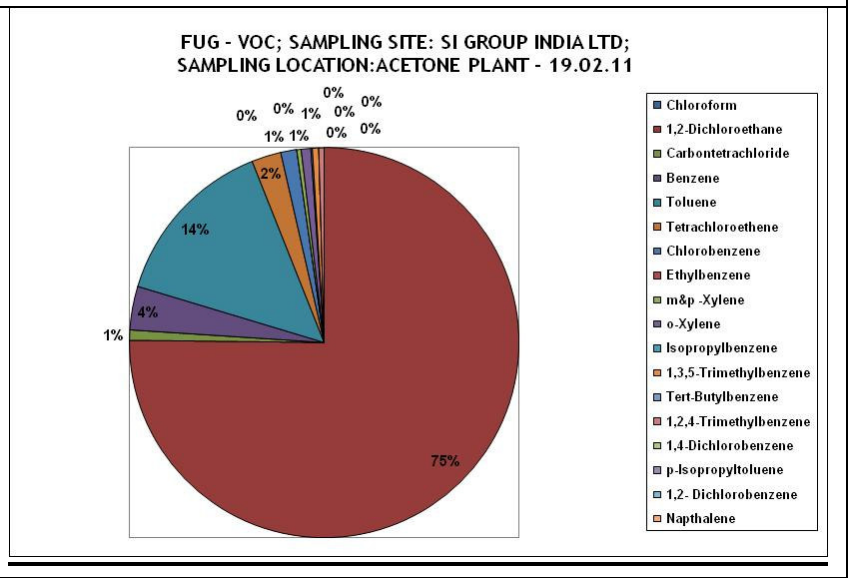
Samples of fugitive emissions and wastewater were collected from the unit and analyzed for VOCs. The concentrations of VOCs in fugitive emission monitoring samples were found to be in the range of 941 to 3207µg/m^3. The highest concentration was found at Near ETP plant area.

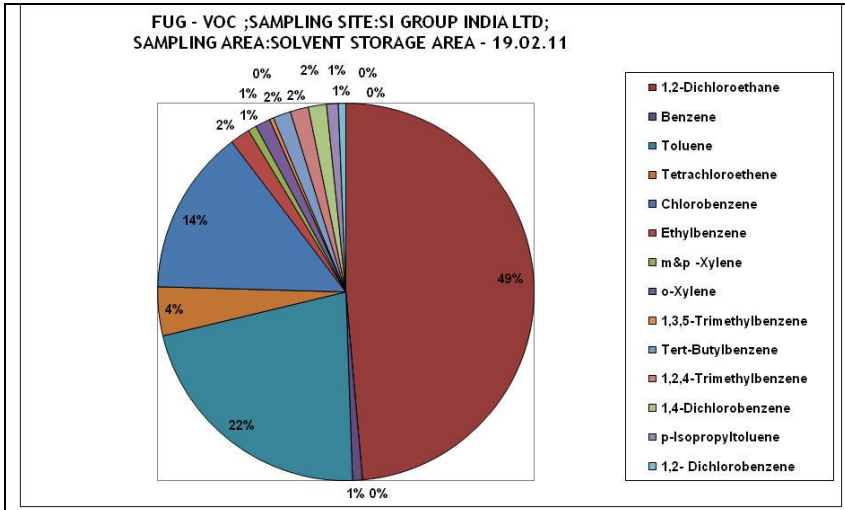
S.No	FUGITIVE EMISSION – VOC SAMPLING AREA:NAVI MUMBAI,MAHARASTRA SAMPLING SITE:SI GROUP INDIA LTD; DATE:19.02.11					
	PARAMETERS	ISOBUTYL PLANT	ACETONE PLANT	SOLVENT STORAGE AREA	BENZENE PLANT	ETP COLLECTION SUMP
1	Chloroform	BDL	BDL	BDL	BDL	1.8
2	1,2-Dichloroethane	BDL	252.6	134.1	BDL	BDL
3	Carbon tetrachloride	BDL	2.9	BDL	2.4	0.5
4	Benzene	BDL	12.2	2.3	35.4	10.8
5	Toluene	BDL	48.1	60.2	101.4	73.1
6	Tetrachloroethene	BDL	8.2	11.5	BDL	27.7
7	Chlorobenzene	BDL	4.4	39.1	30.7	27.3
8	Ethylbenzene	BDL	BDL	4.7	14.2	BDL
9	m&p -Xylene	6.6	1.2	2.0	4.7	BDL
10	o-Xylene	BDL	2.7	3.6	29.8	BDL
11	Isopropylbenzene	BDL	0.4	BDL	99.2	47.5
12	1,3,5-Trimethylbenzene	BDL	1.8	0.9	9.7	0.9
13	Tert-Butylbenzene	10.3	BDL	4.2	BDL	BDL
14	1,2,4-Trimethylbenzene	16.7	1.5	4.3	BDL	1.6
15	1,4-Dichlorobenzene	BDL	BDL	4.3	BDL	3.8
16	p-Isopropyltoluene	BDL	BDL	2.8	BDL	3.7
17	1,2- Dichlorobenzene	BDL	BDL	1.8	BDL	BDL
18	Napthalene	BDL	BDL	BDL	7.3	5.2
TOTAL VOC =		**33.6**	**335.9**	**275.9**	**334.7**	**203.9**

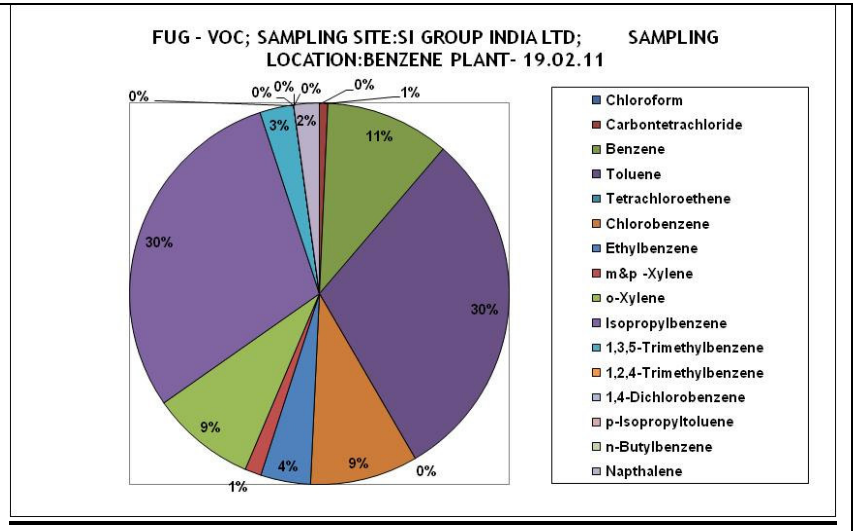

Volatile Organic Compounds - Fugitive Emission
SI Group India Ltd
RESULTS(ug/m3)
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Chloroform
1,2-Dichloroethane
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p-Xylene
o-Xylene
Isopropylbenzene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2-Dichlorobenzene
Napthalene
ETP COLLECTION SUMP
BENZENE PLANT
SOLVENT STORAGE AREA
ACETONE PLANT
ISOBUTYL PLANT


FUG - VOC; SAMPLING SITE:SI GROUP INDIA LTD;
SAMPLING LOCATION:ETP COLLECTION SUMP
1% 2% 2% 1%
3%
5%
23%
36%
0%
0%
0%
13%
14%
Chloroform
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene
1,3,5-Trimethylbenzene
1,2,4-Trimethylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
n-Butylbenzene
Napthalene


FUG - VOC; SAMPLING SITE:SI GROUP INDIA LTD;
SAMPLING LOCATION:ISOBUTYL PLANT - 19.02.11
0.0
6.6
0.0
0.0
0.0
16.7
10.3
m&p -Xylene
o-Xylene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene


FUG - VOC; SAMPLING SITE: SI GROUP INDIA LTD;
SAMPLING LOCATION:ACETONE PLANT - 19.02.11
0%
0% 0% 1% 0% 0%
1% 1% 0% 0%
2%
14%
4%
1%
75%
Chloroform
1,2-Dichloroethane
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2- Dichlorobenzene
Napthalene

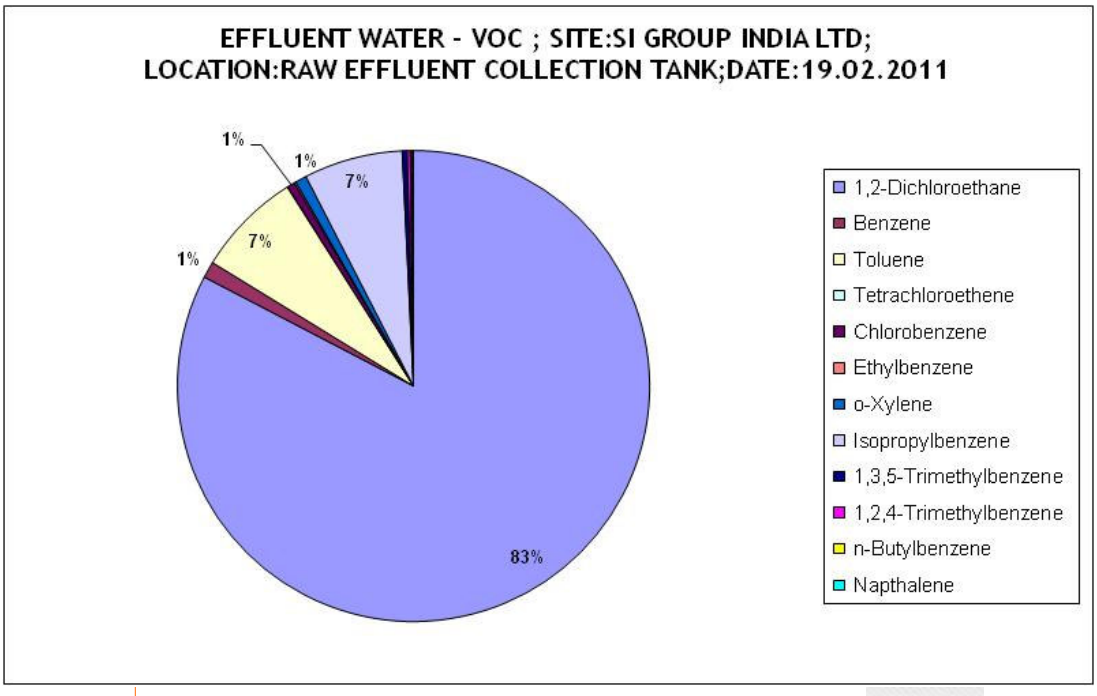

FUG - VOC ;SAMPLING SITE:SI GROUP INDIA LTD;
SAMPLING AREA:SOLVENT STORAGE AREA - 19.02.11
49%
22%
4%
14%
2%
1%
1%
2%
2%
2%
1%
1%
0%
0%
0%
1% 0%
1,2-Dichloroethane
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2- Dichlorobenzene


FUG - VOC; SAMPLING SITE:SI GROUP INDIA LTD; SAMPLING
LOCATION:BENZENE PLANT- 19.02.11
30%
30%
11%
9%
9%
4%
3%
2%
1%
1%
0%
0%
0%
0%
0%
0%
0%
Chloroform
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene
1,3,5-Trimethylbenzene
1,2,4-Trimethylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
n-Butylbenzene
Napthalene

5.4.4 EFFLUENT SAMPLE ANALYSIS:

The concentration of VOCs in effluent sample taken from collection tank of ETP was found to be 1073.4µg/l in which 1,2-Dichloroethane is found maximum concentration.

S.NO	EFFLUENT WATER –VOC SAMPLING SITE:SI GROUP INDIA LTDSAMPLING AREA:NAVI MUMBAI LOCATION:RAW EFFLUENT COLLECTION TANK ; DATE:19.02.2011 PARAMETERS	RESULTS (µg/l)
1	1,2-Dichloroethane	887.3
2	Benzene	12.0
3	Toluene	77.6
4	Tetrachloroethene	0.5
5	Chlorobenzene	5.4
6	Ethylbenzene	1.3
7	o-Xylene	8.3
8	Isopropylbenzene	72.7
9	1,3,5-Trimethylbenzene	3.5
10	1,2,4-Trimethylbenzene	2.3
11	n-Butylbenzene	1.0
12	Napthalene	1.3
TOTAL VOC		**1073.4**

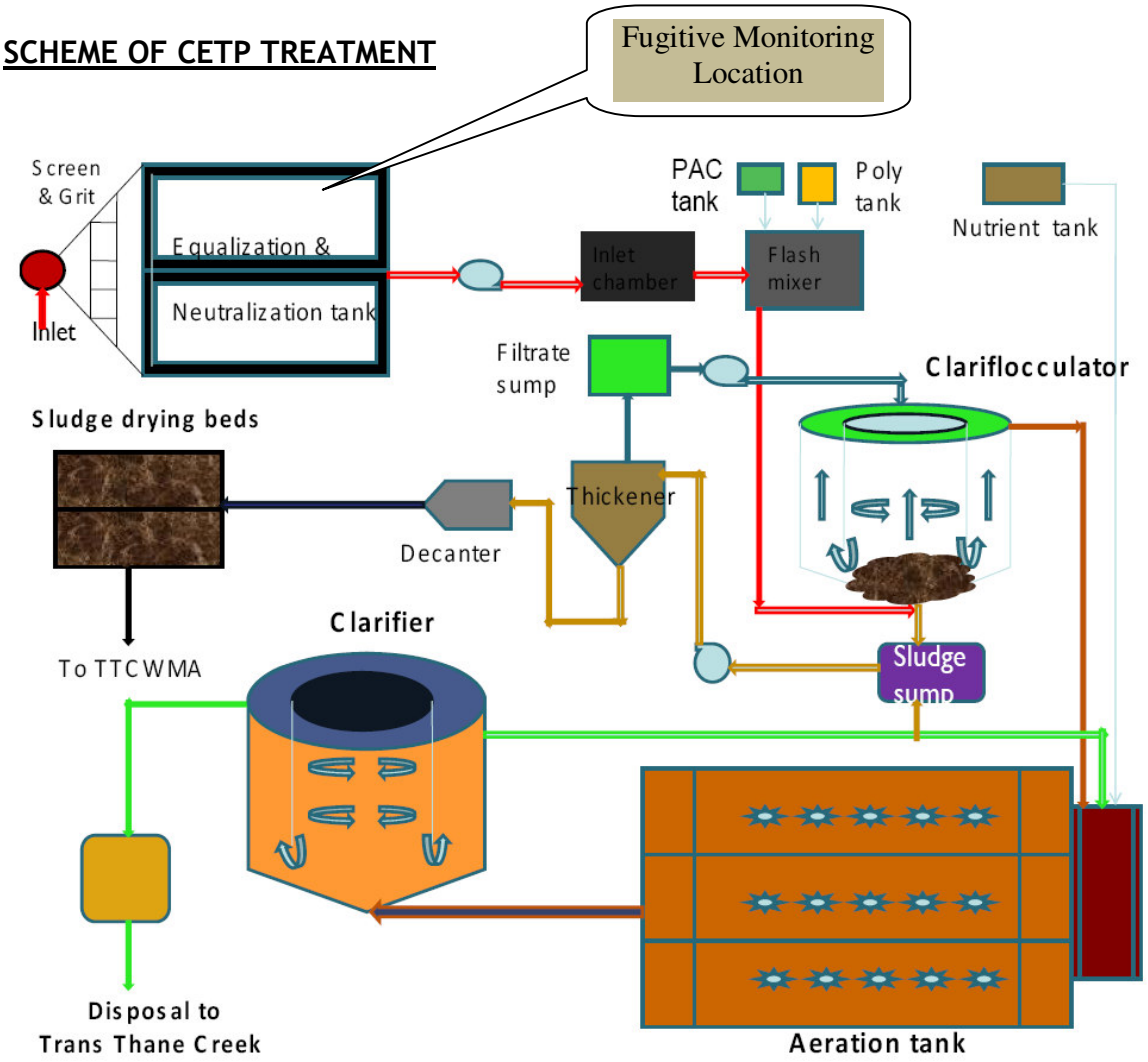


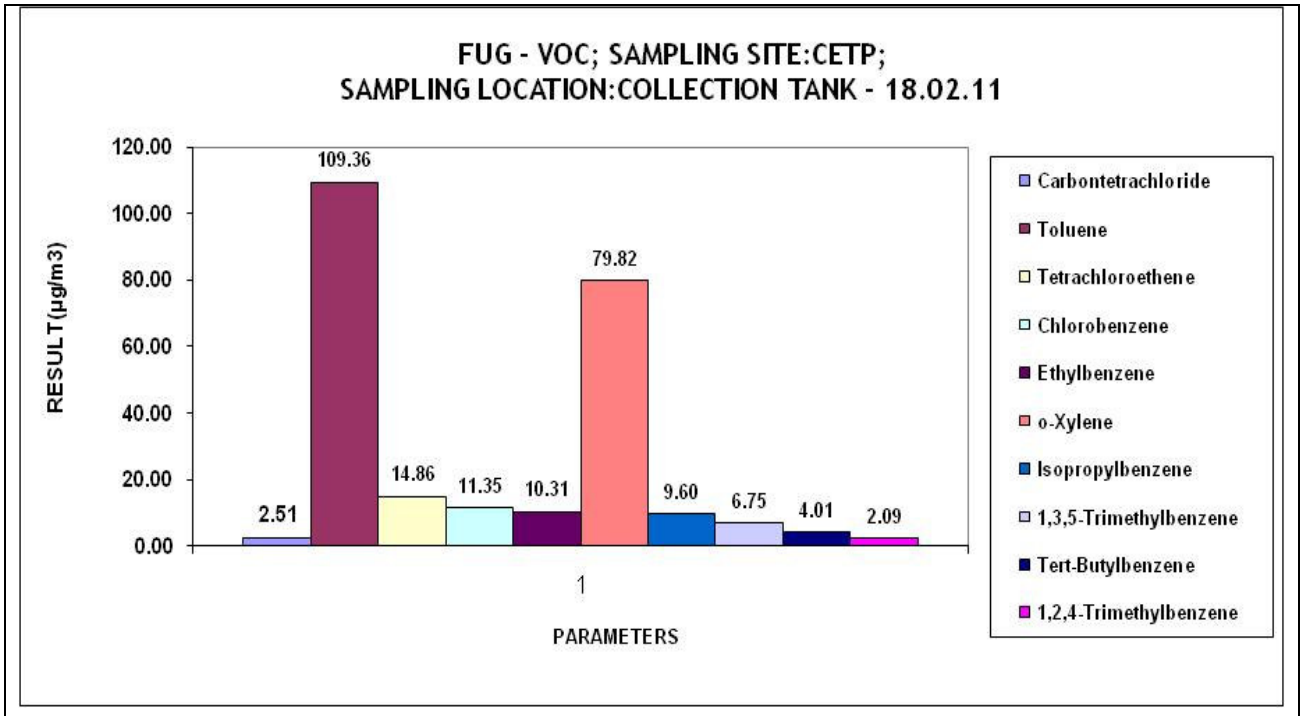
5.4.5 M/s. Common Effluent Treatment Plant (Fugitive Emission)

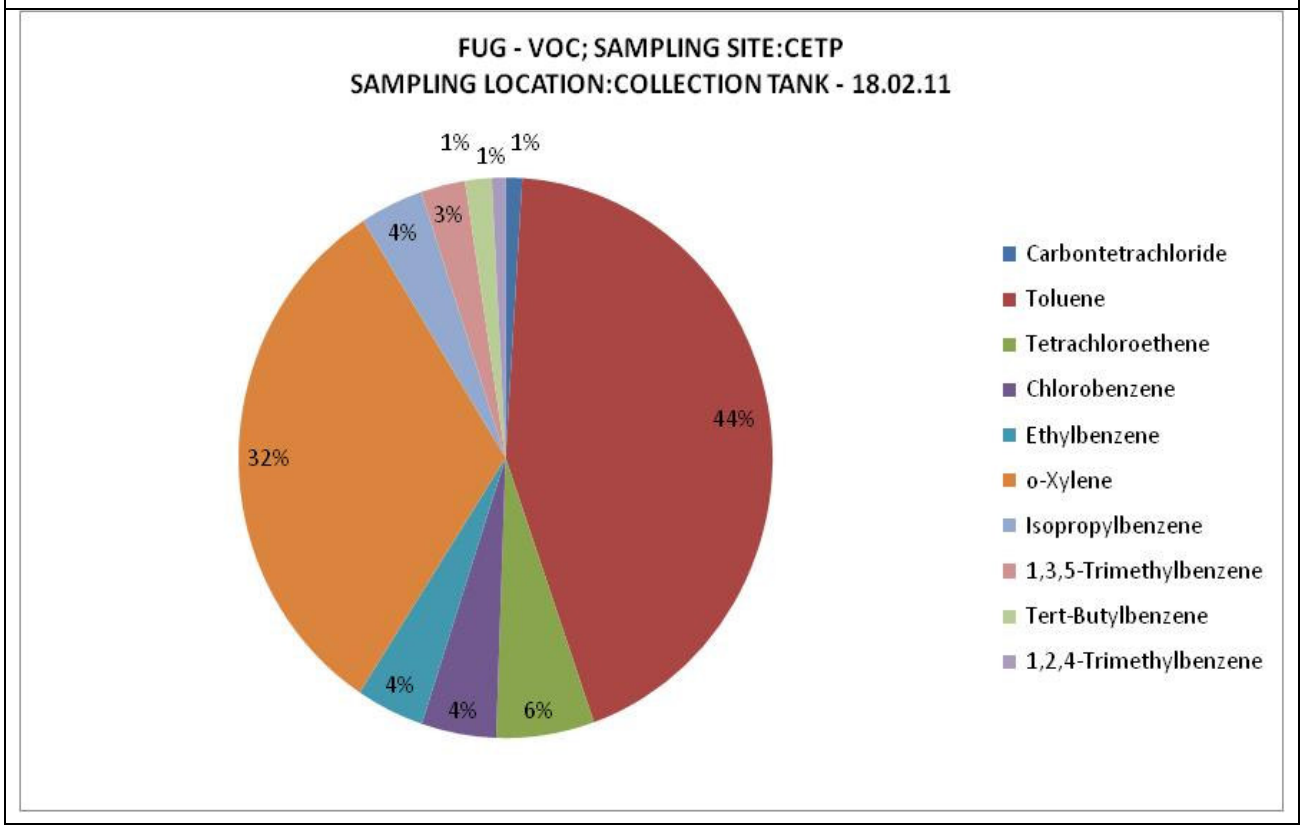
Sample of fugitive emissions was collected from the unit and analysed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be 250.6µg/m^3 near collection sump area in which Toluene and o-Xylene is found to higher concentration compared to other VOCs. The unit is collecting continuously the industrial effluent for further treatment and disposal. The concentration of these VOCs may vary depends on the influent load condition.

S.No	FUGITIVE EMISSION - VOC	
	SAMPLING AREA:NAVI MUMBAI,MAHARASTRA	
	SAMPLING SITE:CETP; DATE:18.02.11	
	PARAMETERS	NEAR COLLECTION TANK AREA (µg/m3)
1	Carbontetrachloride	2.51
2	Toluene	109.36
3	Tetrachloroethene	14.86
4	Chlorobenzene	11.35
5	Ethylbenzene	10.31
6	o-Xylene	79.82
7	Isopropylbenzene	9.60
8	1,3,5-Trimethylbenzene	6.75
9	Tert-Butylbenzene	4.01
10	1,2,4-Trimethylbenzene	2.09
TOTAL VOC =		**250.65**

SCHEME OF CETP TREATMENT



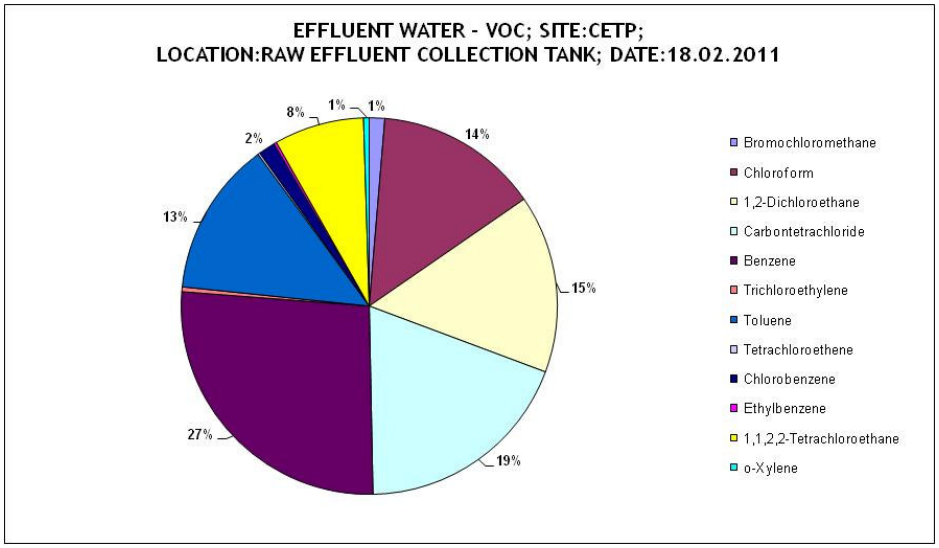

FUG - VOC; SAMPLING SITE:CETP;
SAMPLING LOCATION:COLLECTION TANK - 18.02.11
RESULT(µg/m3)
120.00
100.00
80.00
60.00
40.00
20.00
0.00
109.36
79.82
14.86
11.35
10.31
9.60
6.75
4.01
2.09
2.51
1
PARAMETERS
Carbontetrachloride
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
o-Xylene
Isopropylbenzene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene


FUG - VOC; SAMPLING SITE:CETP
SAMPLING LOCATION:COLLECTION TANK - 18.02.11
1%
1%
1%
3%
4%
44%
32%
4%
4%
6%
Carbontetrachloride
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
o-Xylene
Isopropylbenzene
1,3,5-Trimethylbenzene
Tert-Butylbenzene
1,2,4-Trimethylbenzene

5.4.6 EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from collection tank of ETP was found to be 32229µg/l in which 1,2-Dichloroethane was found very high concentration of 21945µg/l followed by dichlormethane, Xylene and other compounds. The higher concentration may be due to improper separation of intermediate/solvents/products at different process stages, which also affects the treatment efficiency of the ETP.

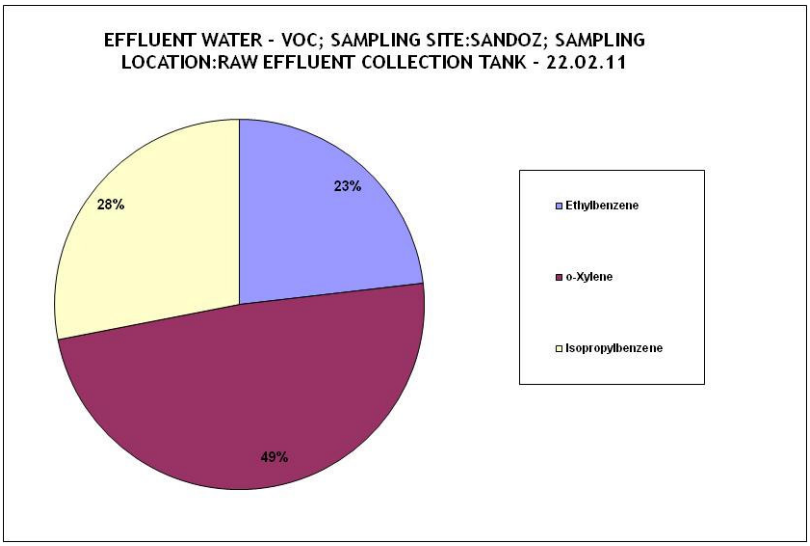
S.NO	EFFLUENT WATER -VOC SAMPLING SITE:CETP;SAMPLING AREA:NAVI MUMBAI LOCATION:RAW EFFLUENT COLLECTION TANK ; DATE:18.02.2011 PARAMETERS	RESULTS (µg/l)
1	Bromochloromethane	4.3
2	Chloroform	45.4
3	1,2-Dichloroethane	49.3
4	Carbontetrachloride	61.3
5	Benzene	85.6
6	Trichloroethylene	1.3
7	Toluene	42.9
8	Tetrachloroethene	0.6
9	Chlorobenzene	4.6
10	Ethylbenzene	0.8
11	1,1,2,2-Tetrachloroethane	25.0
12	o-Xylene	1.6
TOTAL VOC		**322.6**



5.4.7 M/s. Sandoz India Ltd.,
EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from collection tank of ETP was found to be 2.5µg/l which will be very low concentration and observed that no influent during sampling.

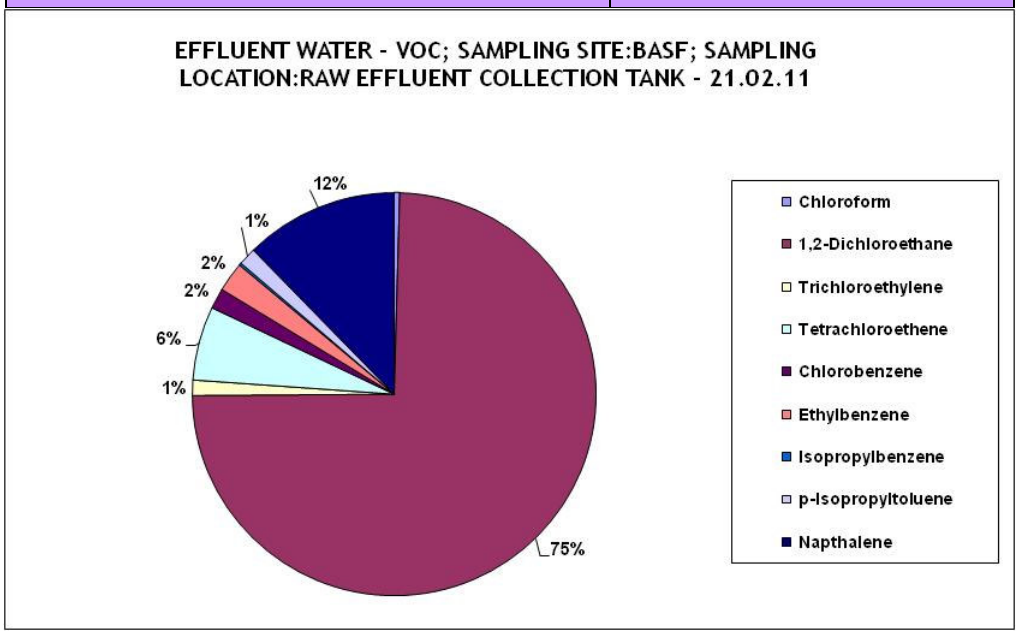
S.NO	EFFLUENT WATER -VOC	
	SAMPLING SITE:SANDOZ;SAMPLING AREA:NAVI MUMBAI	
	LOCATION: RAW EFFLUENT COLLECTION TANK ; DATE:22.02.2011	
	PARAMETERS	RESULTS (µg/l)
1	Ethylbenzene	0.6
2	o-Xylene	1.2
3	Isopropylbenzene	0.7
TOTAL VOC		2.5



5.4.8 M/s. BASF India Ltd.,
EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from collection tank of ETP was found to be 144.3µg/l in which 1,2-Dichloroethane was found to be maximum concentration when compared to other detected VOC.

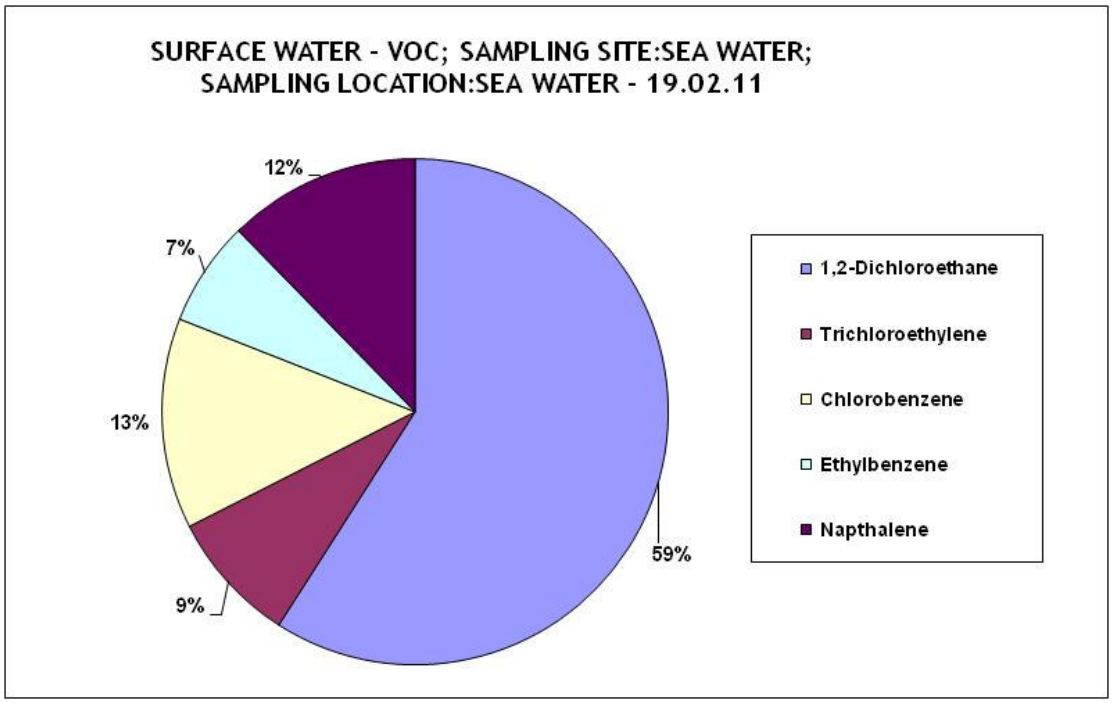
S.NO	EFFLUENT WATER -VOC	
	SAMPLING SITE:BASF SAMPLING AREA:NAVI MUMBAI	
	LOCATION:RAW EFFLUENT COLLECTION TANK ; DATE:21.02.2011	
	PARAMETERS	RESULTS (µg/l)
1	Chloroform	0.6
2	1,2-Dichloroethane	107.5
3	Trichloroethylene	1.8
4	Tetrachloroethene	8.5
5	Chlorobenzene	2.4
6	Ethylbenzene	3.4
7	Isopropylbenzene	0.3
8	p-Isopropyltoluene	2.1
9	Napthalene	17.8
TOTAL VOC		144.3



5.4.9 SEA WATER (Back Water) SAMPLE ANLAYSIS:

The concentration of VOCs in water sample taken from sea water (back water) was found to be 8.7µg/l.

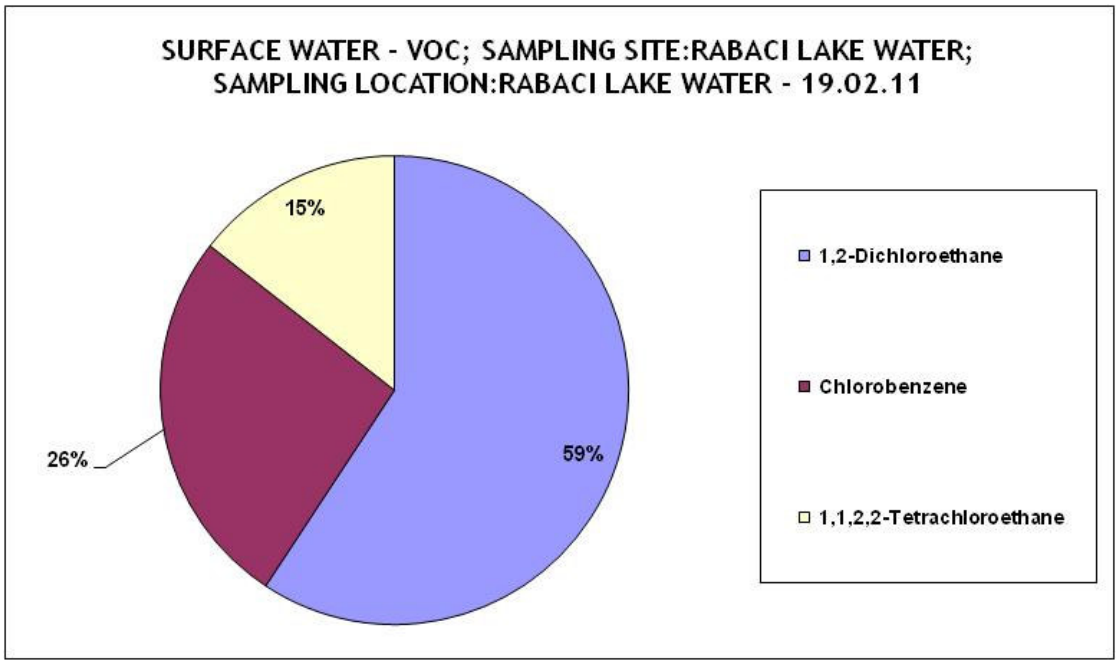
S.NO	SURFACE WATER -VOC SAMPLING SITE:SEA WATER SAMPLING AREA:NAVI MUMBAI LOCATION:SEA WATER ; DATE:19.02.2011 PARAMETERS	RESULTS (µg/l)
1	1,2-Dichloroethane	5.1
2	Trichloroethylene	0.7
3	Chlorobenzene	1.2
4	Ethylbenzene	0.6
5	Napthalene	1.1
TOTAL VOC		**8.7**



5.4.10 LAKE WATER (Rabaci Lake Water) SAMPLE ANLAYSIS:

The concentration of VOCs in water sample taken from lake water was found to be 6.6µg/l.

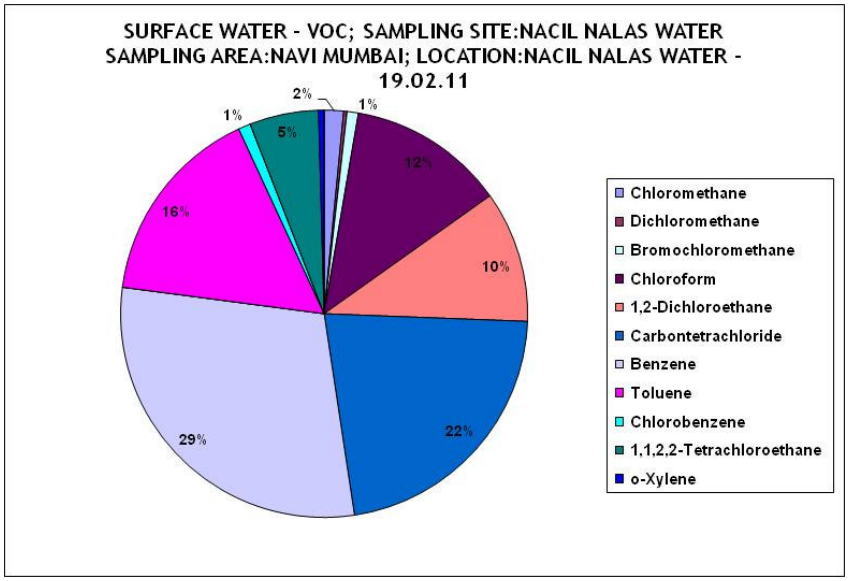
S.NO	SURFACE WATER -VOC	
	SAMPLING SITE:RABACI LAKE WATER SAMPLING AREA:NAVI MUMBAI	
	LOCATION:RABACI LAKE WATER ; DATE:19.02.2011	
	PARAMETERS	RESULTS (µg/l)
1	1,2-Dichloroethane	3.9
3	Chlorobenzene	1.7
4	1,1,2,2-Tetrachloroethane	1.0
TOTAL VOC		6.6



5.4.11 LAKE WATER (NACIL Nalla Water) SAMPLE ANLAYSIS:

The concentration of VOCs in water sample taken from Nacil lake water was found to be 595.0 µg/l in which Benzene, Carbon Tetrachloride

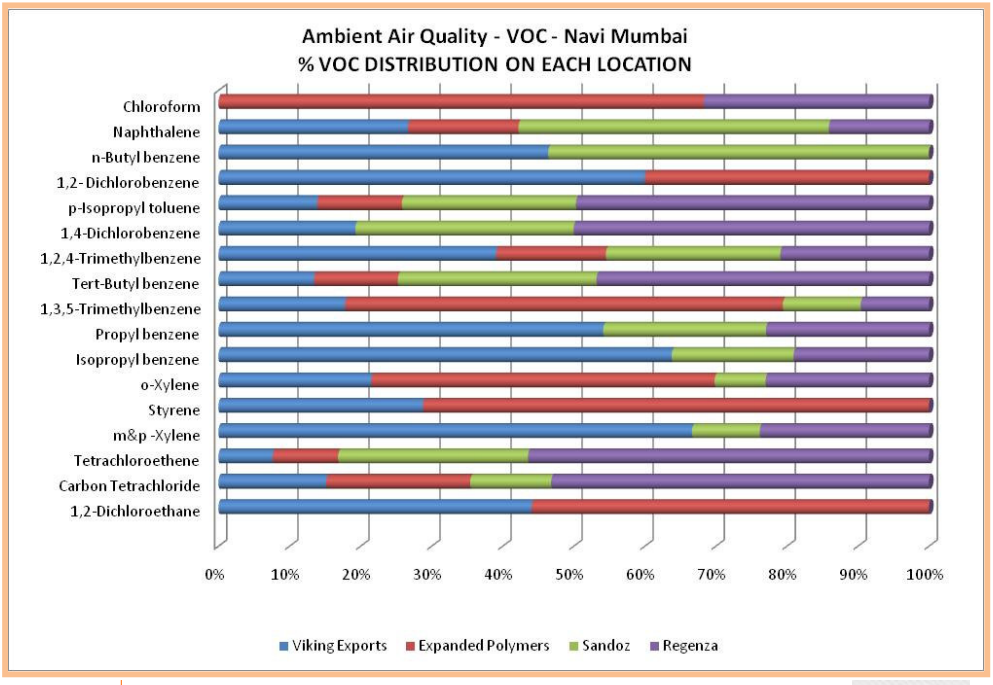
S.NO	SURFACE WATER -VOC	
	SAMPLING SITE:RABACI LAKE WATER SAMPLING AREA:NAVI MUMBAI	
	LOCATION:RABACI LAKE WATER ; DATE:19.02.2011	
	PARAMETERS	**RESULTS (µg/l)**
1	Chloromethane	7.26
2	Dichloromethane	1.2
3	Bromochloromethane	4.27
4	Chloroform	58.97
5	1,2-Dichloroethane	49.33
6	Carbontetrachloride	104.14
7	Benzene	139.37
8	Toluene	75.76
9	Chlorobenzene	4.62
10	1,1,2,2-Tetrachloroethane	25.91
11	o-Xylene	2.0
TOTAL VOC		**472.9**

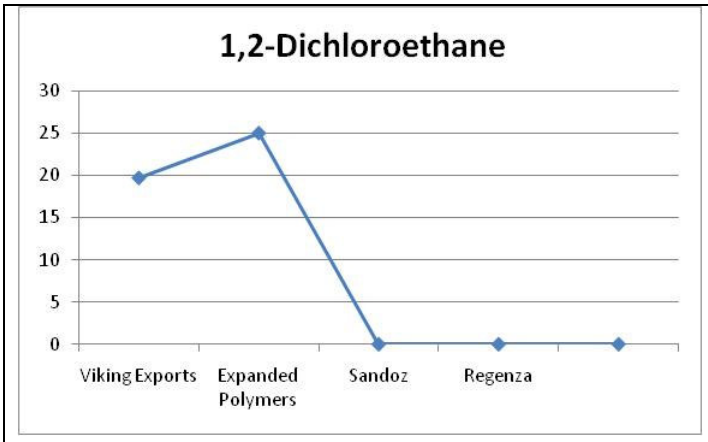


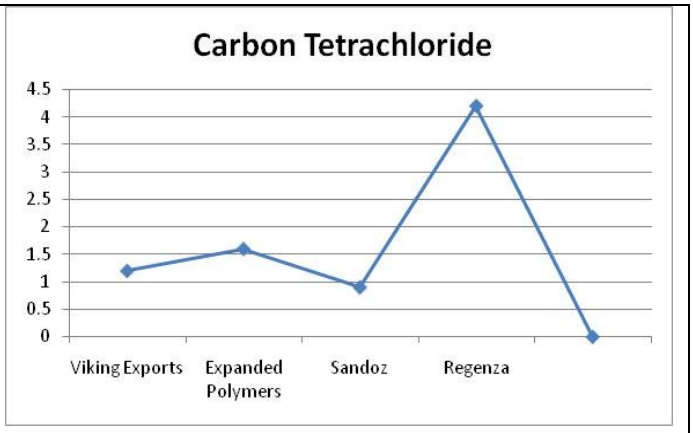
5.5 Observation and Findings on Navi Mumbai Industrial Area

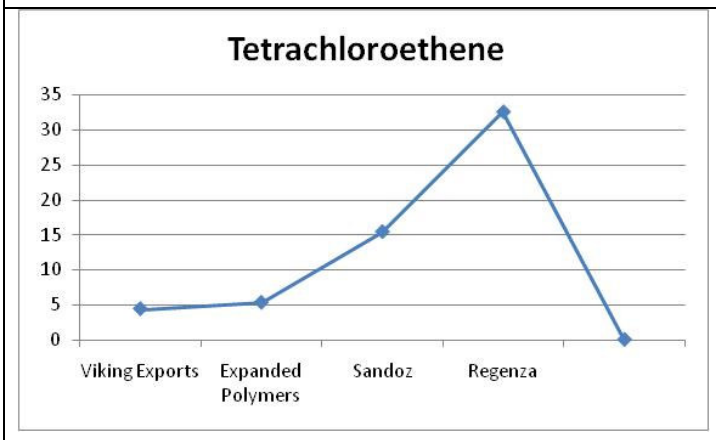
- The order of the pollutant in Ambient Air is 1,2-Dichloroethane, Styrene, Tetrachloroethane, Xylene, Chloroform, Dichlorobenzene, Naphthalene and Carbon Tetrachloride and the presence of these compounds was observed at almost all the monitored locations.
- Concentration of 1,2-Dichloroethane, Tetrachlolorethane, Xylene and Toluene are observed to be more in maximum locations among the VOCs detected whereas at some cycle of monitoring and few locations Styrene, Dichlorobenzene and Naphthalene were also found with more concentration.
- The probable places of loss of VOCs are Centrifuging, filtration, glands, charging material into the reactors, solvent storage area, distillation and ETP area.
- Total 17 VOCs including 13 highly toxic and suspected carcinogenic compounds are found during monitoring at Navi Mumbai.
- The total VOCs concentration was measured at all locations, in the range of 53.3 ug/m3 – minimum at Station-3 (Sandoz India Ltd., upwind station of the Industrial Estate) to 86.9ug/m3 – maximum at Station - 4 (The Regenza in South West direction industrial area).
- ATD method found to have reported many compounds which are relevant to the industries used solvents and some have no relevance to solvents used in industries, because of may be the impurities in their used solvents.
- Average concentration of predominant and total VOCs found in each locations and the % distribution of individual VOCs in each locations is depicted in the following table and chart.

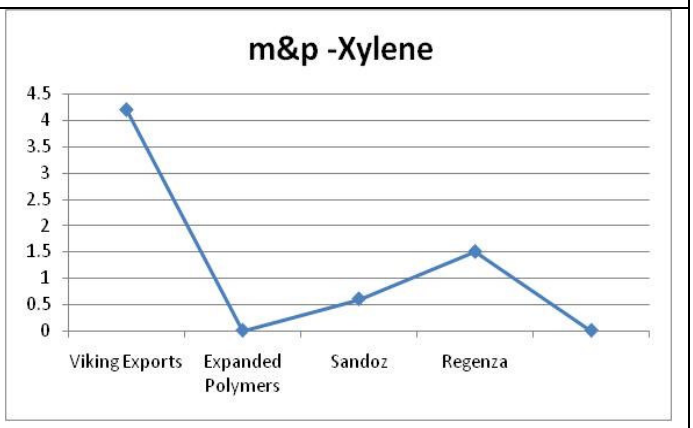
AMBIENT AIR QUALITY - VOC				
PRESENCE OF VOC IN PARAMETER WISE FOR ALL LOCATIONS				
Parameter	**Viking Exports**	**Expanded Polymers**	**Sandoz**	**Regenza**
1,2-Dichloroethane	19.7	25	BDL	BDL
Carbon Tetrachloride	1.2	1.6	0.9	4.2
Tetrachloroethene	4.4	5.3	15.4	32.5
m&p –Xylene	4.2	BDL	0.6	1.5
Styrene	4.2	10.4	BDL	BDL
o-Xylene	7.2	16.2	2.4	7.7
Isopropyl benzene	6.7	BDL	1.8	2
Propyl benzene	2.6	BDL	1.1	1.1
1,3,5-Trimethylbenzene	1.3	4.5	0.8	0.7
Tert-Butyl benzene	2.5	2.2	5.2	8.7
1,2,4-Trimethylbenzene	4.3	1.7	2.7	2.3
1,4-Dichlorobenzene	2.7	BDL	4.3	7
p-Isopropyl toluene	2.1	1.8	3.7	7.5
1,2- Dichlorobenzene	0.6	0.4	BDL	BDL
n-Butyl benzene	1.3	BDL	1.5	BDL
Naphthalene	5.5	3.2	9	2.9
Chloroform	BDL	2.8	BDL	1.3

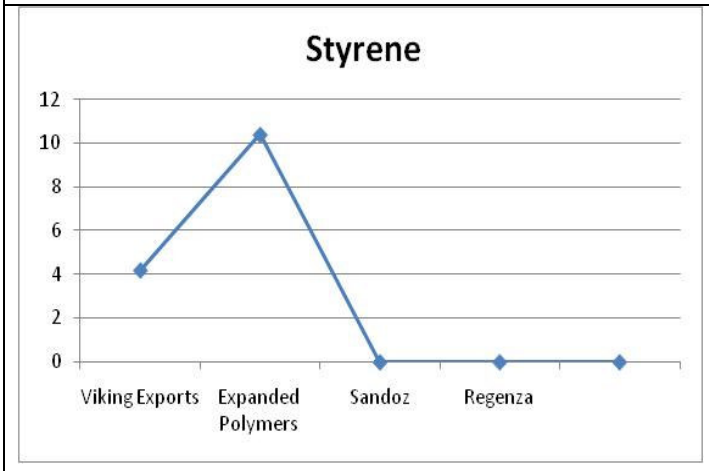


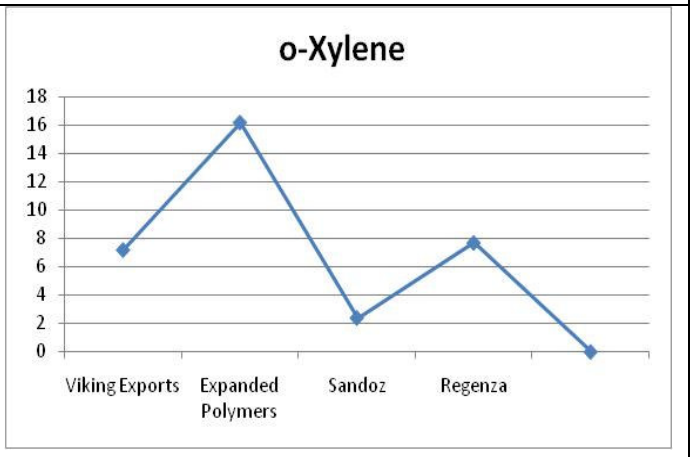

1,2-Dichloroethane
30
25
20
15
10
5
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

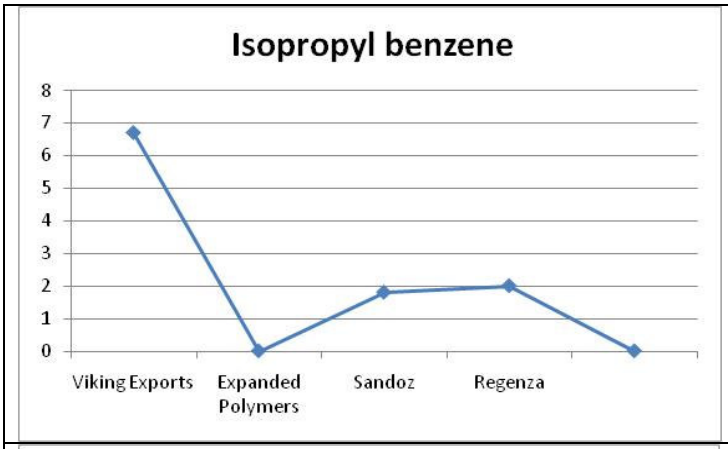

Carbon Tetrachloride
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

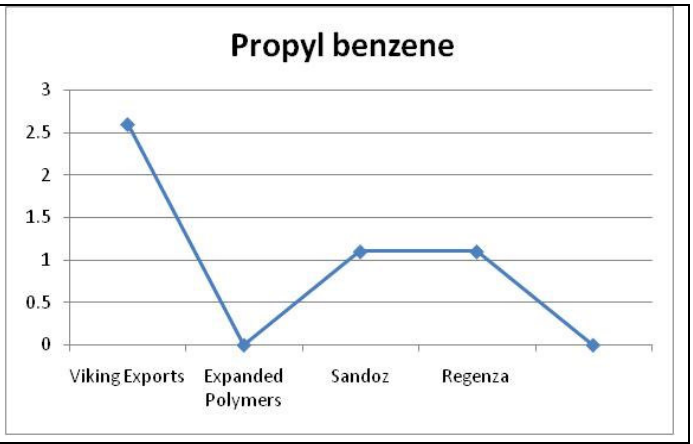

Tetrachloroethene
35
30
25
20
15
10
5
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

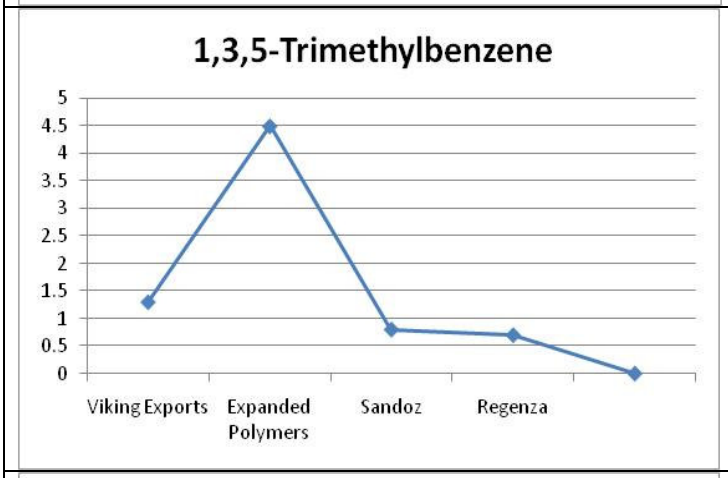

m&p -Xylene
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

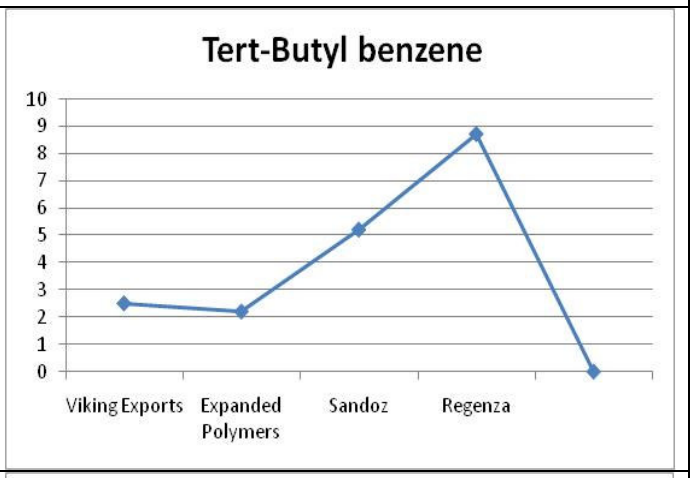

Styrene
12
10
8
6
4
2
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

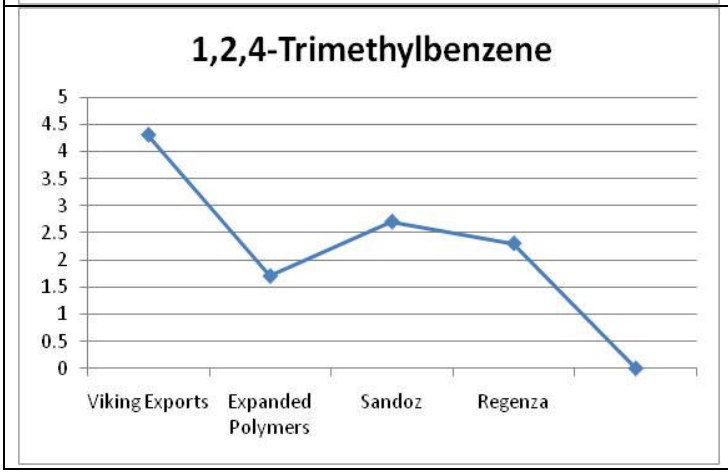

o-Xylene
18
16
14
12
10
8
6
4
2
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

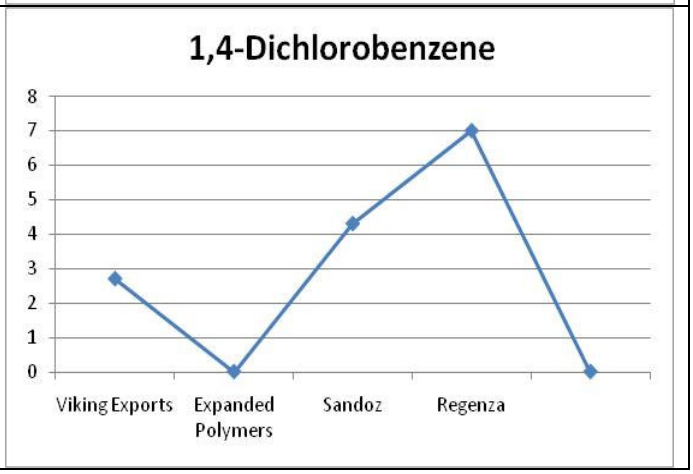

Isopropyl benzene
8
7
6
5
4
3
2
1
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

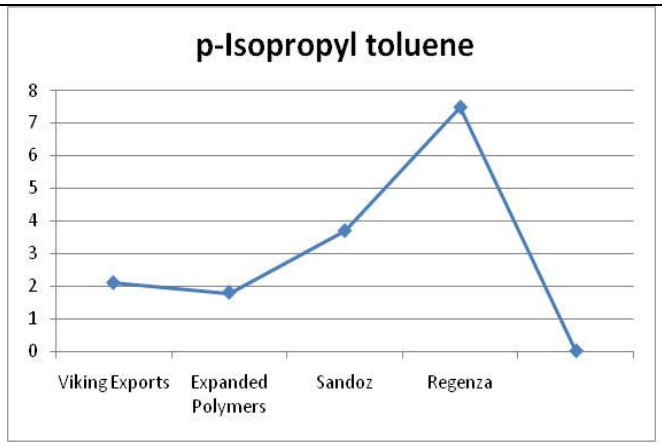

Propyl benzene
3
2.5
2
1.5
1
0.5
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

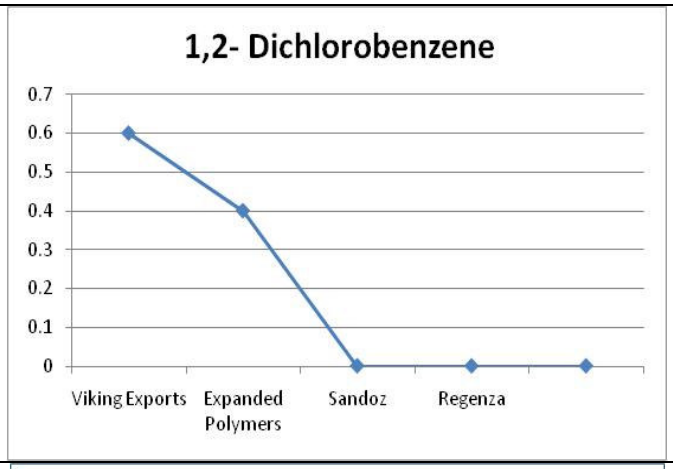

1,3,5-Trimethylbenzene
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

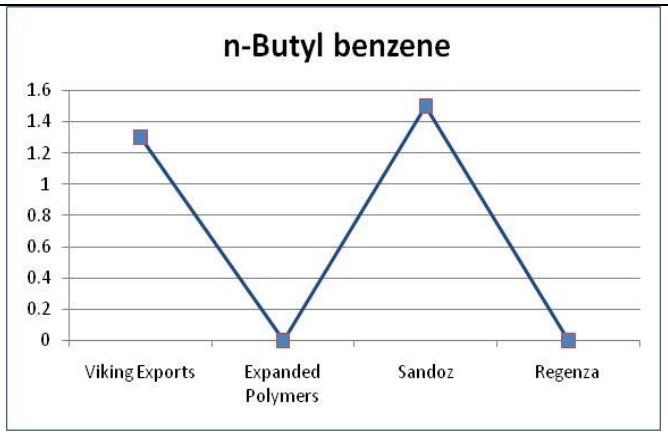

Tert-Butyl benzene
10
9
8
7
6
5
4
3
2
1
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

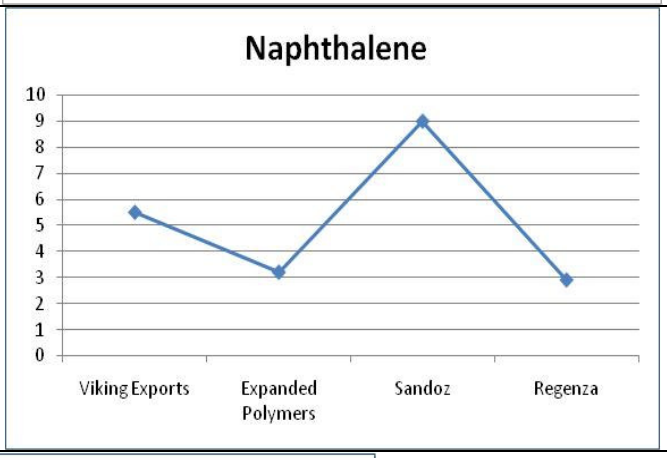

1,2,4-Trimethylbenzene
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

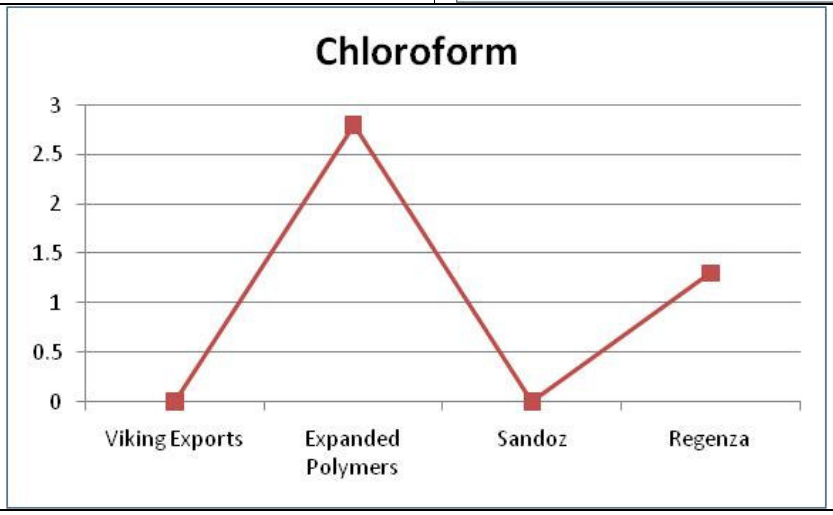

1,4-Dichlorobenzene
8
7
6
5
4
3
2
1
0
Viking Exports
Expanded Polymers
Sandoz
Regenza


p-Isopropyl toluene
8
7
6
5
4
3
2
1
0
Viking Exports
Expanded Polymers
Sandoz
Regenza


1,2- Dichlorobenzene
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Viking Exports
Expanded Polymers
Sandoz
Regenza


n-Butyl benzene
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Viking Exports
Expanded Polymers
Sandoz
Regenza


Naphthalene
10
9
8
7
6
5
4
3
2
1
0
Viking Exports
Expanded Polymers
Sandoz
Regenza


Chloroform
3
2.5
2
1.5
1
0.5
0
Viking Exports
Expanded Polymers
Sandoz
Regenza

- The Benzene concentration in all AAQM stations was found well below within the prescribed national standard of 5µg/m^3
- Generation of Hazardous waste can be minimized by better operating methods and systems as well as solvent recovery with effective condensation with which the concentration of VOC dispersing to atmosphere can be reduced.
- Normally the wastewater generated by the industries contains high VOCs and the industries are doing only primary treatment. During these processes some percentage of VOCs are dispersed into the atmosphere. After primary treatment the industries are pumping their effluent to CETP for further treatments. In CETP during aeration process, most of the VOCs are vaporized and dispersed into the atmosphere. These VOCs are directly impacting the Ambient VOCs concentration.
- Chlorinated compounds escape at the higher rate in to the atmosphere which may increase the ground level ozone concentration.
- Companies change the products with respect to demand in the market accordingly the solvent type and quantity will also vary. Due to these variations the concentrations of VOC in AAQ, Fugitive and wastewater may vary.
- Presence of VOCs in wastewater affects the ambient air quality, efficiency of the effluent treatment system and the quality of the final receiving body. VOCs (Solvents) are emitted in to the environment during various treatment unit operations particularly during aeration in equalization tanks and aeration tanks.
- In case of CETP at Navi Mumbai, the concentrations of Benzene, Carbon Tetrachloride, 1,2-Dichloroethane and Chloroform were found to be very high as compared to other VOCs present in the influent.
- In Surface water except Nacil lake other two locations are very low concentrations of few VOCs are detected. But in Nacil river water Chlorofom, 1,2-Dichloroethane, Carbon Tetrachloride, Benzene and Toluene got detected with minimum concentrations.

VOC PROJECT REPORT ON DOMBIVALI INDUSTRIAL AREA

CHAPTER – VI

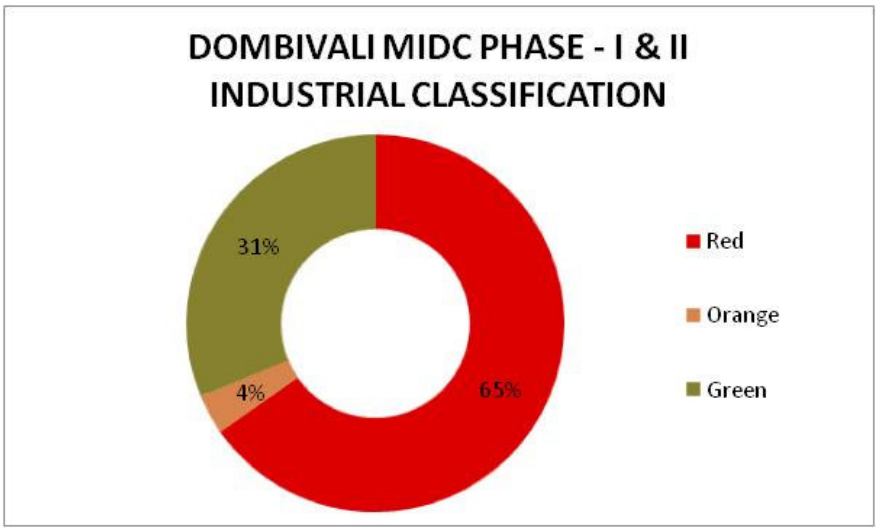
6.0 ABOUT DOMBIVALI INDUSTRIAL ESTATE:

The Dombivali industrial area was established by MIDC in 1964. The Dombivali MIDC occupies an area of about 347.88 Hector. And is approachable from Mumbai-Pune National Highway- 4 via the Kalyan-Shil Phata and also from Mumbai-Agra National Highway -3 via the Bhiwandi-Kalyan Road and it is about 45.00 km from Mumbai International Airport and 15.00 km from Thane city. This area is 3.00 km from Dombivali railway station and 5.00 km from Kalyan junction on the central railway.

This area comprises of revenue villages like Sagaon-Sonarpada, Asde-Golivali, Gajbandhan-Patharli and Chole in Kalyan tahasil, Thane district. The area is located on the Kalyan-Shil and Kalyan-Dombivali roads. In this area, industrial plots and sheds have been developed as Phase-I and II and residential and commercial plots/area in between & surrounding Phase-I & Phase-II.

Industry Classification:

Type	Large	Medium	Small	Total
Red	1	8	336	345
Orange	0	0	18	18
Green	0	0	165	165
Total	1	8	519	528

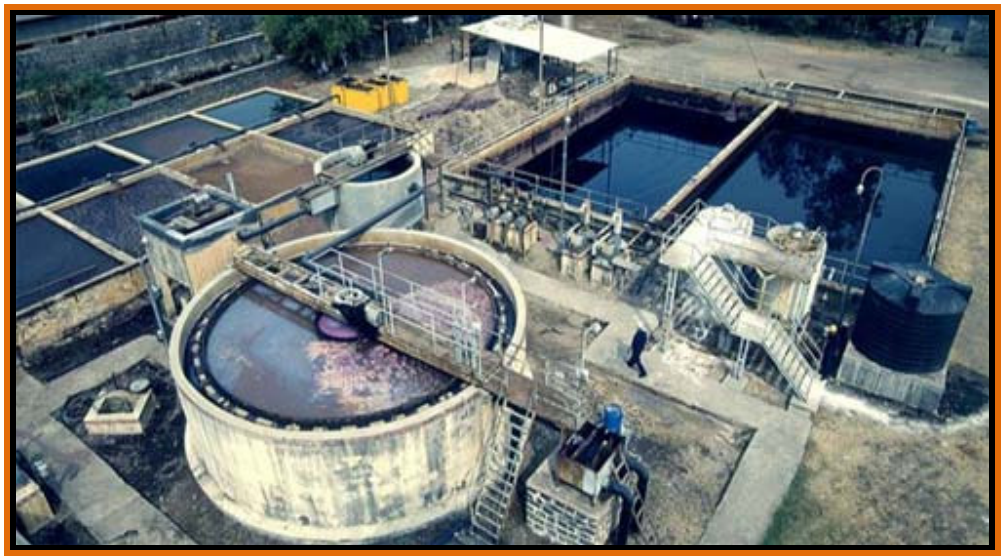


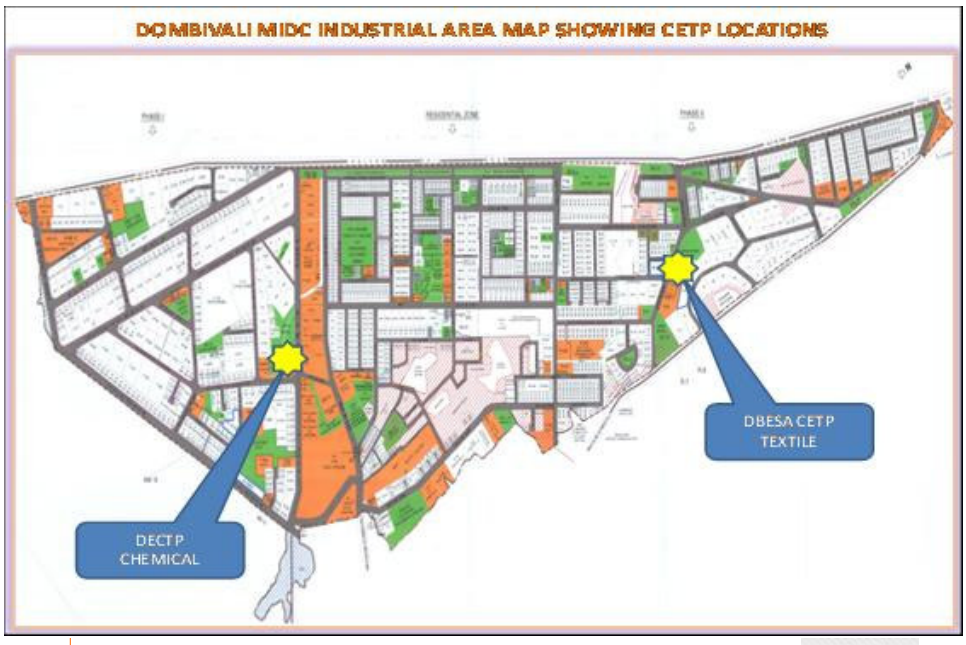
There are 345 Industries which are generating trade effluent and have provided ETPs for treating the same and the treated effluent is sent to CETP for further treatment and disposal.

CETPs:-There are 2 no. of CETPs functioning in the industrial area.

The capacity of individual CETP is as bellows:-

1) Dombivali DBESA CETP Textile (Phase-I) = 16 MLD
2) DCETP Chemical (Phase-II) = 1.5 MLD





Out of 345 effluent generating industries, major units are textile, chemical and bulk drugs, pharmaceuticals, dyes, pesticides, etc. The partly treated effluent of the SSI units and fully treated Effluent of MSI/ LSI units is carried through MIDC pipe line to CETP, along with the domestic effluent (sewage) of Industries in the MIDC zone. The total treated effluent generated from MIDC area is about 14.0 MLD. Quantity of Industrial effluent generated in MIDC industrial Area is about 14 MLD, the treated effluent is finally discharged into the creek through open nalla which was passing through residential area.

6.1 Location of the Sampling:

The meteorological parameters have been studied and accordingly prevailing wind direction is North West to South East and sometimes North to South with minimum temperature of 23^{o}C and Maximum 32^{o}C. The relative humidity was found in the range of 50 – 65% and wind speed is ranging from 0.8m/sec to 2.3 m/s.

Following industries were selected for VOC monitoring:

Center : (1) Premises of MIDC Office in the center of industrial area.

Up Wind : (2) Premises of Alchemie Laboratories Ltd., in the North of industrial area.

Cross Wind : (3) Premises of M/s Runa Chemicals Pvt Ltd., in the East direction of industrial area.

Down Wind : (4) Premises of M/s Aarthi Industries Pvt Ltd., in the North East direction of industrial area.

Cross Wind : (4) Premises of M/s CETP in Phase-II is in the North East direction of industrial area.

DOMBIVALI MIDC INDUSTRIAL AREA MAP SHOWING AAQM LOCATIONS

6.2 Results and Discussions

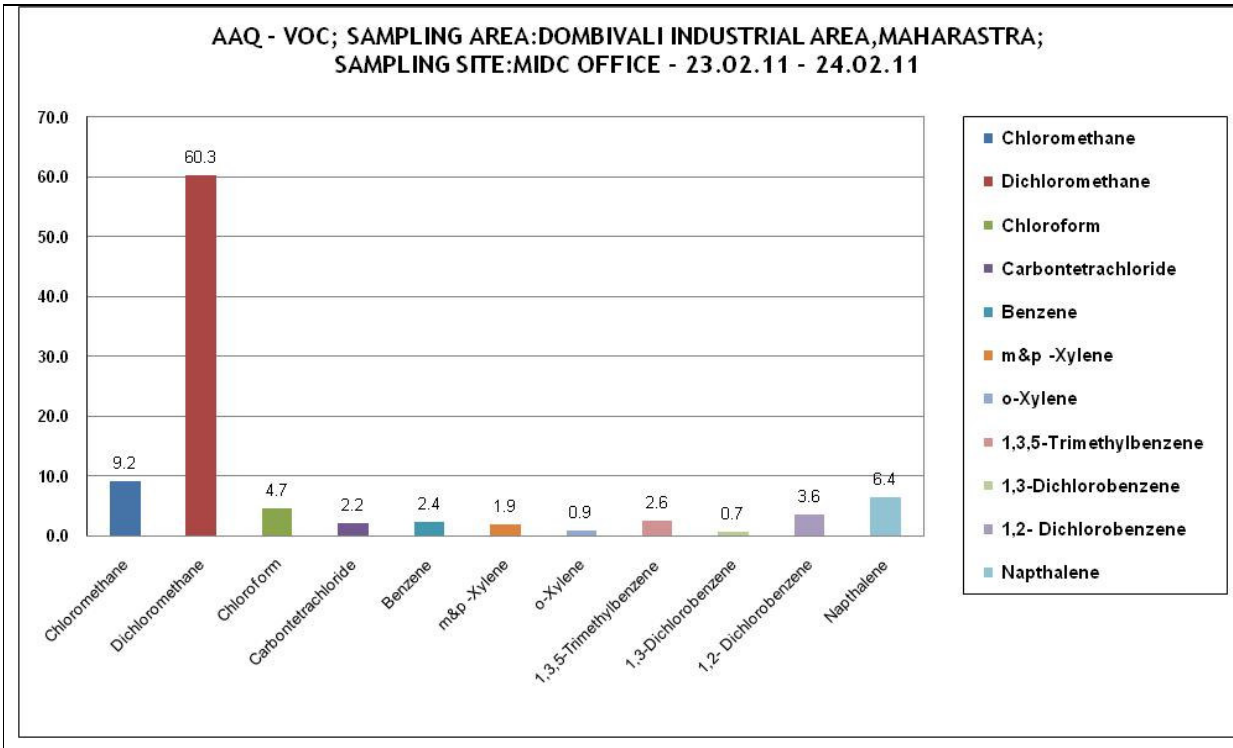
6.2.1 Results & Discussion for Ambient Air Quality Monitoring at Dombivali:-

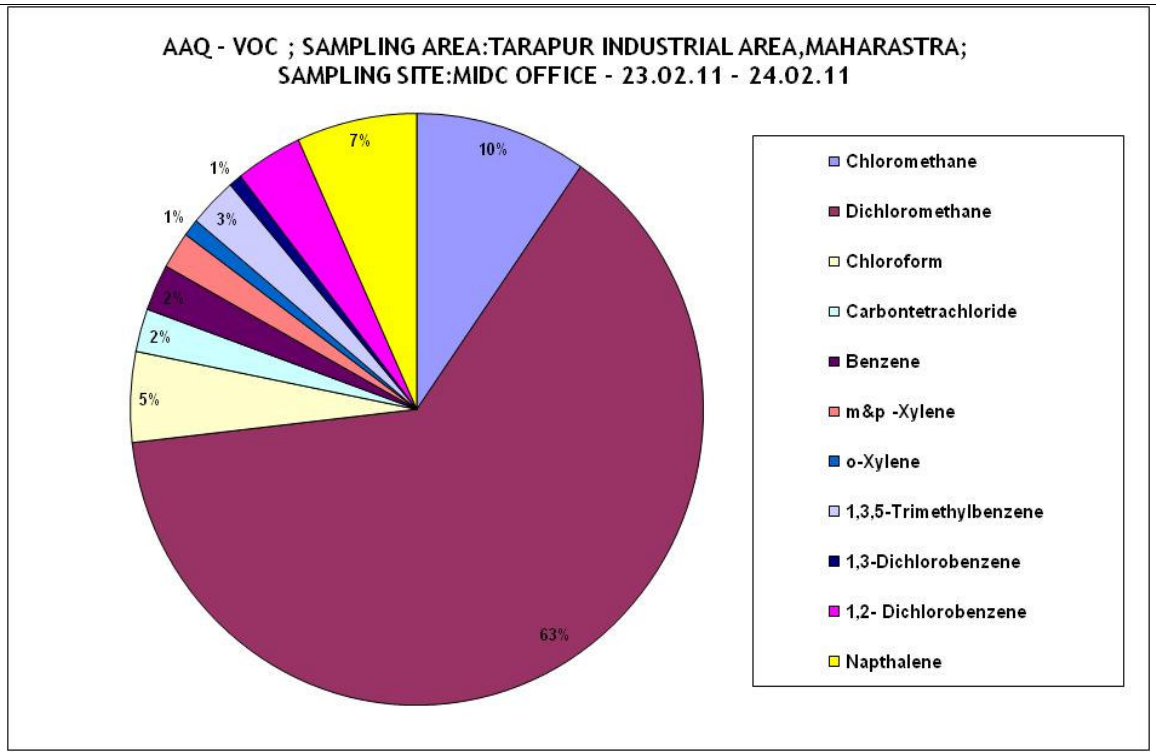
Station 1: Premises of MIDC office (at the centre of the industrial area near residential colony (towards west of the highway)

The AAQM Station-1 was identified as center of the industrial area as per the prevailing wind direction at the time of the study and 11 VOCs are detected in this location. The wind direction was South West to North East. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 70%. Approximate height from ground level is 15 feet.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: DOMBIVALI INDUSTRIAL AREA,MAHARASTRA				
	SAMPLING SITE:MIDC OFFICE - 23.02.11 TO 24.02.11				
	PARAMETERS	TIME:13:00-21:00	TIME:21:00-05:00	TIME:05:00-13:00	AVERAGE
		RESULTS (µg/m3)			
1	Chloromethane	BDL	27.6	BDL	9.2
2	Dichloromethane	BDL	180.8	BDL	60.3
3	Chloroform	3.6	BDL	10.5	4.7
4	Carbon Tetrachloride	6.7	BDL	BDL	2.2
5	Benzene	BDL	BDL	7.2	2.4
6	m&p –Xylene	3.8	BDL	2.0	1.9
7	o-Xylene	0.8	BDL	1.9	0.9
8	1,3,5-Trimethylbenzene	4.4	BDL	3.3	2.6
9	1,3-Dichlorobenzene	BDL	BDL	2.1	0.7
10	1,2- Dichlorobenzene	2.6	BDL	8.1	3.6
11	Napthalene	10.4	BDL	8.9	6.4
TOTAL VOC =		32.2	208.3	44.1	94.9

No VOC was found common in all the cycles of monitoring out of the total detected 11 VOCs. Concentration of Dichloromethane and Chloromethane was found to be highest in second cycle of monitoring, however the concentration of Benzene, Chloroform, Dichlorobenzene, Naphthalene and Carbon Tetrachloride is also found to be maximum in this location.


AAQ - VOC; SAMPLING AREA:DOMBIVALI INDUSTRIAL AREA,MAHARASTRA;
SAMPLING SITE:MIDC OFFICE - 23.02.11 - 24.02.11
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
9.2
60.3
4.7
2.2
2.4
1.9
0.9
2.6
0.7
3.6
6.4
Chloromethane
Dichloromethane
Chloroform
Carbontetrachloride
Benzene
m&p -Xylene
o-Xylene
1,3,5-Trimethylbenzene
1,3-Dichlorobenzene
1,2- Dichlorobenzene
Napthalene


AAQ - VOC ; SAMPLING AREA:TARAPUR INDUSTRIAL AREA,MAHARASTRA;
SAMPLING SITE:MIDC OFFICE - 23.02.11 - 24.02.11
10%
63%
5%
2%
2%
1%
3%
1%
7%
Chloromethane
Dichloromethane
Chloroform
Carbontetrachloride
Benzene
m&p -Xylene
o-Xylene
1,3,5-Trimethylbenzene
1,3-Dichlorobenzene
1,2- Dichlorobenzene
Napthalene

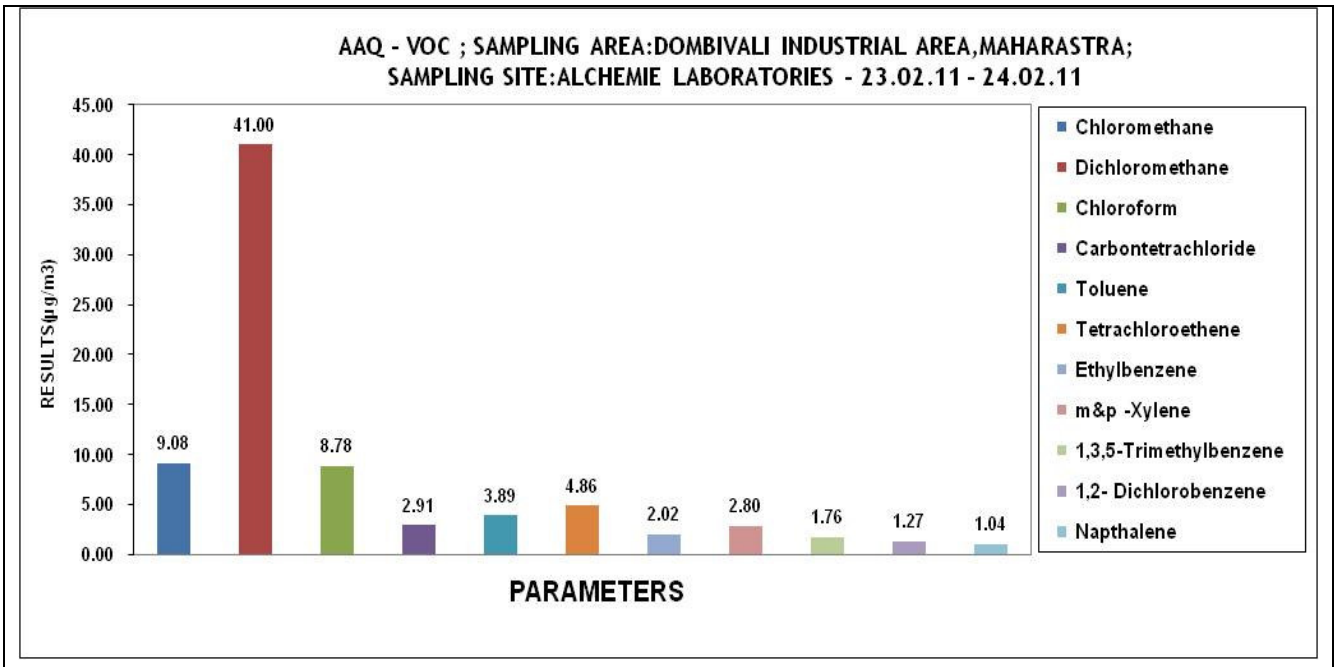
Station 2: Premises of Alchemie Laboratories [along the highway towards Kalyan (North)] Plot No. B 39, Phase I MIDC Dombivli East, which is North side of the industrial area.

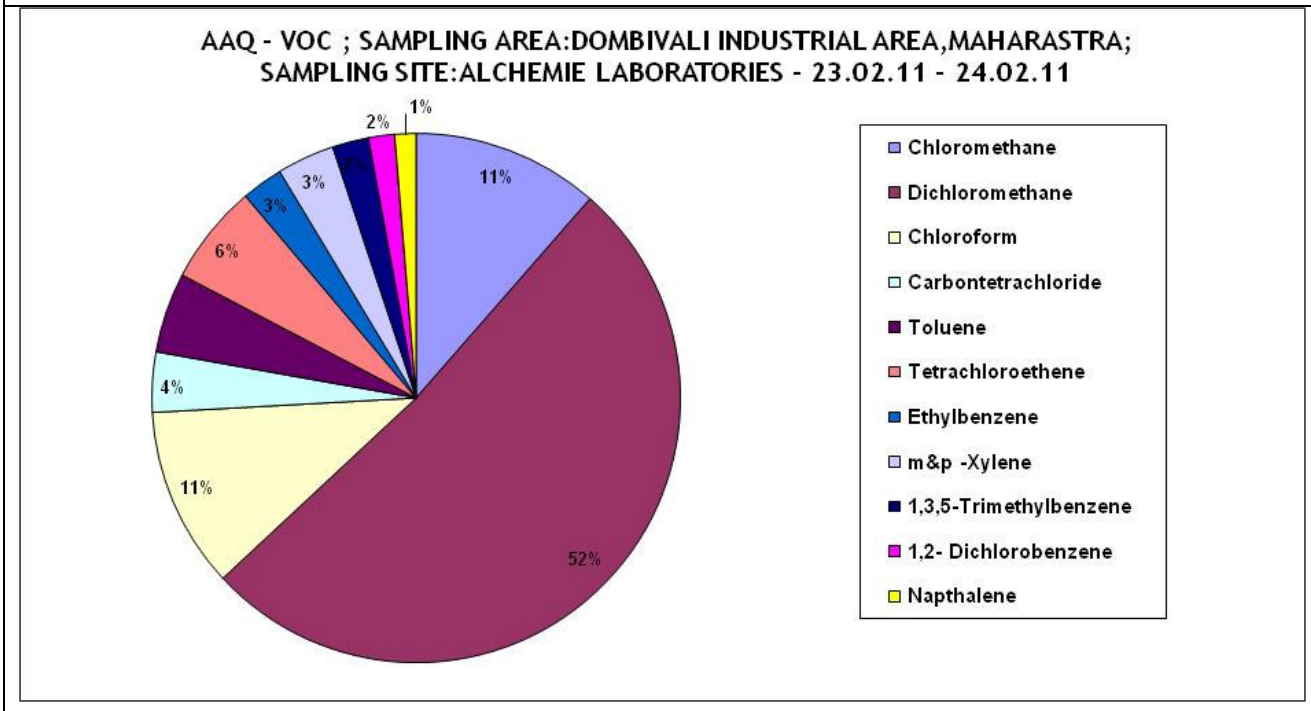
The AAQ station-2 is identified as cross-wind station as per prevailing wind direction at the time of the study and 11 VOCs are detected in this location. The wind direction was North West to South East and some time North to South. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 75%. Approximate height from ground level is 20 feet.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: DOMBIVALI INDUSTRIAL AREA,MAHARASTRA				
	SAMPLING SITE:ALCHEMIE LABORATORIES - 23.02.11 TO 24.02.11				
	PARAMETERS	TIME:13:20-21:20	TIME:21:20-05:20	TIME:05:20-13:20	AVERAGE
		RESULTS (µg/m3)			
1	Chloromethane	BDL	27.25	BDL	9.08
2	Dichloromethane	BDL	123	BDL	41.00
3	Chloroform	26.34	BDL	BDL	8.78
4	Carbontetrachloride	2.92	BDL	5.82	2.91
5	Toluene	BDL	11.67	BDL	3.89
6	Tetrachloroethene	10.04	BDL	4.54	4.86
7	Ethylbenzene	BDL	BDL	6.06	2.02
8	m&p -Xylene	4.29	BDL	4.12	2.80
9	1,3,5-Trimethylbenzene	5.27	BDL	BDL	1.76
10	1,2- Dichlorobenzene	3.81	BDL	BDL	1.27
11	Napthalene	3.11	BDL	BDL	1.04
TOTAL VOC =		55.78	161.92	20.53	79.41

Chloromethane and Dichloromethane is found maximum concentration in the second cycle in this location, chloroform is found maximum concentration in the first cycle in this location followed by Tetrachloroethane, m & p-Xylene and Carbon

Tetrachloride.


AAQ - VOC ; SAMPLING AREA:DOMBIVALI INDUSTRIAL AREA,MAHARASTRA;
SAMPLING SITE:ALCHEMIE LABORATORIES - 23.02.11 - 24.02.11
RESULTS(µg/m3)
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
9.08
41.00
8.78
2.91
3.89
4.86
2.02
2.80
1.76
1.27
1.04
PARAMETERS
Chloromethane
Dichloromethane
Chloroform
Carbontetrachloride
Toluene
Tetrachloroethene
Ethylbenzene
m&p -Xylene
1,3,5-Trimethylbenzene
1,2- Dichlorobenzene
Napthalene

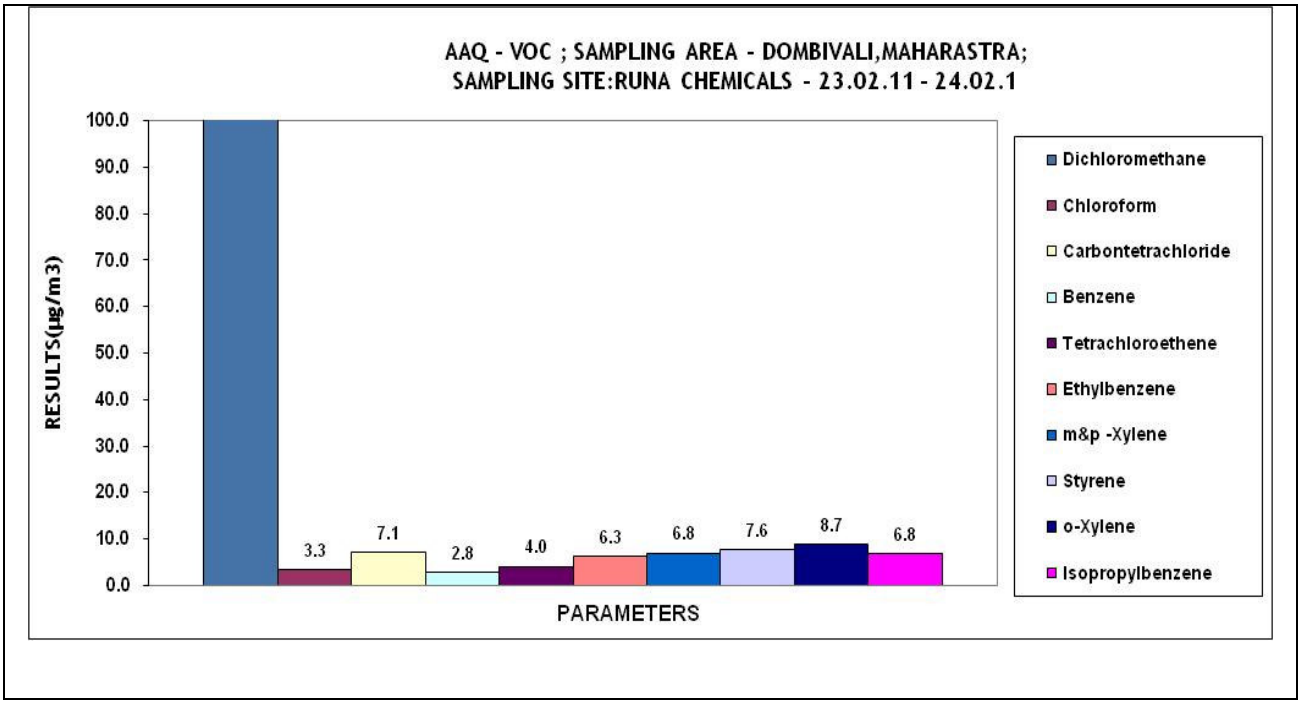

AAQ - VOC ; SAMPLING AREA:DOMBIVALI INDUSTRIAL AREA,MAHARASTRA;
SAMPLING SITE:ALCHEMIE LABORATORIES - 23.02.11 - 24.02.11
11%
52%
11%
4%
6%
3%
3%
2%
1%
Chloromethane
Dichloromethane
Chloroform
Carbontetrachloride
Toluene
Tetrachloroethene
Ethylbenzene
m&p -Xylene
1,3,5-Trimethylbenzene
1,2- Dichlorobenzene
Napthalene

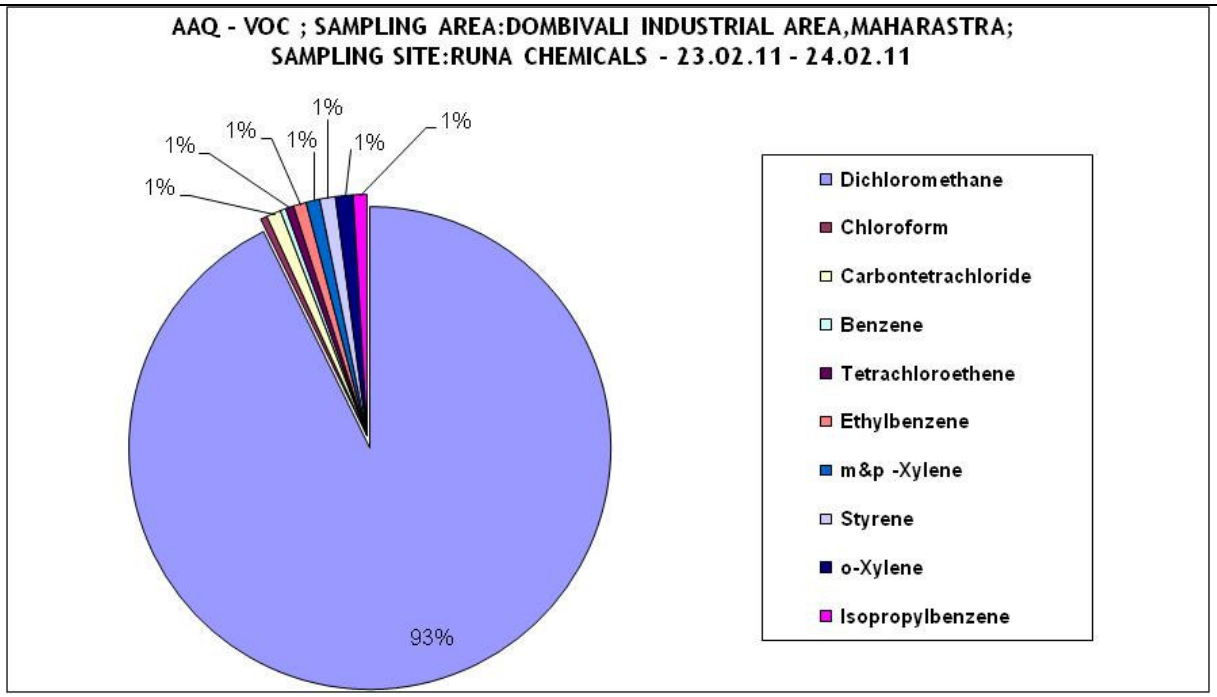
Station 3: Premises of M/s Runa Chemicals [along the highway between Phase I and Phase II of the industrial area] Plot No W 11, Phase II, MIDC Dombivli East which is East direction of industrial area.

The AAQ station-3 is identified as cross-wind station as per prevailing wind direction at the time of the study and 10 VOCs are detected in this location. The wind direction was North West to South East and some time North to South. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 75%. Approximate height from ground level is 20 feet.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: DOMBIVALI INDUSTRIAL AREA,MAHARASTRA				
	SAMPLING SITE:RUNA CHEMICALS - 23.02.11 TO 24.02.11				
	PARAMETERS	TIME:13:35-21:35	TIME:21:35-05.35	TIME:05.35-13:35	AVERAGE
		RESULTS (µg/m3)			
1	Dichloromethane	BDL	2037.0	BDL	679.0
2	Chloroform	BDL	BDL	9.9	3.3
3	Carbontetrachloride	9.7	BDL	11.5	7.1
4	Benzene	8.3	BDL	BDL	2.8
5	Tetrachloroethene	8.0	BDL	4.0	4.0
6	Ethylbenzene	15.5	BDL	3.3	6.3
7	m&p -Xylene	12.7	BDL	7.8	6.8
8	Styrene	22.9	BDL	BDL	7.6
9	o-Xylene	19.2	BDL	6.9	8.7
10	Isopropylbenzene	16.8	BDL	3.5	6.8
TOTAL VOC =		113.2	2037.0	46.9	732.4

10 VOCs are found in this location in which Dichloromethane is found maximum concentration in the second cycle of the study followed by Ethyl benzene, m&p-Xylene, Styrene and o-Xylene out of 10 detected VOCs.





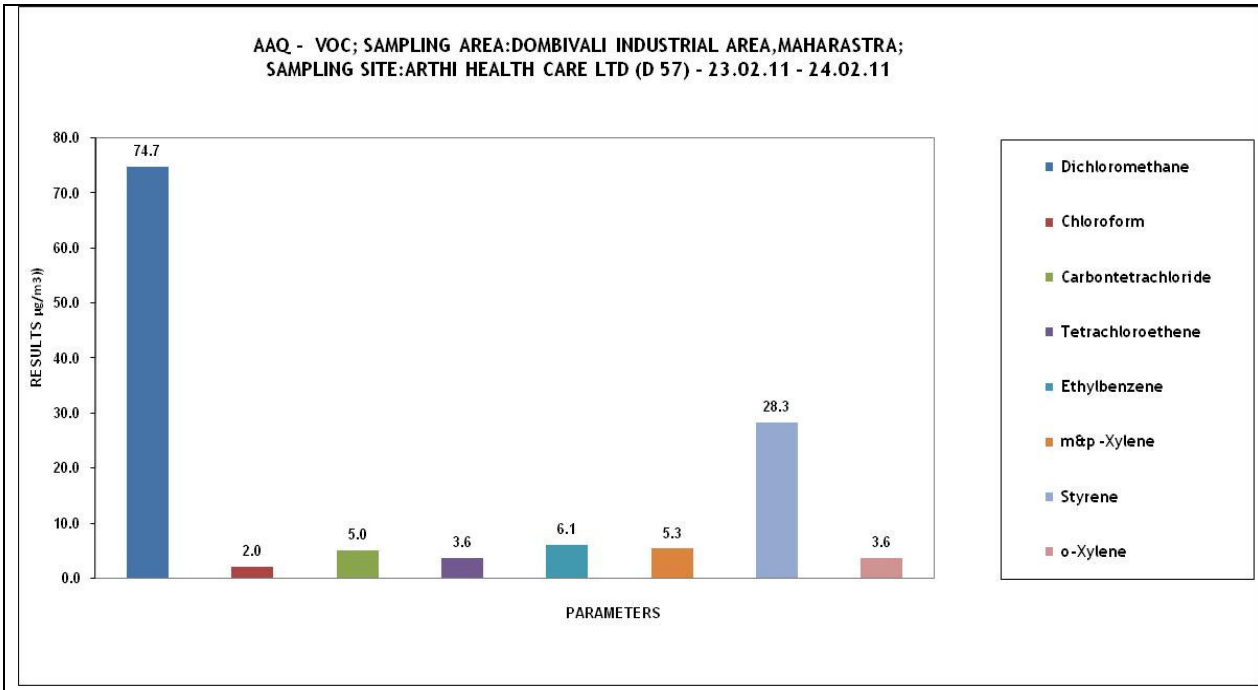
Station 4: Premises of M/s Aarti Industries [along the highway towards Shil Phata road (South), Plot No D 57, Phase II, MIDC Dombivili East which is in the North East direction of industrial area.

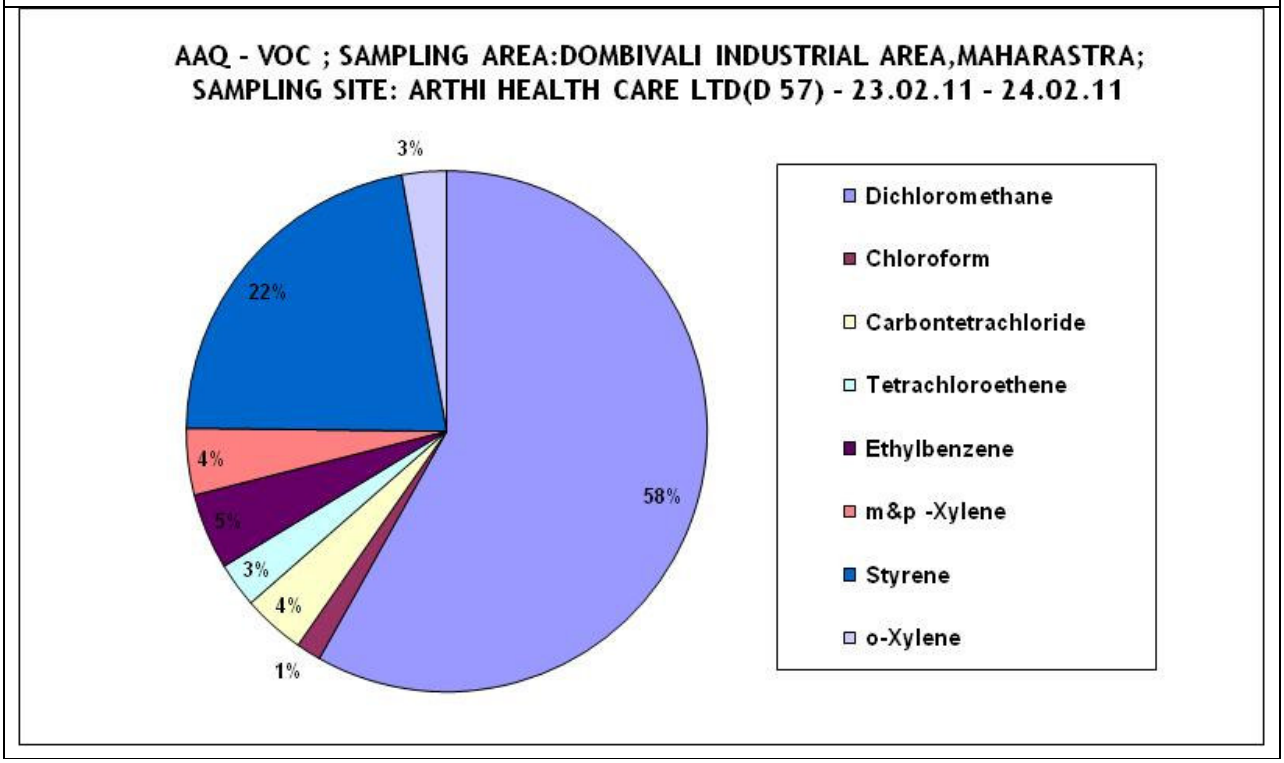
The AAQ station-4 is identified as down-wind station as per prevailing wind direction at the time of the study and 8 VOCs are detected in this location. The wind direction was North West to South East and some time North to South. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 75%. Approximate height from ground level is 20 feet.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: DOMBIVALI INDUSTRIAL AREA,MAHARASTRA				
	SAMPLING SITE:ARTHI HEALTH CARE LTD(D 57) - 23.02.11 TO 24.02.11				
	PARAMETERS	TIME:14:20-22:20	TIME:22:20-06:20	TIME:06:20-14:20	AVERAGE

		RESULTS (µg/m3)			
1	Dichloromethane	BDL	224.1	BDL	74.7
2	Chloroform	BDL	BDL	5.9	2.0
3	Carbontetrachloride	7.7	BDL	7.2	5.0
4	Tetrachloroethene	7.7	BDL	3.0	3.6
5	Ethylbenzene	15.3	BDL	2.9	6.1
6	m&p –Xylene	9.3	BDL	6.7	5.3
7	Styrene	33.1	BDL	51.9	28.3
8	o-Xylene	7.2	BDL	3.4	3.6
TOTAL VOC =		**80.3**	**224.1**	**81.1**	**128.5**

8 VOCs are found in this location in which Dichloromethane and Styrene is detected with maximum concentration out of 8 detected VOCs.


AAQ - VOC; SAMPLING AREA:DOMBIVALI INDUSTRIAL AREA,MAHARASTRA;
SAMPLING SITE:ARTHI HEALTH CARE LTD (D 57) - 23.02.11 - 24.02.11
RESULTS µg/m3))
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
74.7
2.0
5.0
3.6
6.1
5.3
28.3
3.6
PARAMETERS
Dichloromethane
Chloroform
Carbontetrachloride
Tetrachloroethene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene

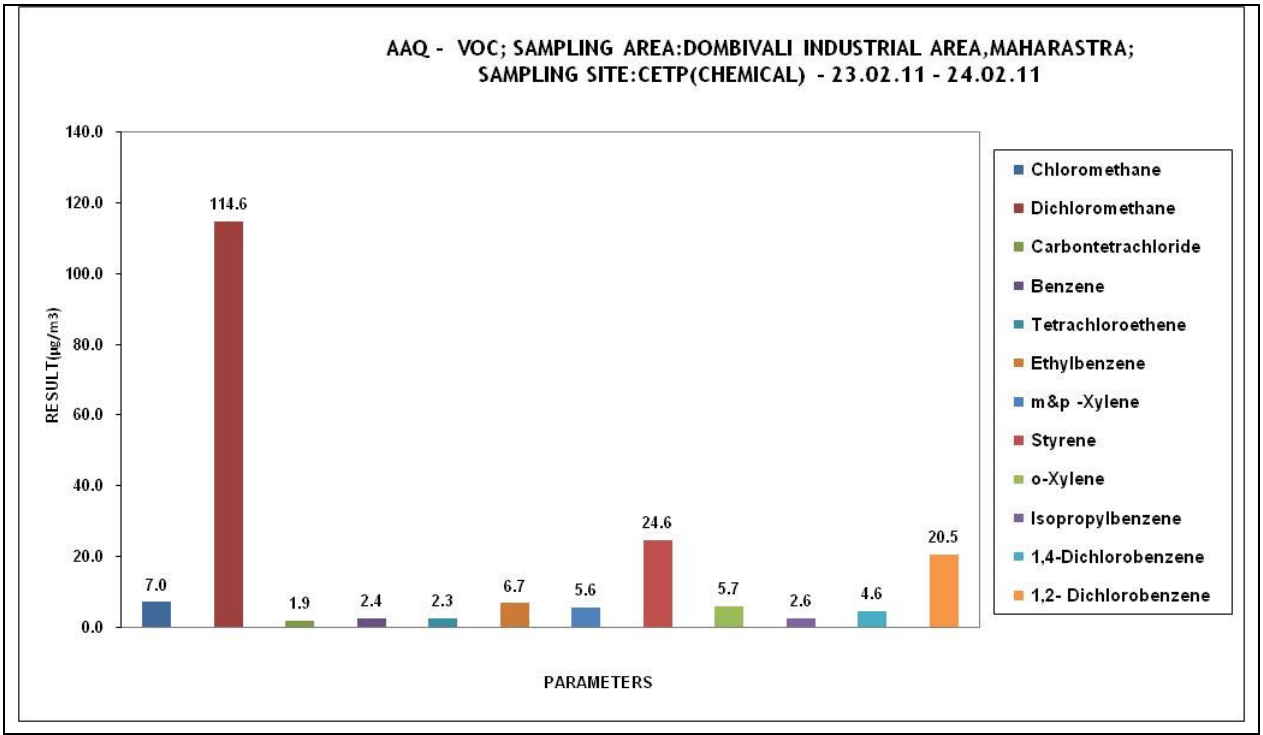

AAQ - VOC ; SAMPLING AREA:DOMBIVALI INDUSTRIAL AREA,MAHARASTRA;
SAMPLING SITE: ARTHI HEALTH CARE LTD(D 57) - 23.02.11 - 24.02.11
3%
22%
4%
5%
3%
4%
1%
58%
Dichloromethane
Chloroform
Carbontetrachloride
Tetrachloroethene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene

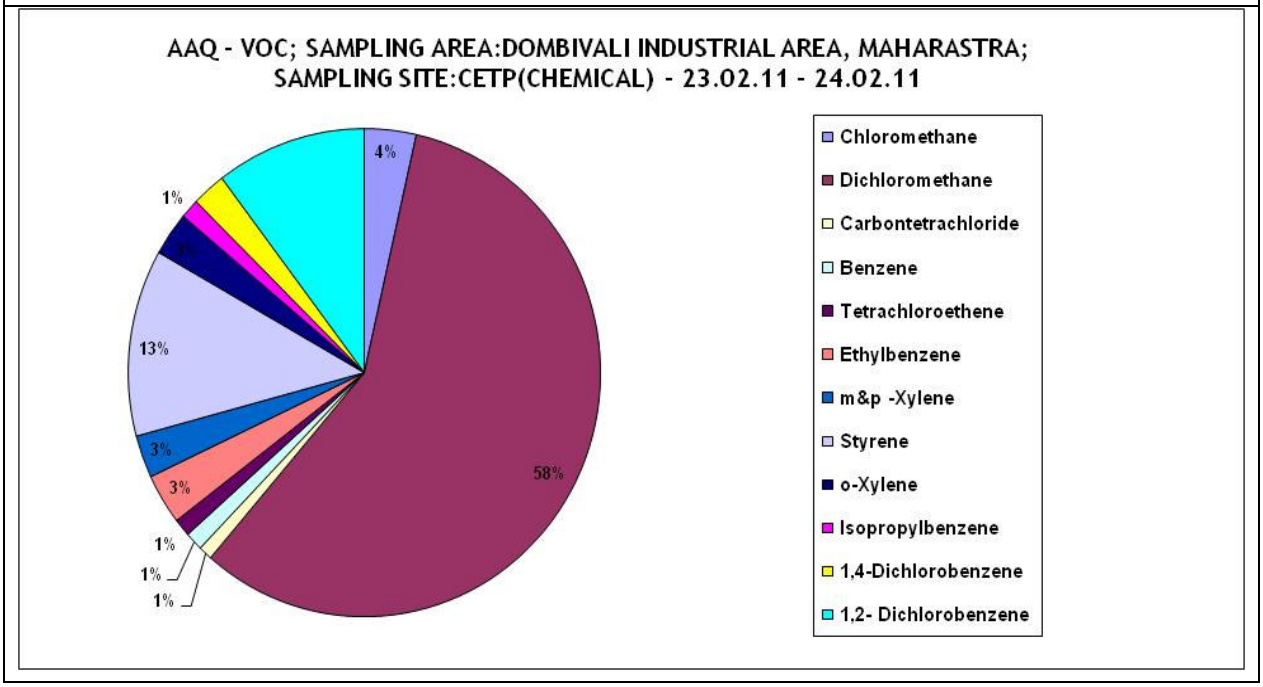
Station 5: Premises of M/s CETP in Phase II (South West of the industrial area) MIDC Dombivili East and which is in the South West direction of industrial area.

The AAQ station-5 is identified as up-wind station as per prevailing wind direction at the time of the study and 12 VOCs are detected in this location. The wind direction was North West to South East and some time North to South. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 75%. Approximate height from ground level is 15 feet.

S.No	AMBIENT AIR QUALITY – VOC				
	SAMPLING AREA: DOMBIVALI INDUSTRIAL AREA,MAHARASTRA				
	SAMPLING SITE:CETP (CHEMICAL) - 23.02.11 TO 24.02.11				
	PARAMETERS	TIME:14:45-22:45	TIME:22:45-06:45	TIME:06:45-14:45	AVERAGE
		RESULTS (µg/m3)			
1	Chloromethane	BDL	21.1	BDL	7.0
2	Dichloromethane	BDL	343.7	BDL	114.6
3	Carbontetrachloride	4.0	BDL	1.6	1.9
4	Benzene	BDL	7.3	BDL	2.4
5	Tetrachloroethene	3.3	BDL	3.7	2.3
6	Ethylbenzene	12.9	BDL	7.1	6.7
7	m&p -Xylene	5.6	BDL	11.2	5.6
8	Styrene	54.1	BDL	19.6	24.6
9	o-Xylene	7.7	BDL	9.4	5.7
10	Isopropylbenzene	4.1	BDL	3.6	2.6
11	1,4-Dichlorobenzene	BDL	BDL	13.7	4.6
12	1,2- Dichlorobenzene	BDL	BDL	61.4	20.5
TOTAL VOC =		91.8	372.0	131.3	198.4

12 VOCs are found in this location in which Dichloromethane, Dichlrobenzene and Styrene is detected with maximum concentration out of 12 detected VOCs.





AMBIENT AIR QUALITY MONITORING ANALYSIS REPORT: DOMBIVALI

(23/02/11 - 24/02/11)

24 hours' average concentration of total VOCs at each location with average of each cycle is depicted in following Table for the ease of comparison.

Station No	Sampling Locations	TVOCs Concentrations (micro gram / cubic meters)		
1	Premises of MIDC Office **(23/02/11 - 24/02/11)**	32.2 (13:00 Hrs - 21:00Hrs)	208.3 (21:00 Hrs - 05:00 Hrs)	44.1 (05:00 Hrs - 13:00Hrs)
		Average Concentration : 94.9		
2	Premises of M/s. Alchemie Laboratories Ltd., **(23/02/11 - 24/02/11)**	55.8 (13:20 Hrs - 21:20Hrs)	161.9 (21:20 Hrs - 05:20 Hrs)	20.5 (05:20 Hrs - 13:20Hrs)
		Average Concentration : 79.4		
3	Premises of M/s Runa Chemicals Ltd., **(23/02/11 - 24/02/11)**	113.2 (13:35 Hrs - 21:35Hrs)	2037.0 (21:35 Hrs - 05:35 Hrs)	46.9 (05:35 Hrs - 13:35Hrs)
		Average Concentration : 732.4		
4	Premises of M/s. Aarthi Health Care Ltd., **(23/02/11 - 24/02/11)**	80.3 (14:20 Hrs - 22:20Hrs)	224.1 (22:20 Hrs - 06:20Hrs)	81.1 (06:20 Hrs - 14:20Hrs)
		Average Concentration : 128.5		
5	Premises of CETP **(23/02/11 - 24/02/11)**	91.8 (14:45 Hrs - 22:45Hrs)	372.0 (22:45 Hrs - 06:45Hrs)	131.3 (06:45 Hrs - 14:45Hrs)
		Average Concentration : 198.4		

A A Q M Station in Down wind direction	:	Station-4
A A Q M Station in Cross wind direction	:	Station-2 & 3
A A Q M Station in Up wind direction	:	Station-5
A A Q M Station in center of Industrial Area	:	Station-1

Land Use Classification	Industrial Zone
Sky Conditions	Sunny Sky
Ambient Temperature	22°C to 32°C
Predominant Wind Directions	South West to North East

Sampling and Analysis Methodology Adopted: EPA TO-17

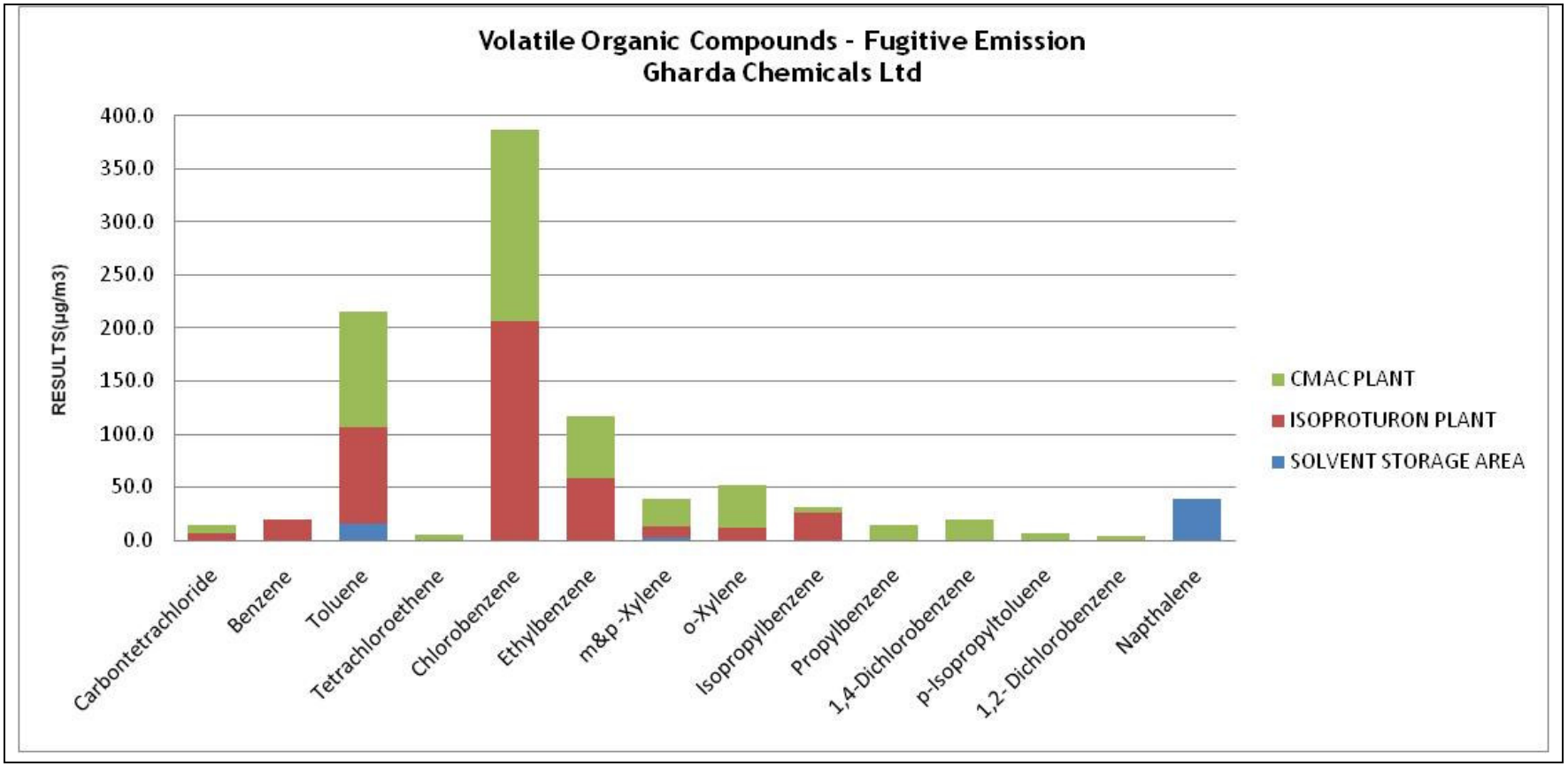
Change in the concentration of VOCs observed in each cycle of the entire 24 hours monitoring at almost all stations. That may due to the change in batch process steps of the industries, weekly shutdown, and maintenance/repair in the plants/storages/machineries could be the probable causes of the same. Dichloromethane, Chloromethane, Chloroform, Carbon Tetrachloride, Tetrachloroethane, Xylene, Dichlorobenzene and Styrene are having pre-dominant presence among other VOCs at these locations.

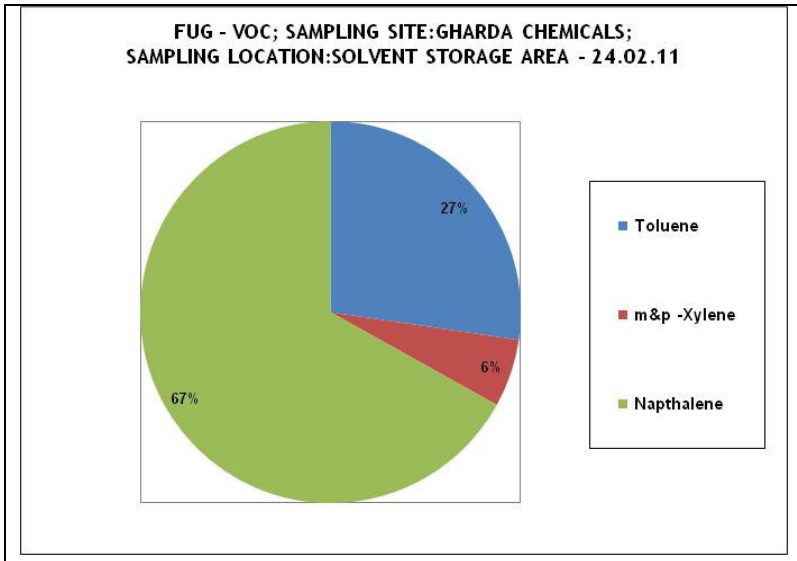
6.3 Result of Monitoring at Industries:

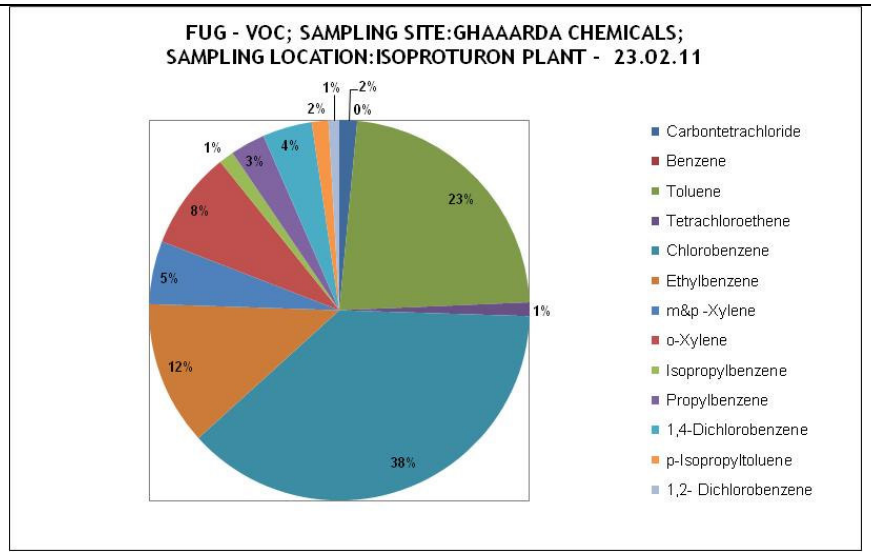
6.3.1 M/s Gharda Chemicals Ltd.,

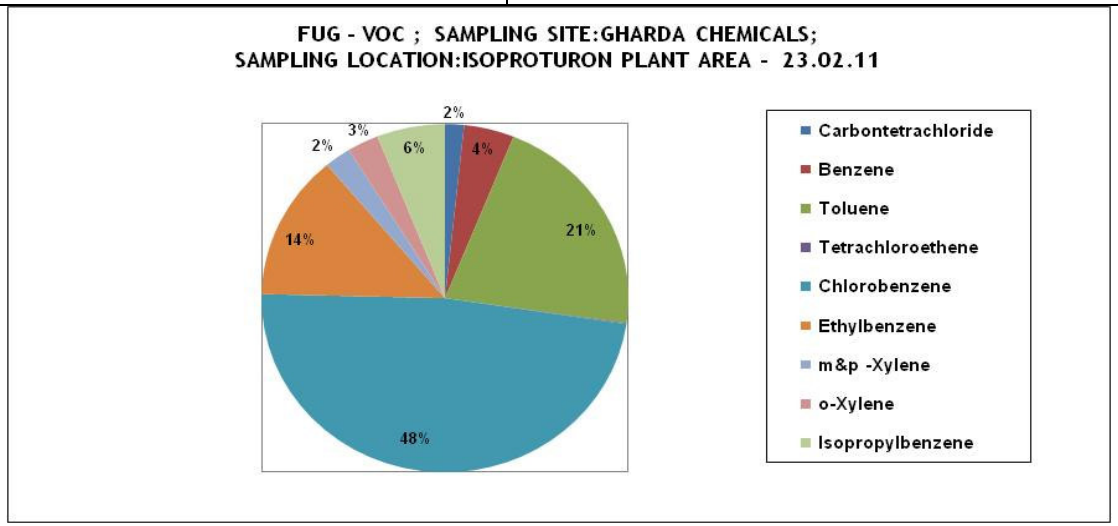
Samples of fugitive emissions and wastewater were collected from the unit and analyzed for VOCs. The concentration of TVOCs in fugitive emission monitoring sample was found to be in the range of 57.4 to 479.6µg/m^3. The highest concentration was found at the location near CMAC plant area followed by Solvent storage and Isoproturon plant area. ETP where evaporation from effluent streams takes place at higher rates especially in aeration of the effluent.

S.No	FUGITIVE EMISSION – VOC [RESULTS µg/m3]			
	SAMPLING AREA: DOMBIVILI,MAHARASTRA			
	SAMPLING SITE:GHARDA CHEMICALS; DATE:23.02.11 - 24.02.11			
	PARAMEATERS	SOLVENT STORAGE AREA	ISOPROTURON PLANT	CMAC PLANT
1	Carbontetrachloride	BDL	7.1	7.2
2	Benzene	BDL	19.0	BDL
3	Toluene	15.7	90.9	109.5
4	Tetrachloroethene	BDL	0.3	5.6
5	Chlorobenzene	BDL	205.9	181.3
6	Ethylbenzene	BDL	57.9	58.6
7	m&p -Xylene	3.3	10.1	25.7
8	o-Xylene	BDL	11.8	40.0
9	Isopropylbenzene	BDL	25.8	6.0
10	Propylbenzene	BDL	BDL	14.2
11	1,4-Dichlorobenzene	BDL	BDL	20.2
12	p-Isopropyltoluene	BDL	BDL	6.8
13	1,2- Dichlorobenzene	BDL	BDL	4.4
14	Napthalene	38.4	BDL	BDL
TOTAL VOC =		57.4	428.9	479.6


Volatile Organic Compounds - Fugitive Emission
Gharda Chemicals Ltd
RESULTS(µg/m3)
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene
Propylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2- Dichlorobenzene
Napthalene
CMAC PLANT
ISOPROTURON PLANT
SOLVENT STORAGE AREA


FUG - VOC; SAMPLING SITE:GHARDA CHEMICALS;
SAMPLING LOCATION:SOLVENT STORAGE AREA - 24.02.11
27%
6%
67%
Toluene
m&p -Xylene
Napthalene

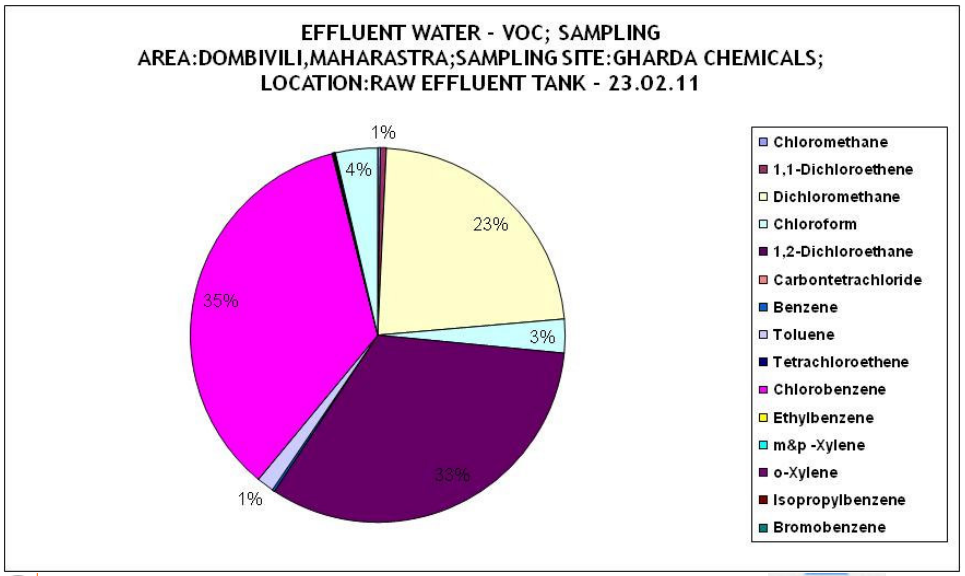

FUG - VOC; SAMPLING SITE:GHAARDA CHEMICALS;
SAMPLING LOCATION:ISOPROTURON PLANT - 23.02.11
1%
2%
2%
0%
1%
3%
4%
23%
8%
5%
1%
12%
38%
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene
Propylbenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2- Dichlorobenzene


FUG - VOC ; SAMPLING SITE:GHARDA CHEMICALS;
SAMPLING LOCATION:ISOPROTURON PLANT AREA - 23.02.11
2%
3%
2%
6%
4%
21%
14%
48%
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Isopropylbenzene

6.3.2 EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from Raw effluent collection tank of ETP was found to be 5193.9 µg/l. The higher concentration may be due to improper separation of intermediate/solvents/products at different process stages, which also affects the treatment efficiency of the ETP.

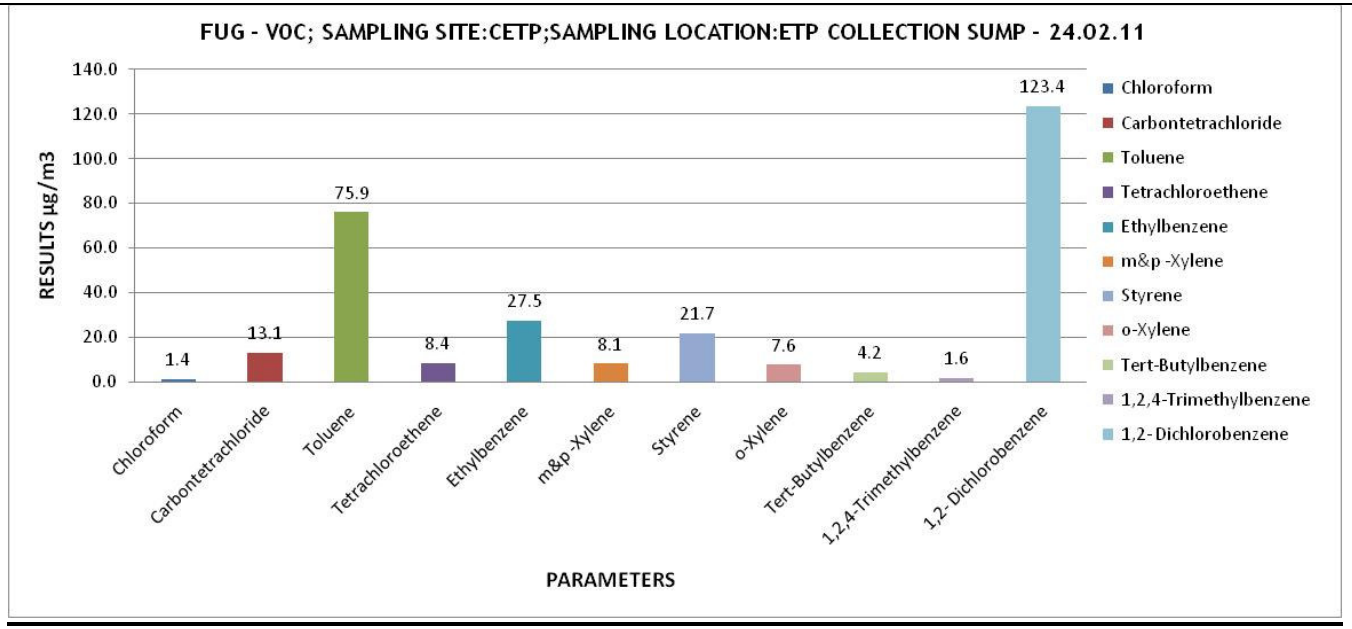
S.NO	EFFLUENT WATER -VOC SAMPLING SITE:GHARDA CHEMICALS;SAMPLING AREA:DOMBIVILI LOCATION:RAW EFFLUENT TANK ; DATE:23.02.2011 PARAMETERS	SAMPLE(µg/l)
1	Chloromethane	11.9
3	1,1-Dichloroethene	26.3
4	Dichloromethane	1188.6
5	Chloroform	151.3
6	1,2-Dichloroethane	1702.9
7	Carbontetrachloride	0.3
8	Benzene	11.1
9	Toluene	76.9
10	Tetrachloroethene	0.6
11	Chlorobenzene	1820.0
12	Ethylbenzene	1.6
13	m&p -Xylene	0.5
14	o-Xylene	2.8
15	Isopropylbenzene	3.5
16	Bromobenzene	3.3
17	1,2,4-Trimethylbenzene	2.2
18	Sec-Butylbenzene	1.4
19	1,2- Dichlorobenzene	189.0
TOTAL VOC		**5193.9**

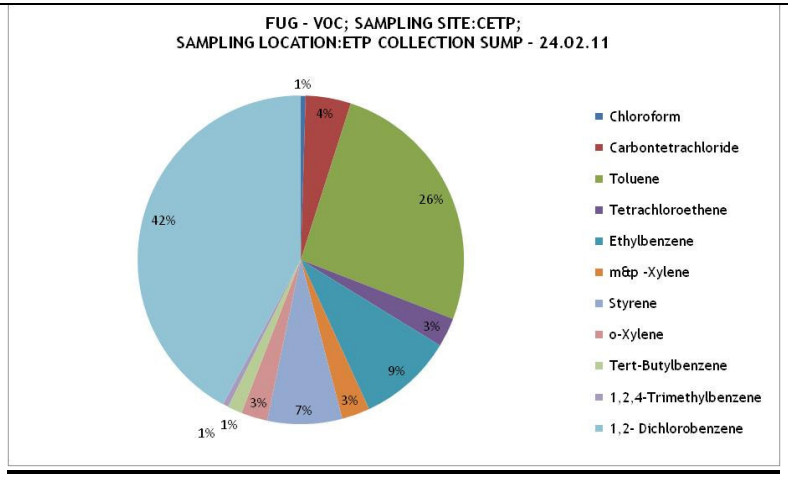


6.3.3 M/s. Common Effluent Treatment Plant

Sample of fugitive emissions was collected from the unit and analysed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be 293.1µg/m^3 near collection sump area in which Toluene, Ethyl Benzene and Styrene is found to higher concentration compared to other VOCs. The unit is collecting continuously the industrial effluent for further treatment and disposal. The concentration of these VOCs may vary depends on the influent load condition.

S.No	FUGITIVE EMISSION – VOC	
	SAMPLING AREA:DOMBIVILI,MAHARASTRA	
	SAMPLING SITE:CETP ; DATE:22.02.11	
	PARAMETERS	ETP COLLECTION SUMP
1	Chloroform	1.4
2	Carbontetrachloride	13.1
3	Toluene	75.9
4	Tetrachloroethene	8.4
5	Ethylbenzene	27.5
6	m&p -Xylene	8.1
7	Styrene	21.7
8	o-Xylene	7.6
9	Tert-Butylbenzene	4.2
10	1,2,4-Trimethylbenzene	1.6
12	1,2- Dichlorobenzene	123.4
TOTAL VOC =		**293.1**

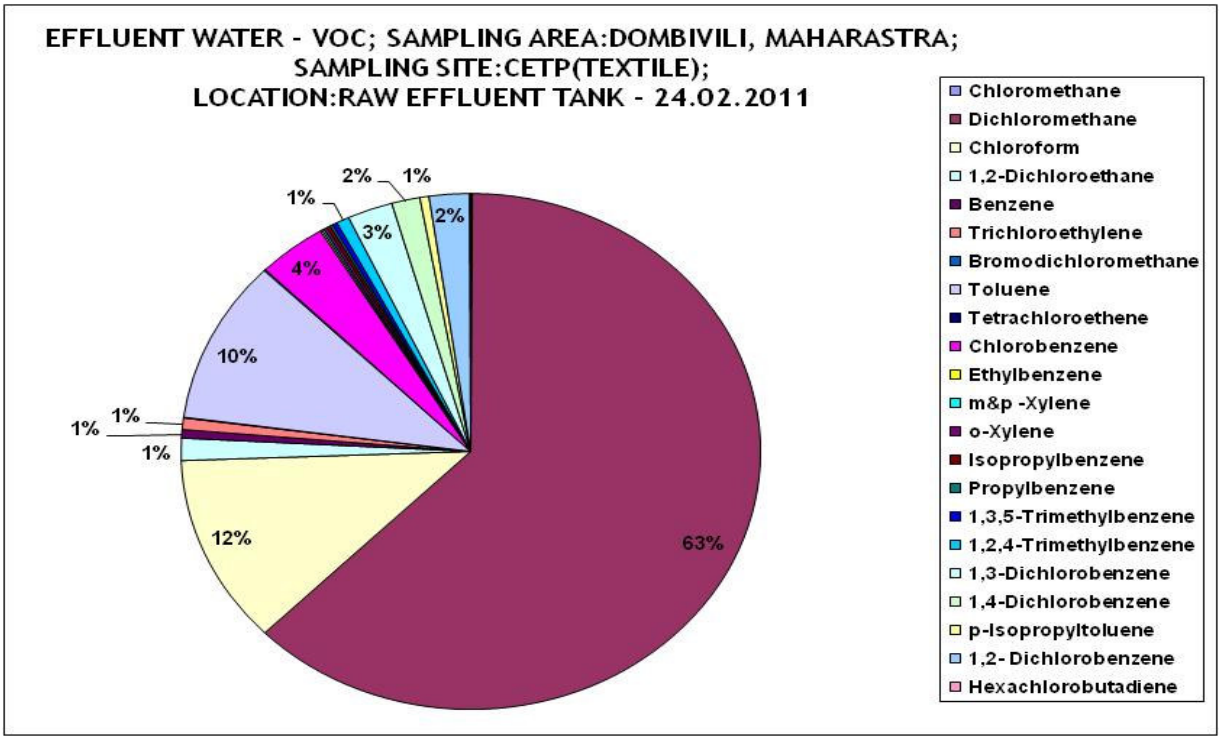

FUG - VOC; SAMPLING SITE:CETP;SAMPLING LOCATION:ETP COLLECTION SUMP - 24.02.11
RESULTS µg/m3
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
1.4
13.1
75.9
8.4
27.5
8.1
21.7
7.6
4.2
1.6
123.4
Chloroform
Carbontetrachloride
Toluene
Tetrachloroethene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,2- Dichlorobenzene
PARAMETERS


FUG - VOC; SAMPLING SITE:CETP;
SAMPLING LOCATION:ETP COLLECTION SUMP - 24.02.11
1%
4%
26%
3%
9%
3%
7%
3%
1%
1%
42%
Chloroform
Carbontetrachloride
Toluene
Tetrachloroethene
Ethylbenzene
m&p -Xylene
Styrene
o-Xylene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
1,2- Dichlorobenzene

6.3.4 EFFLUENT SAMPLE ANALYSIS:

The concentration of VOCs in effluent sample taken from collection tank of CETP was found to be 7529.6µg/l. comparatively it shows around 25 VOCs are present in the effluent with higher concentrations and it may vary from influent flow and characteristics.

S.NO	EFFLUENT WATER -VOC (2110011950)	
	SAMPLING SITE:CETP (TEXTILE);SAMPLING AREA:DOMBIVILI	
	LOCATION:RAW EFFLUENT TANK ; DATE:24.02.2011	
	PARAMETERS	SAMPLE(µg/l)
1	Chloromethane	6.6
3	Dichloromethane	4706.5
4	Chloroform	891.6
5	1,2-Dichloroethane	104.8
6	Benzene	39.8
7	Trichloroethylene	54.4
8	Bromodichloromethane	3.4
9	Toluene	771.6
10	Tetrachloroethene	6.5
12	Chlorobenzene	290.3
13	Ethylbenzene	8.4
14	m&p -Xylene	8.8
15	o-Xylene	14.5
16	Isopropylbenzene	14.8
17	Propylbenzene	11.6
18	1,3,5-Trimethylbenzene	20.0
19	1,2,4-Trimethylbenzene	54.3
20	1,3-Dichlorobenzene	190.9
21	1,4-Dichlorobenzene	118.6
23	p-Isopropyltoluene	38.3
24	1,2- Dichlorobenzene	169.5
25	Hexachlorobutadiene	4.5
TOTAL VOC		**7529.6**



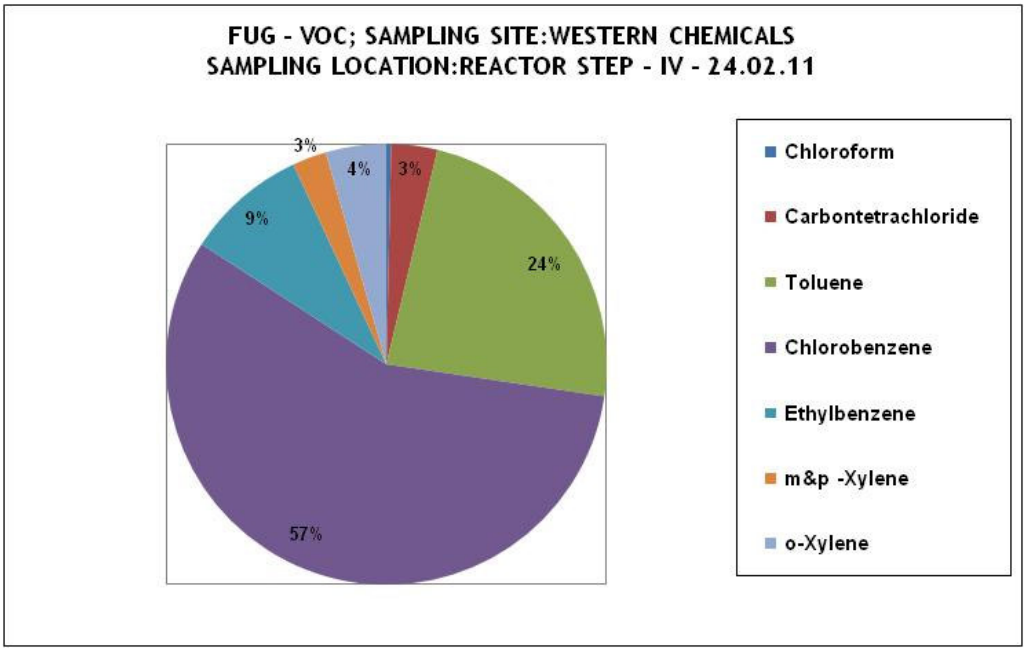
S.NO	EFFLUENT WATER -VOC (2110011953)	
	SAMPLING SITE:CETP(CHEMICALS);SAMPLING AREA:DOMBIVILI	
	LOCATION:RAW EFFLUENT TANK ; DATE:24.02.2011	
	PARAMETERS	SAMPLE(µg/l)
1	Chloromethane	7.7
2	Dichloromethane	3089.9
3	Chloroform	130.9
4	1,2-Dichloroethane	40.1
5	Carbontetrachloride	0.7
6	Benzene	4.6
7	Trichloroethylene	0.9
8	Toluene	500.2
9	Tetrachloroethene	0.6
10	Chlorobenzene	16.7
11	Ethylbenzene	1.8
12	m&p -Xylene	0.7
13	o-Xylene	2.0
14	2-Chlorotoluene	0.2
15	1,3-Dichlorobenzene	3.5
16	1,4-Dichlorobenzene	4.2
17	p-Isopropyltoluene	0.9
18	1,2- Dichlorobenzene	274.2

TOTAL VOC	**4079.9**

6.3.5 M/s Western Chemicals Ltd.,

Samples of fugitive emissions and wastewater were collected from the unit and analyzed for VOCs. The concentration of TVOCs in fugitive emission monitoring sample was found to be 327µg/m^3. Chlorobenzene and Toluene concentration was found maximum at this location when compared to other detected VOCs.

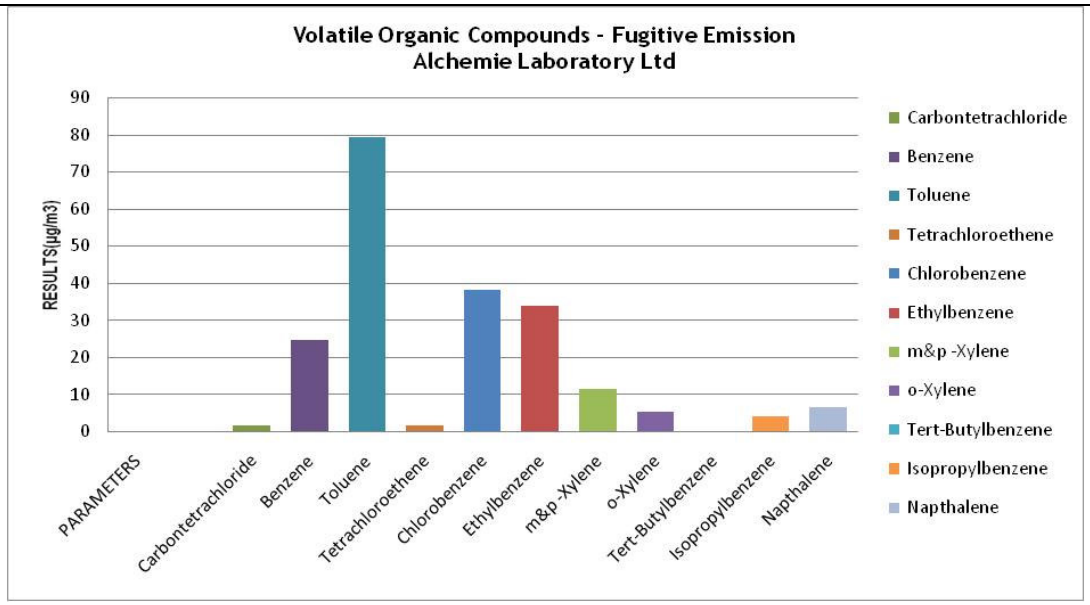
S.No	FUGITIVE EMISSION - VOC SAMPLING AREA:DOMBIVILI,MAHARASTRA SAMPLING SITE:WESTERN CHEMICALS; DATE:22.02.11	
	PARAMETERS	**REACTOR STEP - IV**
1	Chloroform	1.2
2	Carbontetrachloride	11.0
3	Toluene	77.2
4	Chlorobenzene	185.8
5	Ethylbenzene	29.1
6	m&p -Xylene	8.2
7	o-Xylene	14.5
TOTAL VOC =		**327.0**

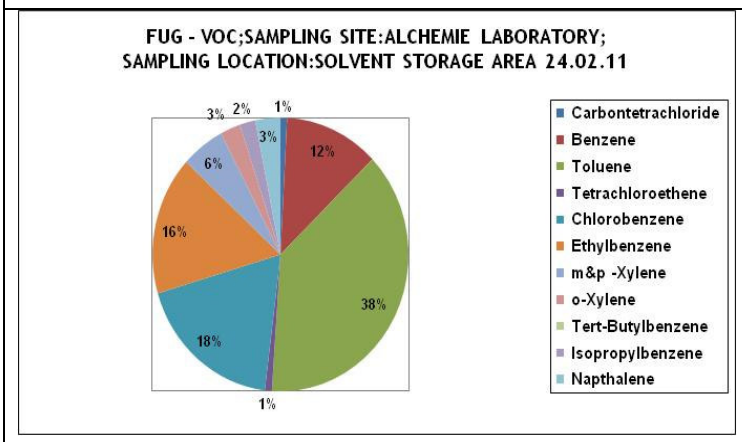


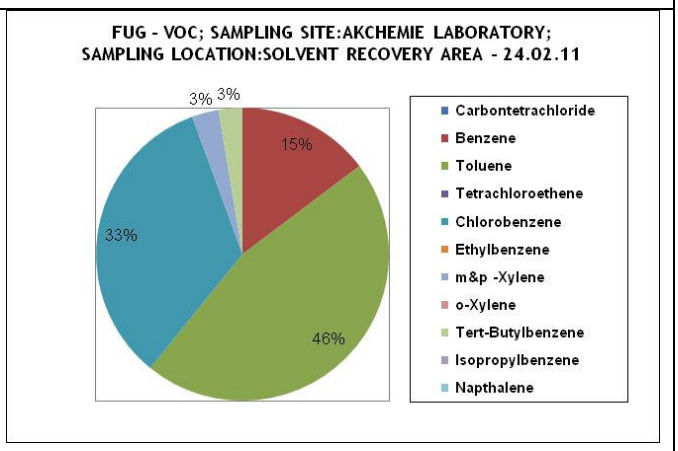
6.3.6 M/s Alchemie Laboratories Ltd.,

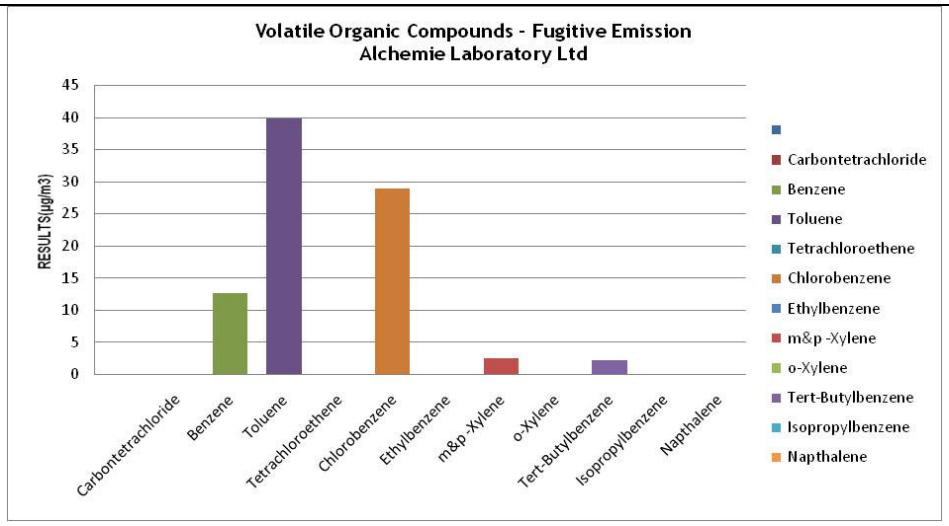
Samples of fugitive emissions and wastewater were collected from the unit and analyzed for VOCs. The concentration of TVOCs in fugitive emission monitoring sample was found to be in the range of 86.2 to 207.1µg/m^3. The highest concentration was found at the location near Solvent storage area followed by Solvent recovery area. ETP where evaporation from effluent streams takes place at higher rates especially in aeration of the effluent.

S.No	FUGITIVE EMISSION - VOC		
	SAMPLING AREA: DOMBIVILI,MAHARASTRA		
	SAMPLING SITE:ALCHEMIE LABORATORY; DATE:24.02.11		
	PARAMETERS	SOLVENT STORAGE AREA	SOLVENT RECOVERY AREA
1	Carbontetrachloride	1.7	BDL
2	Benzene	24.6	12.7
3	Toluene	79.5	39.8
4	Tetrachloroethene	1.8	BDL
5	Chlorobenzene	38.2	29.0
6	Ethylbenzene	34.1	BDL
7	m&p -Xylene	11.4	2.5
8	o-Xylene	5.2	BDL
9	Tert-Butylbenzene	BDL	2.3
10	Isopropylbenzene	4.1	BDL
11	Napthalene	6.5	BDL
TOTAL VOC =		**207.1**	**86.2**


Volatile Organic Compounds - Fugitive Emission
Alchemie Laboratory Ltd
RESULTS(µg/m3)
90
80
70
60
50
40
30
20
10
0
PARAMETERS
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Tert-Butylbenzene
Isopropylbenzene
Napthalene


FUG - VOC;SAMPLING SITE:ALCHEMIE LABORATORY;
SAMPLING LOCATION:SOLVENT STORAGE AREA 24.02.11
12%
38%
1%
18%
16%
6%
3%
2%
3%
1%
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Tert-Butylbenzene
Isopropylbenzene
Napthalene

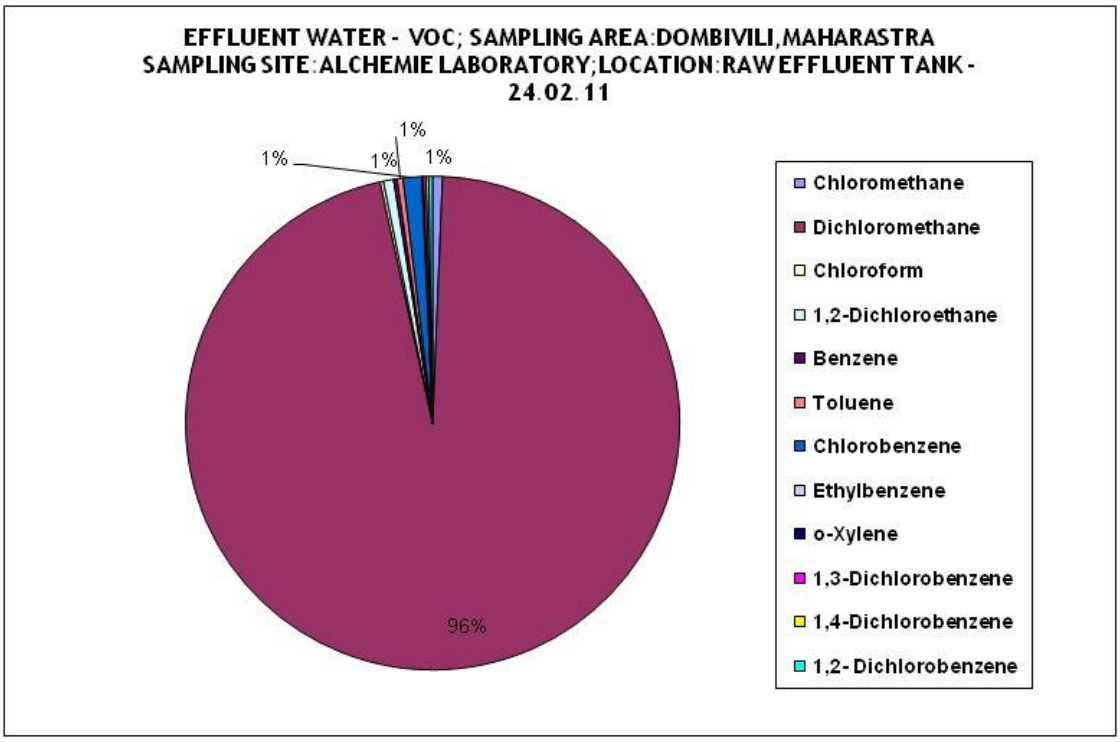

FUG - VOC; SAMPLING SITE:AKCHEMIE LABORATORY;
SAMPLING LOCATION:SOLVENT RECOVERY AREA - 24.02.11
15%
46%
33%
3%
3%
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Tert-Butylbenzene
Isopropylbenzene
Napthalene


Volatile Organic Compounds - Fugitive Emission
Alchemie Laboratory Ltd
RESULTS(µg/m3)
45
40
35
30
25
20
15
10
5
0
Carbontetrachloride
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
Tert-Butylbenzene
Isopropylbenzene
Napthalene

6.3.7 EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from raw effluent collection tank of ETP was found to be 1395.7 µg/l. Dichloromethane was found to maximum concentration in this sample. The higher concentration may be due to improper separation of intermediate/solvents/products at different process stages, which also affects the treatment efficiency of the ETP.

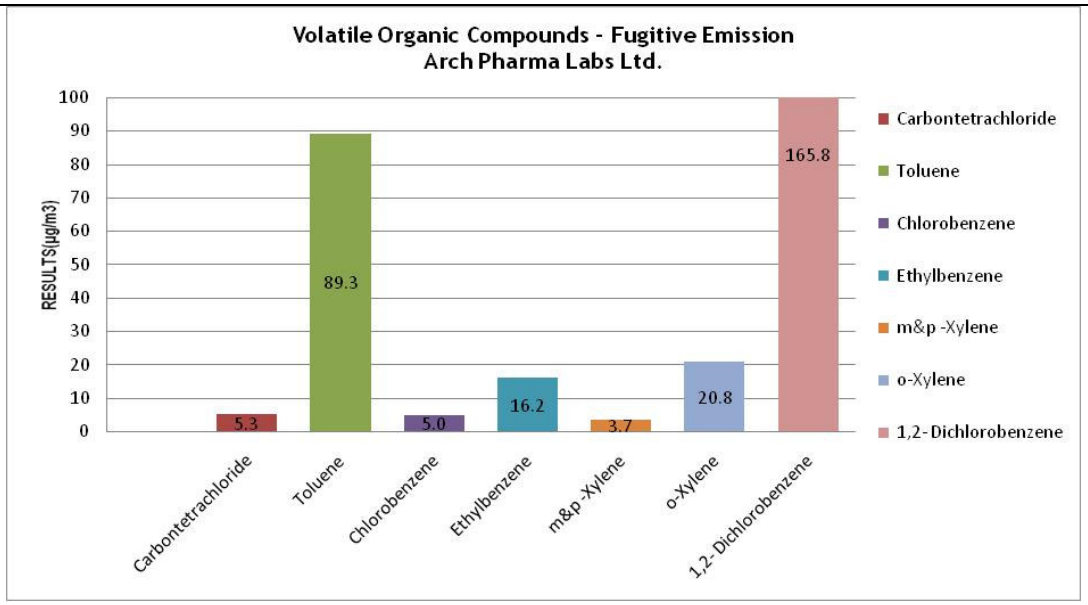
S.NO	EFFLUENT WATER -VOC	
	SAMPLING SITE:ALCHEMIE LABORATORY;SAMPLING AREA:DOMBIVILI	
	LOCATION:RAW EFFLUENT TANK ; DATE:24.02.2011	
	PARAMETERS	SAMPLE(µg/l)
1	Chloromethane	9.0
2	Dichloromethane	1339.1
3	Chloroform	2.9
4	1,2-Dichloroethane	9.4
5	Benzene	3.3
6	Toluene	5.3
7	Chlorobenzene	17.0
8	Ethylbenzene	1.0
9	o-Xylene	0.4
10	1,3-Dichlorobenzene	2.6
11	1,4-Dichlorobenzene	2.3
12	1,2- Dichlorobenzene	3.5
TOTAL VOC		**1395.7**

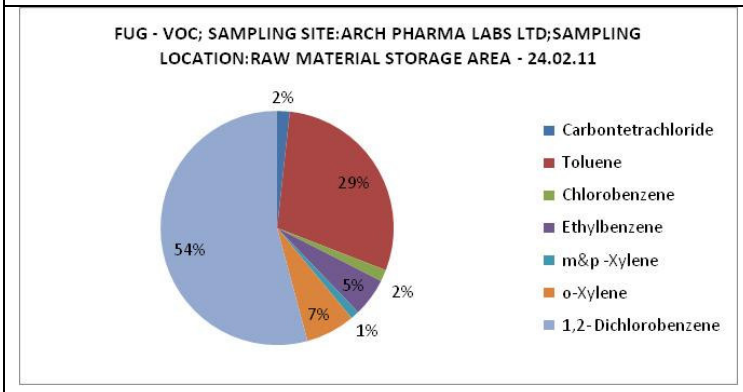

EFFLUENT WATER - VOC; SAMPLING AREA:DOMBIVILI,MAHARASTRA
SAMPLING SITE:ALCHEMIE LABORATORY;LOCATION:RAW EFFLUENT TANK -
24.02.11
1%
1%
1%
1%
96%
Chloromethane
Dichloromethane
Chloroform
1,2-Dichloroethane
Benzene
Toluene
Chlorobenzene
Ethylbenzene
o-Xylene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
1,2- Dichlorobenzene

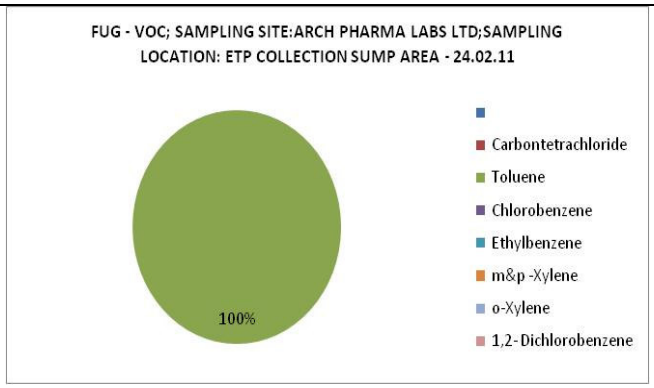
6.3.8 M/s Arch Pharma Labs Ltd.,

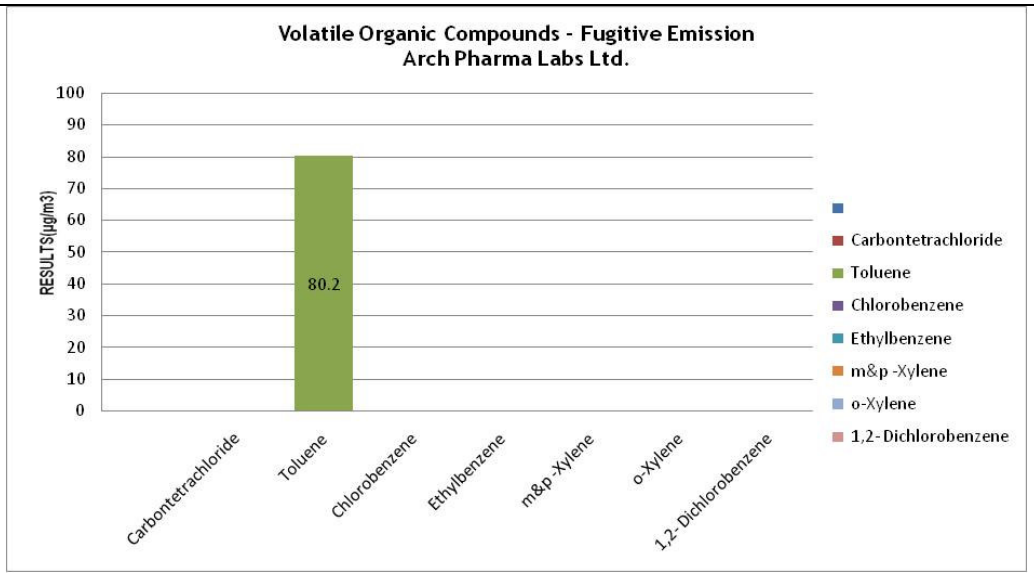
Samples of fugitive emissions and wastewater were collected from the unit and analyzed for VOCs. The concentration of TVOCs in fugitive emission monitoring sample was found to be in the range of 80.2 to 306.1µg/m^3. The highest concentration was found at the location near Raw material storage area followed by ETP collection sump area. ETP where evaporation from effluent streams takes place at higher rates especially in aeration of the effluent.

S.No	FUGITIVE EMISSION - VOC		
	SAMPLING AREA: DOMBIVILI,MAHARASTRA		
	SAMPLING SITE:ARCH PHARMA LABS LTD; DATE:24.02.11		
	PARAMETERS	RAW MATERIAL STORAGE AREA	ETP COLLECTION SUMP
1	Carbontetrachloride	5.3	BDL
2	Toluene	89.3	80.2
3	Chlorobenzene	5.0	BDL
4	Ethylbenzene	16.2	BDL
5	m&p –Xylene	3.7	BDL
6	o-Xylene	20.8	BDL
7	1,2- Dichlorobenzene	165.8	BDL
TOTAL VOC =		**306.1**	**80.24**


Volatile Organic Compounds - Fugitive Emission
Arch Pharma Labs Ltd.
RESULTS(µg/m3)
100
90
80
70
60
50
40
30
20
10
0
5.3
89.3
5.0
16.2
3.7
20.8
165.8
Carbontetrachloride
Toluene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
1,2- Dichlorobenzene


FUG - VOC; SAMPLING SITE:ARCH PHARMA LABS LTD;SAMPLING LOCATION:RAW MATERIAL STORAGE AREA - 24.02.11
2%
29%
54%
5%
2%
7%
1%
Carbontetrachloride
Toluene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
1,2- Dichlorobenzene

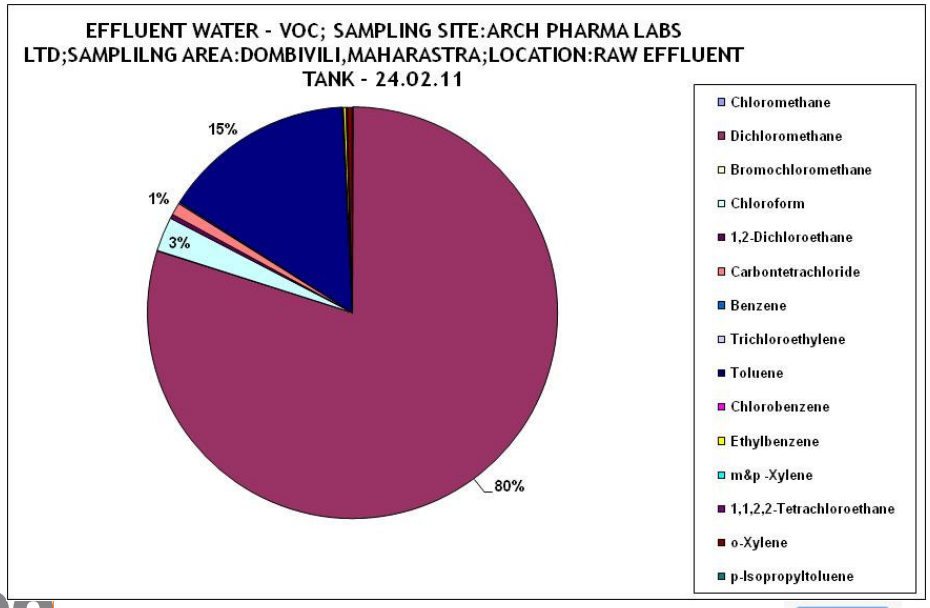

FUG - VOC; SAMPLING SITE:ARCH PHARMA LABS LTD;SAMPLING LOCATION: ETP COLLECTION SUMP AREA - 24.02.11
100%
Carbontetrachloride
Toluene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
1,2- Dichlorobenzene


Volatile Organic Compounds - Fugitive Emission
Arch Pharma Labs Ltd.
RESULTS(µg/m3)
100
90
80
70
60
50
40
30
20
10
0
80.2
Carbontetrachloride
Toluene
Chlorobenzene
Ethylbenzene
m&p -Xylene
o-Xylene
1,2-Dichlorobenzene

6.3.9 EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from raw effluent collection tank of ETP was found to be 23986 µg/l. Dichloromethane, Toluene and Chloroform was found to maximum concentration in this sample. The higher concentration may be due to improper separation of intermediate/solvents/products at different process stages, which also affects the treatment efficiency of the ETP.

S.NO	EFFLUENT WATER -VOC	
	SAMPLING SITE:ARCH PHARMA LABS LTD;SAMPLING AREA:DOMBIVILI	
	LOCATION:RAW EFFLUENT TANK ; DATE:24.02.2011	
	PARAMETERS	RESULT (µg/l)
1	Chloromethane	14.3
2	Dichloromethane	19142.6
3	Bromochloromethane	8.7
4	Chloroform	650.0
5	1,2-Dichloroethane	79.5
6	Carbontetrachloride	234.5
7	Benzene	29.6
8	Trichloroethylene	5.3
9	Toluene	3630.8
10	Chlorobenzene	19.5
11	Ethylbenzene	51.3
12	m&p –Xylene	11.7
13	1,1,2,2-Tetrachloroethane	11.6
14	o-Xylene	91.7
15	p-Isopropyltoluene	5.0
TOTAL VOC		23986.0



6.3.10 M/s Aarthi Health Care Ltd.,

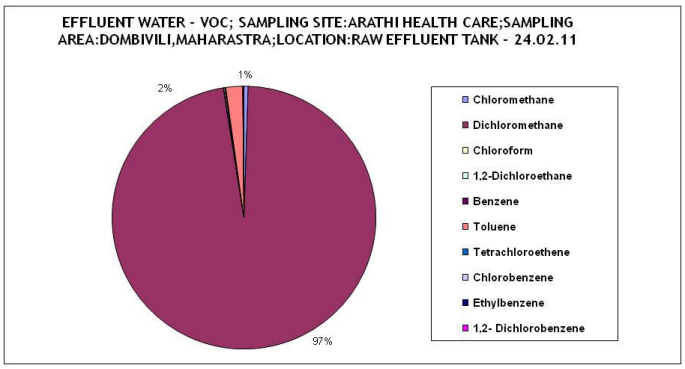
Samples of fugitive emissions and wastewater were collected from the unit and analyzed for VOCs. The concentration of TVOCs in fugitive emission monitoring sample was found to be 13.3µg/m^3.

S.No	FUGITIVE EMISSION – VOC: RESULTS µg/m3	
	SAMPLING AREA:DOMBIVILI,MAHARASTRA	
	SAMPLING SITE:ARTHI HEALTH CARE LTD ; DATE:22.02.11	
	PARAMETERS	SOLVENT STORAGAE AREA
1	Dichloromethane	13.26
TOTAL VOC =		13.26

6.3.11 EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from raw effluent collection tank of ETP was found to be 4177.5 µg/l. Dichloromethane and Toluene was found to maximum concentration in this sample.

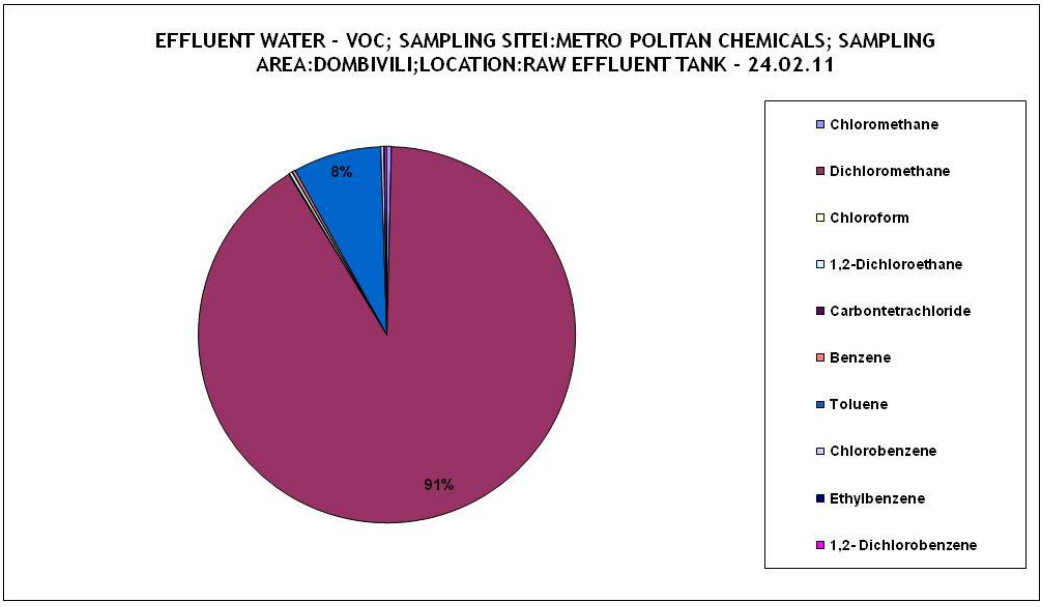
S.NO	EFFLUENT WATER -VOC	
	SAMPLING SITE:ARATHI HEALTHCARE;SAMPLING AREA:DOMBIVILI	
	LOCATION:RAW EFFLUENT TANK ; DATE:24.02.2011	
	PARAMETERS	SAMPLE(µg/l)
1	Chloromethane	21.1
2	Dichloromethane	4051.3
3	Chloroform	1.8
4	1,2-Dichloroethane	6.0
5	Benzene	4.7
6	Toluene	86.5
7	Tetrachloroethene	0.6
8	Chlorobenzene	3.2
9	Ethylbenzene	0.8
10	1,2- Dichlorobenzene	1.7
TOTAL VOC		4177.5


EFFLUENT WATER - VOC; SAMPLING SITE:ARATHI HEALTH CARE;SAMPLING AREA:DOMBIVILI,MAHARASTRA;LOCATION:RAW EFFLUENT TANK - 24.02.11
1%
2%
97%
Chloromethane
Dichloromethane
Chloroform
1,2-Dichloroethane
Benzene
Toluene
Tetrachloroethene
Chlorobenzene
Ethylbenzene
1,2- Dichlorobenzene

6.3.11 METROPOLITAN CHEMICALS:
EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from raw effluent collection tank of ETP was found to be 2102.3 µg/l. Dichloromethane and Toluene was found to maximum concentration in this sample.

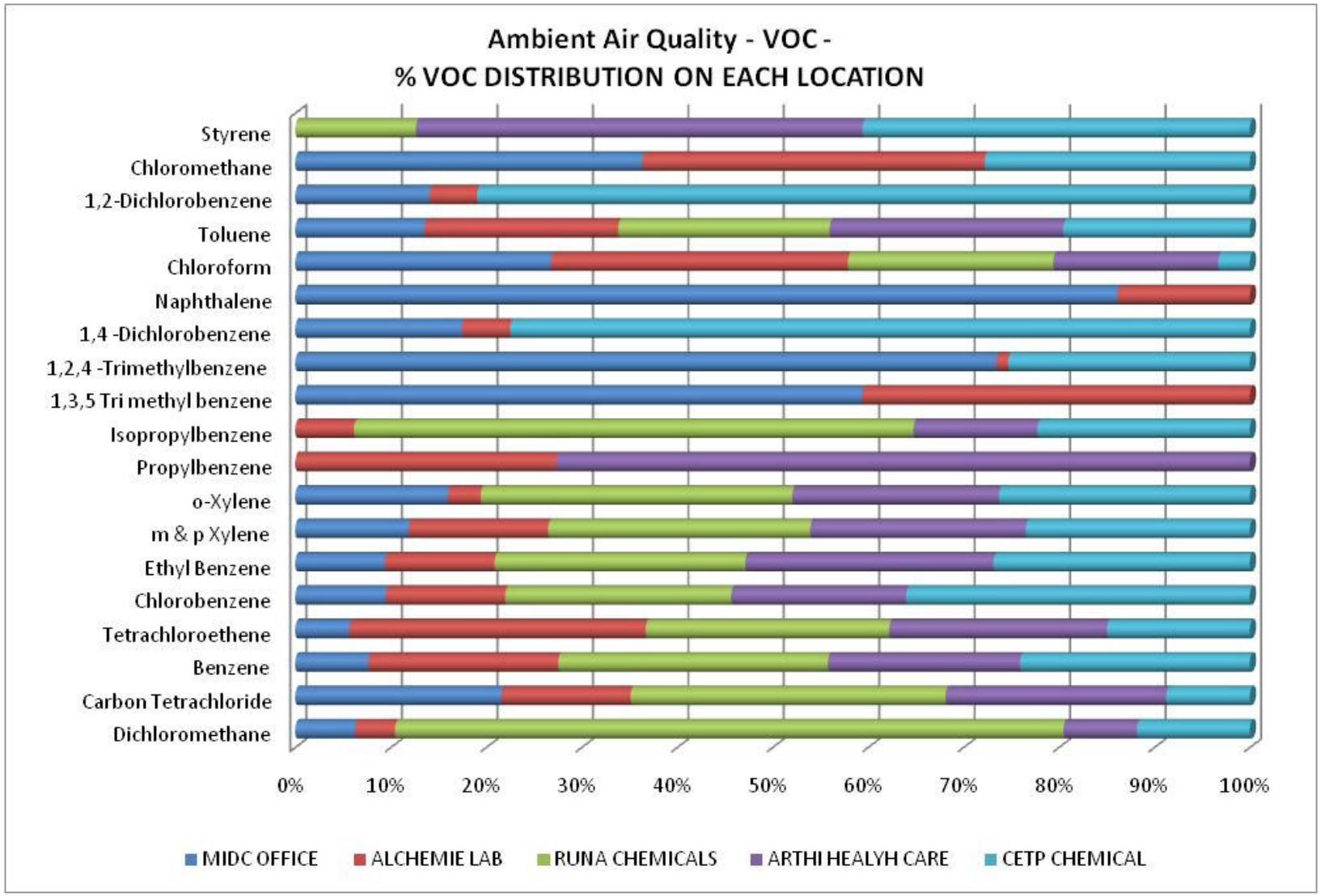
EFFLUENT WATER -VOC (2110011954)	
SAMPLING SITE:METROPOLITAN CHEMICALS;SAMPLING AREA:DOMBIVILI	
LOCATION:RAW EFFLUENT TANK ; DATE:24.02.2011	
Chloromethane	8.1
Dichloromethane	1910.4
Chloroform	1.9
1,2-Dichloroethane	5.4
Carbontetrachloride	0.9
Benzene	5.2
Toluene	159.5
Chlorobenzene	5.6
Ethylbenzene	0.9
1,2- Dichlorobenzene	4.5
TOTAL VOC =	**2102.3**

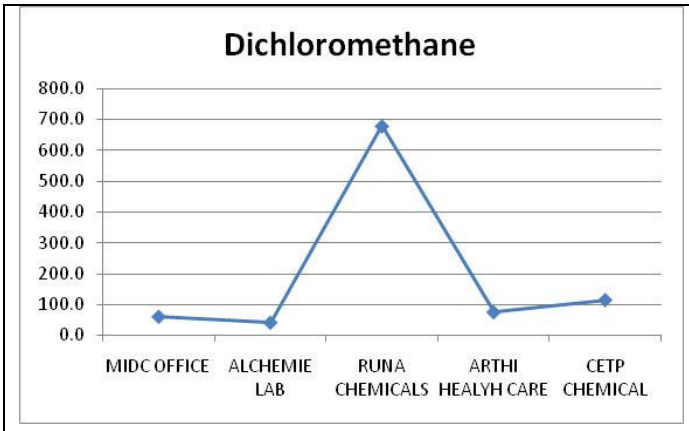


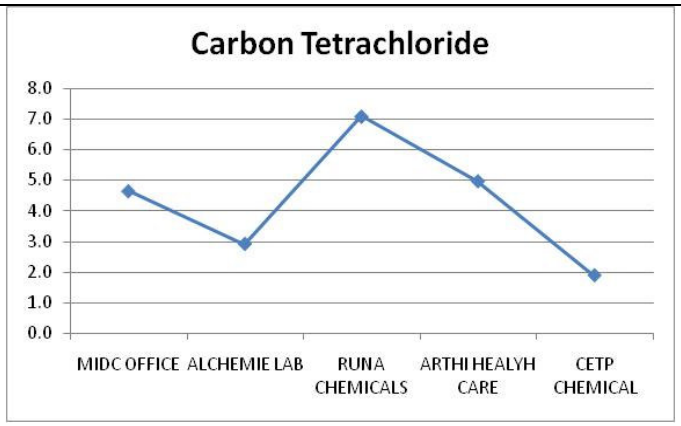
6.4 Observation and Findings on Dombivali Industrial Area

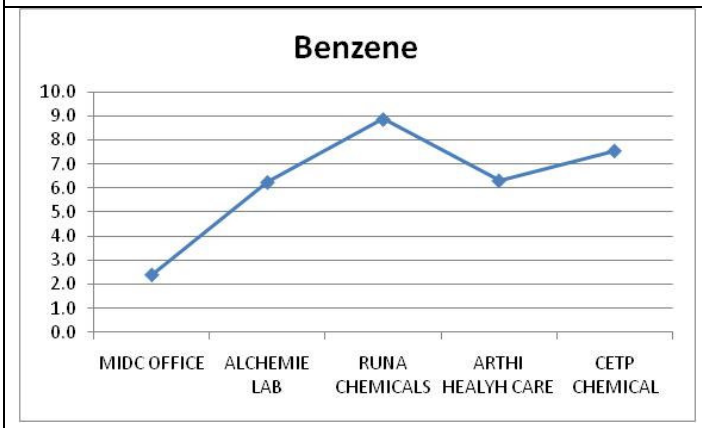
- The order of the pollutant in Ambient Air is Dichloromethane, Chloromethane, Chloroform, Styrene, Ethyl Benzene, 1,2-Dichlorobenzene, Xylene, Carbon Tetrachloride, Benzene and Naphthalene was found in maximum monitored locations.
- Concentration of Dichloromethane and Chloromethane are observed to be more in almost all the locations among the VOCs detected whereas at some cycle of monitoring and few locations Chloroform, Styrene, Dichlorobenzene and Naphthalene were also found with more concentration.
- The probable places of loss of VOCs are Centrifuging, filtration, glands, charging material into the reactors, solvent storage area, distillation and ETP area.
- Total 12 VOCs including 9 highly toxic and suspected carcinogenic compounds are found during monitoring at Dombivali.
- The total VOCs concentration was measured at all locations, in the range of 79.4 ug/m3 – minimum at Station-2 (Alchemie Laboratories Ltd., upwind station of the Industrial Estate) to 732.4ug/m3 – maximum at Station - 3 (Runa Chemicals in East direction of industrial area which is cross wind direction).
- ATD method found to have reported many compounds which are relevant to the industries used solvents and some have no relevance to solvents used in industries, because of may be the impurities in their used solvents.
- Average concentration of predominant and total VOCs found in each locations and the % distribution of individual VOCs in each locations is depicted in the following table and chart.

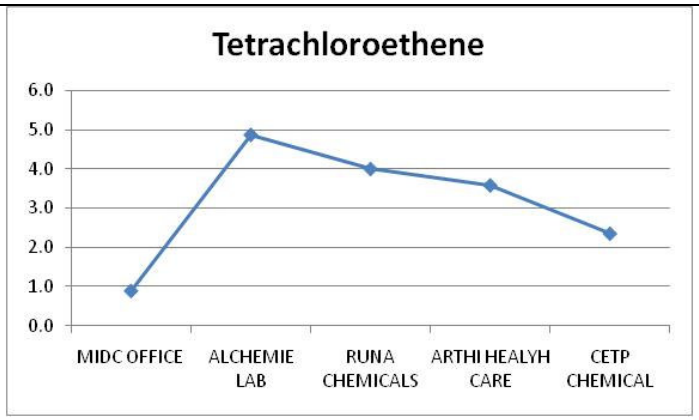
AMBIENT AIR QUALITY - VOC : RESULTS (µg/m3)					
PRESENCE OF VOC IN PARAMETER WISE FOR ALL LOCATIONS					
Parameter	**MIDC OFFICE**	**ALCHEMIE LAB**	**RUNA CHEMICALS**	**ARTHI HEALYH CARE**	**CETP CHEMICAL**
Dichloromethane	60.3	41.0	679.0	74.7	114.6
Carbon Tetrachloride	4.6	2.9	7.1	5.0	1.9
Benzene	2.4	6.3	8.9	6.3	7.6
Tetrachloroethene	0.9	4.9	4.0	3.6	2.3
Chlorobenzene	6.5	8.6	16.2	12.6	24.7
Ethyl Benzene	6.4	7.8	17.9	17.7	18.3
m & p Xylene	3.7	4.6	8.7	7.1	7.4
o-Xylene	7.5	1.6	15.3	10.1	12.3
Propylbenzene	BDL	0.6	BDL	1.5	BDL
Isopropylbenzene	BDL	0.7	6.8	1.5	2.6
1,3,5 Tri methyl benzene	2.6	1.8	BDL	BDL	BDL
1,2,4 -Trimethylbenzene	1.8	0.0	BDL	BDL	0.6
1,4 -Dichlorobenzene	1.0	0.3	BDL	BDL	4.6
Naphthalene	6.4	1.0	BDL	BDL	BDL
Chloroform	13.7	15.9	11.0	8.8	1.7
Toluene	28.4	42.8	46.7	51.5	41.1
1,2-Dichlorobenzene	3.6	1.3	BDL	BDL	20.6
Chloromethane	9.2	9.1	BDL	BDL	7.0
Styrene	BDL	BDL	7.6	28.3	24.6

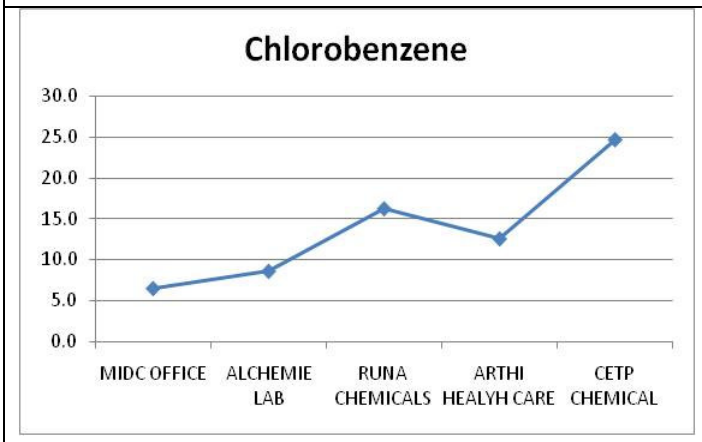

Ambient Air Quality - VOC -
% VOC DISTRIBUTION ON EACH LOCATION
Styrene
Chloromethane
1,2-Dichlorobenzene
Toluene
Chloroform
Naphthalene
1,4 -Dichlorobenzene
1,2,4 -Trimethylbenzene
1,3,5 Tri methyl benzene
Isopropylbenzene
Propylbenzene
o-Xylene
m & p Xylene
Ethyl Benzene
Chlorobenzene
Tetrachloroethene
Benzene
Carbon Tetrachloride
Dichloromethane
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

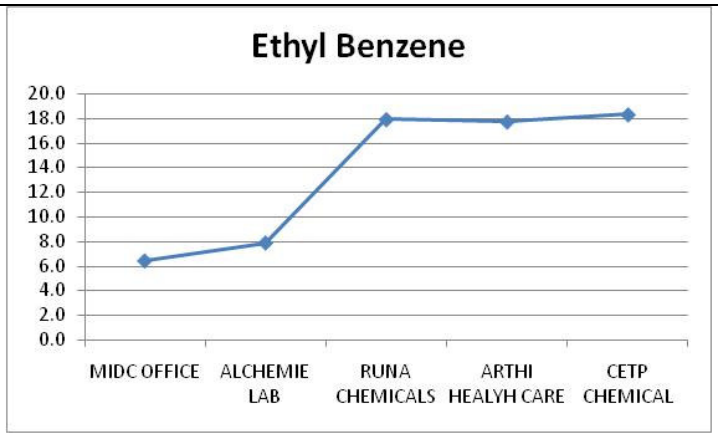

Dichloromethane
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

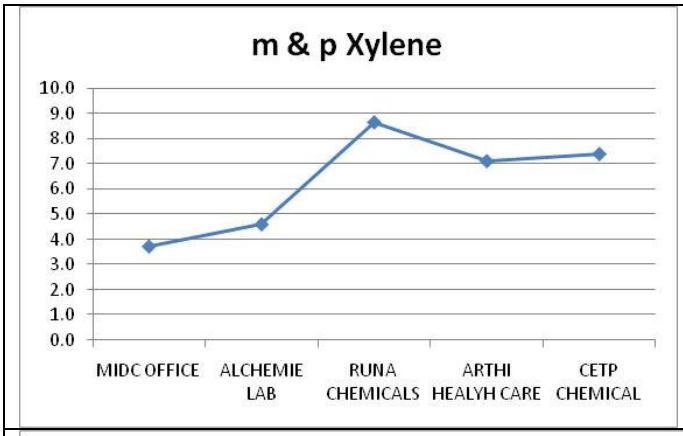

Carbon Tetrachloride
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

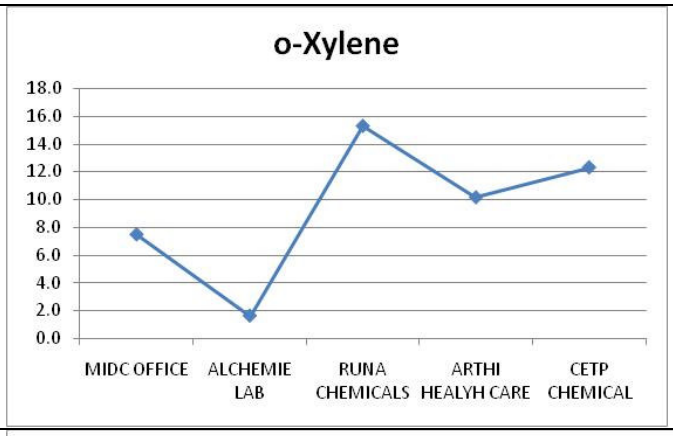

Benzene
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

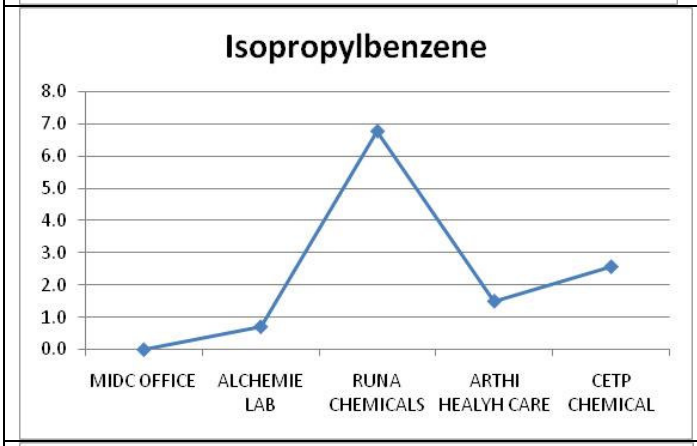

Tetrachloroethene
6.0
5.0
4.0
3.0
2.0
1.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

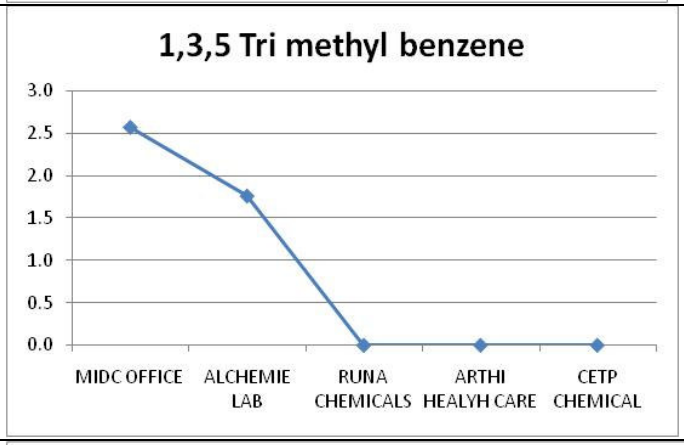

Chlorobenzene
30.0
25.0
20.0
15.0
10.0
5.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

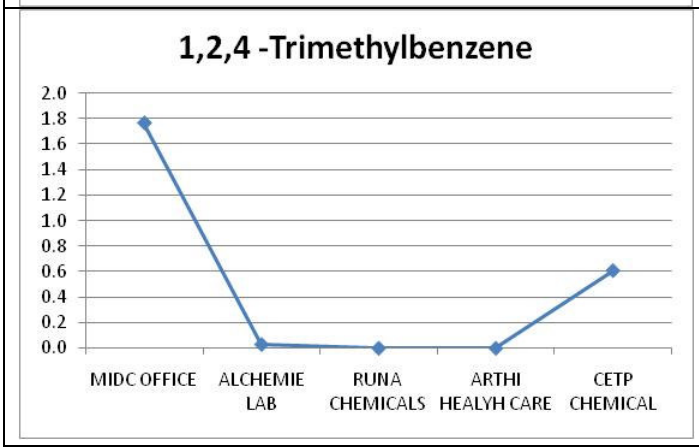

Ethyl Benzene
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

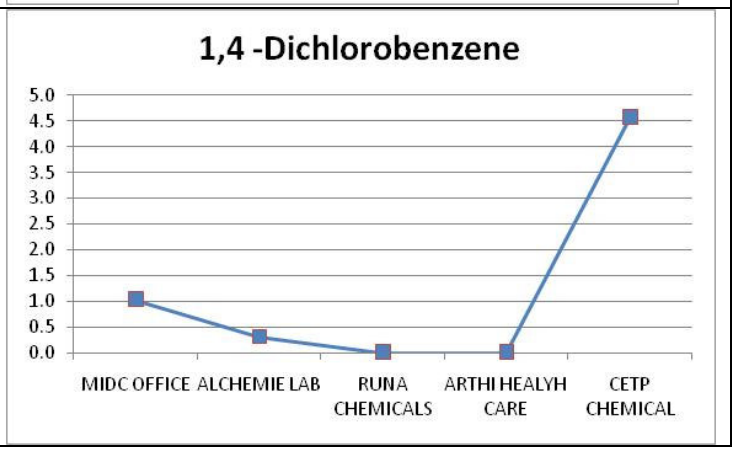

m & p Xylene
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

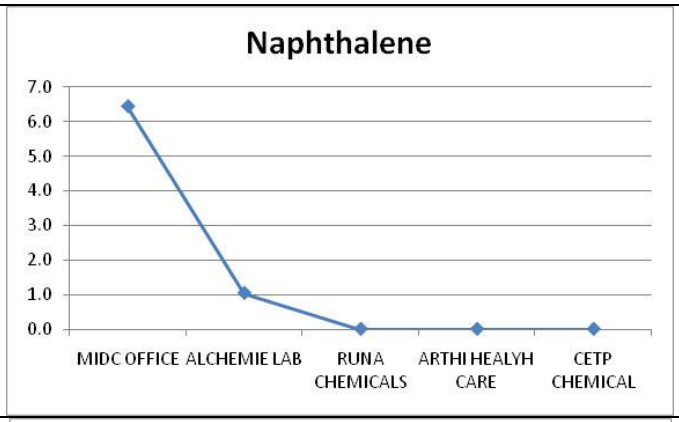

o-Xylene
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

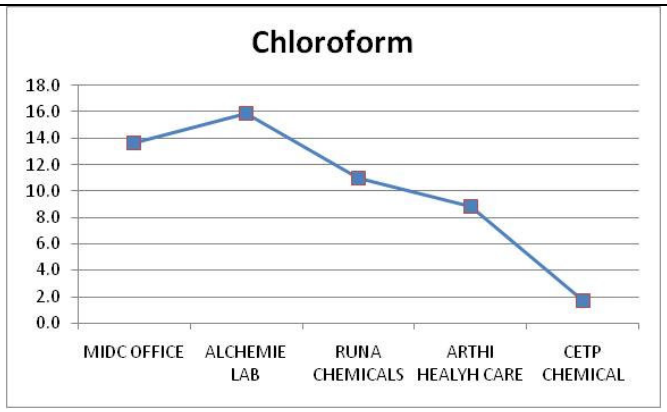

Isopropylbenzene
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

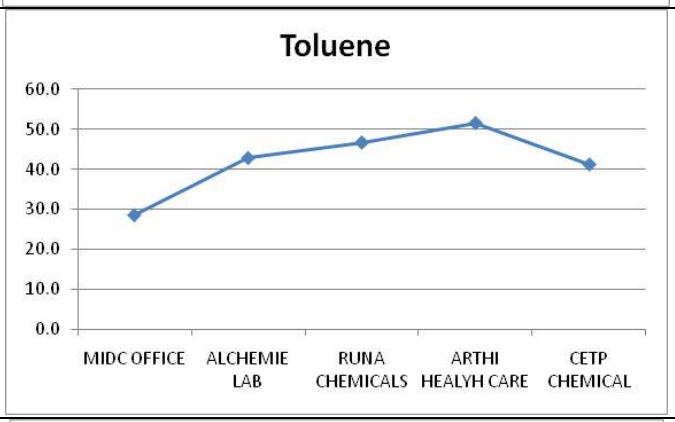

1,3,5 Tri methyl benzene
3.0
2.5
2.0
1.5
1.0
0.5
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

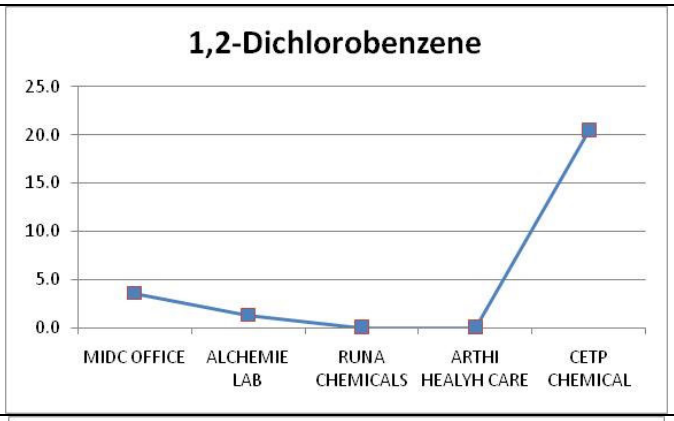

1,2,4 -Trimethylbenzene
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

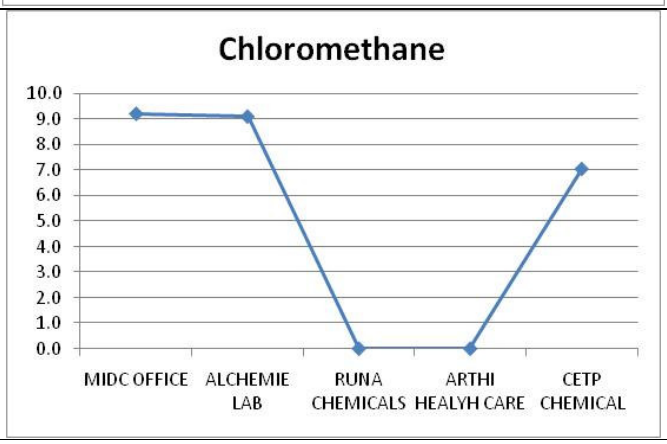

1,4 -Dichlorobenzene
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

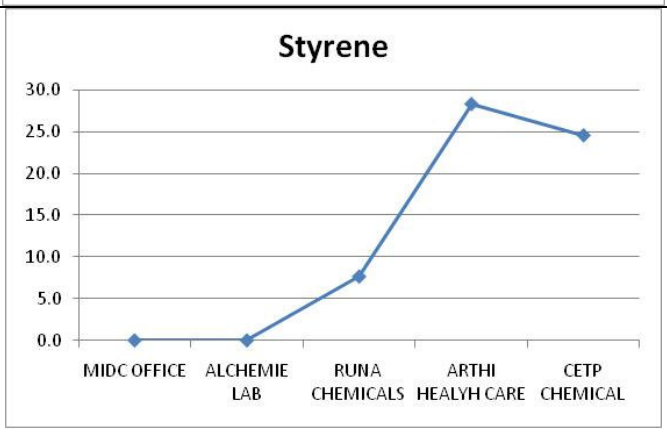

Naphthalene
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL


Chloroform
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL


Toluene
60.0
50.0
40.0
30.0
20.0
10.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL


1,2-Dichlorobenzene
25.0
20.0
15.0
10.0
5.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL


Chloromethane
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL


Styrene
30.0
25.0
20.0
15.0
10.0
5.0
0.0
MIDC OFFICE
ALCHEMIE LAB
RUNA CHEMICALS
ARTHI HEALYH CARE
CETP CHEMICAL

- The Benzene concentration in all AAQM stations was found well below within the prescribed national standard of 5µg/m^3
- Generation of Hazardous waste can be minimized by better operating methods and systems as well as solvent recovery with effective condensation with which the concentration of VOC dispersing to atmosphere can be reduced.
- Normally the wastewater generated by the industries contains high VOCs and the industries are doing only primary treatment. During these processes some percentage of VOCs are dispersed into the atmosphere. After primary treatment the industries are pumping their effluent to CETP for further treatments. In CETP during aeration process, most of the VOCs are vaporized and dispersed into the atmosphere. These VOCs are directly impacting the Ambient VOCs concentration.
- Chlorinated compounds escape at the higher rate in to the atmosphere which may increase the ground level ozone concentration.
- Companies change the products with respect to demand in the market accordingly the solvent type and quantity will also vary. Due to these variations the concentrations of VOC in AAQ, Fugitive, wastewater and solid waste may vary.
- Presence of VOCs in wastewater affects the ambient air quality, efficiency of the effluent treatment system and the quality of the final receiving body. VOCs (Solvents) are emitted in to the environment during various treatment unit operations particularly during aeration in equalization tanks and aeration tanks.
- In case of CETP at Dombivali, the concentrations of Dichloromethane, Chloroform, 1,2-Dichloroethane, Toluene, Chlorobenzene and Dichlorobenzene were found to be very high as compared to other detected VOCs.

VOC PROJECT REPORT ON CHANDRAPUR INDUSTRIAL AREA

CHAPTER – VII

7.0 ABOUT CHANDRAPUR INDUSTRIAL ESTATE: Chandrapur district is famous for its sprawling coal mines and Tadoba wildlife sanctuary, which is an important Tiger destination in the country. The mineral based industrial development and rapid urbanization in this district has albeit resulted in pollution and environmental degradation and its effects are being felt on a wide scale.

The industrial sector occupies a prominent position in the economy of Maharashtra, which still retains the numerous status in the country though states like Gujarat, Karnataka and Andhra Pradesh are surging forward with massive investments. Additional Chandrapur Industrial Area is one of the best Industrial Area in Nagpur region. This Industrial Area is the best Black Gold city of Maharashtra in the region.

MIDC has been set-up with the main objective to promote industrial growth and attract foreign direct investment in Maharashtra. MIDC has made efforts to promote the resource based industrial growth of this region and many corporate have set up industries in this backward district. Addl. Chandrapur Industrial Area spans a total area of 70.23 hectares. Besides, MIDC has acquired 214.40 ha of lands and developed 46 plots at Padolee and 154.62 ha of lands at Korpan, Bhoyegaon, Nandgaon, Ekodi and Kawthala villages to promote the industrial growth in Chandrapur district. It is planned to utilize these areas for setting up of cement manufacture, power plant and lime mining activities. Tadali has been identified as a growth center for sponge iron manufacturing industries considering the ample availability of the iron ore and coal in this region.

The industrial estate set up in 1961 houses 86 industrial units which include chemical, auxiliary and engineering/ service industries. Besides, the existing major industries in Chandrapur district include Coal mines of WCL, Cement plants, paper industry, lime mining and kilns, steel and Super Thermal Power Plant of MSEB.

Chandrapur is a mineral rich district with a dense forest spread over 41.5 % of total land. Based on available minerals and abundant water, industries have been set up

within and in the surrounding of Chandrapur City. Western Coal Ltd. operates 26 coal mines in Chandrapur city and the surrounding areas. The mined coal is supplied to Super Thermal Power station at Chandrapur having a generation capacity of 2340 MW capacity and also having coal linkage to Durgapur open cast coal mine. Coal is transported to STPS by rail and aerial ropeway.

7.1 Location of the Sampling:

The meteorological parameters have been studied and accordingly prevailing wind direction is North West to South East and sometimes North to South with minimum temperature of 23°C and Maximum 32°C. The relative humidity was found in the range of 50 – 65% and wind speed is ranging from 0.8m/sec to 2.3 m/s.

Following industries were selected for VOC monitoring:

Cross Wind : (1) Premises of M/s. Multi Organics Pvt Ltd., in the North direction of industrial area.

Down Wind : (2) Premises of M/s.Abhideep Chemicals Pvt Ltd., in the North East direction of industrial area.

Cross Wind : (3) Premises of M/s Chandrapur Pipes (G-Zone) in the East direction of industrial area.

Cross Wind : (4) Premises of M/s Bilt Guest House (E-Zone) in the North West direction of industrial area.

Cross Wind : (4) Premises of M/s Bilt Radial Well-2 (A-Zone) in the South West direction of industrial area.

7.2 RESULTS & DISCUSSIONS:

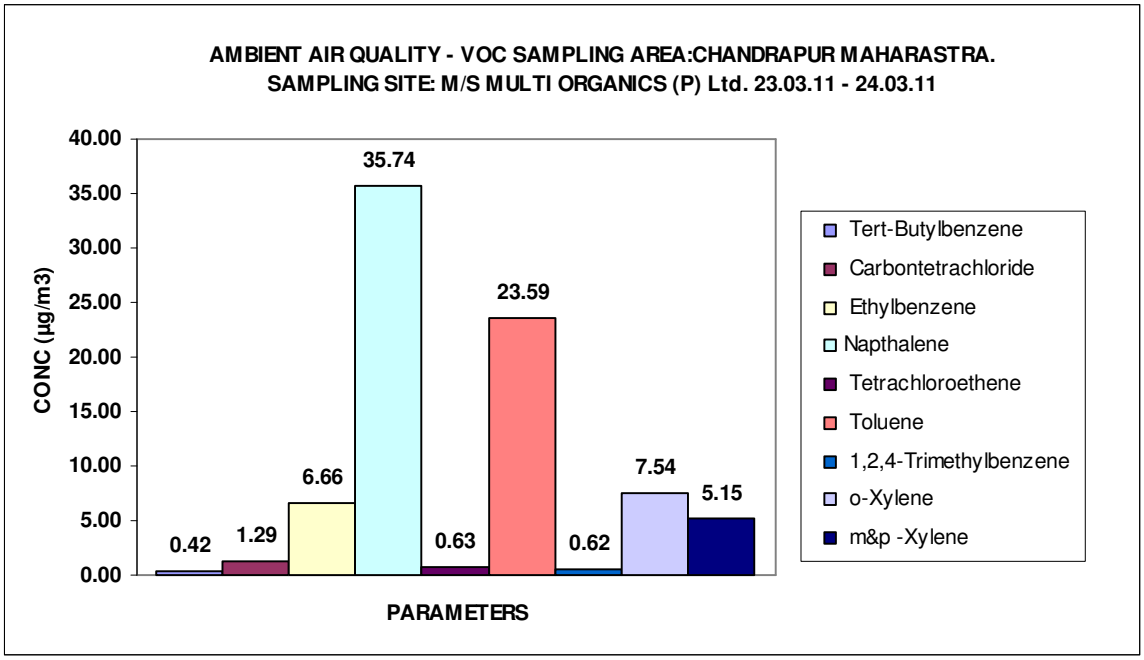
7.2.1 Results & Discussion for Ambient Air Quality Monitoring at Chandrapur:-

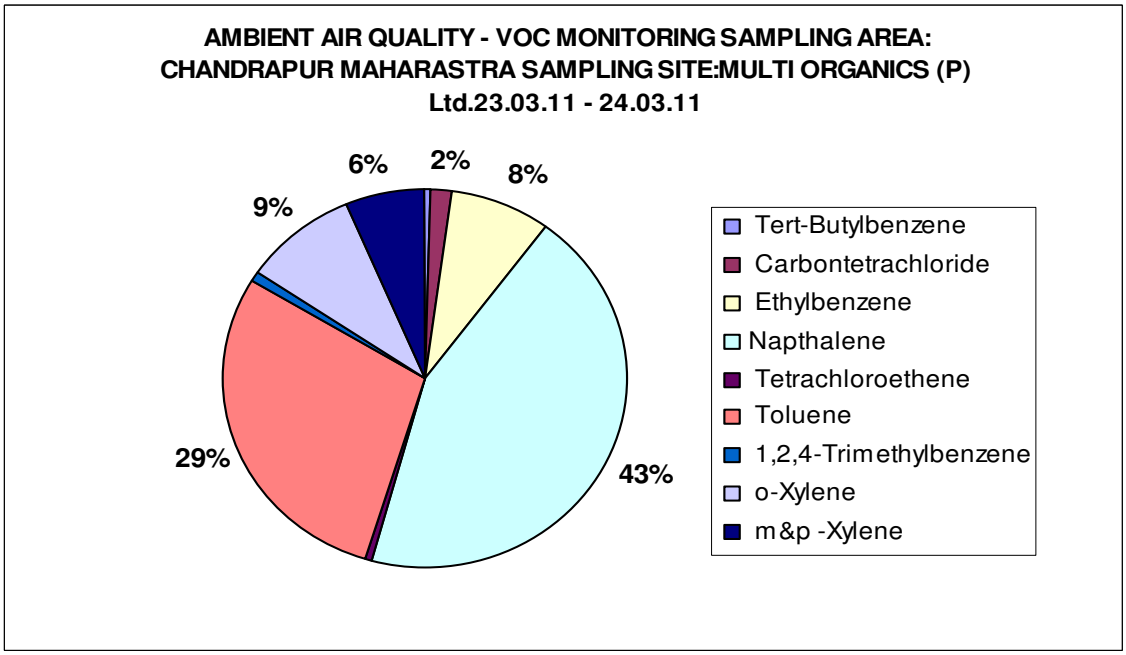
Station 1: Premises Multi organics Ltd., Which is in the North direction of industrial area.

The AAQM Station-1 was identified as up-wind station as per the prevailing wind direction at the time of the study and 9 VOCs are detected in this location. The wind direction was South West to North-East and some time South to North. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 75%. Approximate height from ground level is 15 feet.

S.No.	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: CHANDRAPUR,MAHARASTRA				
	SAMPLING SITE: M/S MULTI ORGANICS (P) Ltd. 23.03.11 -24.03.11				
	PARAMETERS	LOCATION I TIME:12.30-20.30	LOCATION II TIME:20.30 - 4.30	LOCATION III TIME: 4.30 -12.00	AVERAGE
		RESULTS (µg/m3)			
1	Tert-Butylbenzene	BDL	1.25	BDL	0.42
2	Carbontetrachloride	1.37	2.51	BDL	1.29
3	Ethylbenzene	14.31	5.67	BDL	6.66
4	Naphthalene	69.5	37.73	BDL	35.74
5	Tetrachloroethene	BDL	1.9	BDL	0.63
6	Toluene	32.81	37.97	BDL	23.59
7	1,2,4-Trimethylbenzene	BDL	1.85	BDL	0.62
8	o-Xylene	13.25	9.36	BDL	7.54
9	m&p -Xylene	11.04	4.42	BDL	5.15
TOTAL VOC		**131.24**	**102.66**	BDL	**81.65**

9 VOC were found common in the two cycles of monitoring in which no VOCs are detected in the third cycle. Naphthalene and Toluene concentration was found maximum in the First & second cycle in this location followed by other detected VOCs.


AMBIENT AIR QUALITY - VOC SAMPLING AREA:CHANDRAPUR MAHARASTRA.
SAMPLING SITE: M/S MULTI ORGANICS (P) Ltd. 23.03.11 - 24.03.11
CONC (µg/m3)
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.42
1.29
6.66
35.74
0.63
23.59
0.62
7.54
5.15
PARAMETERS
Tert-Butylbenzene
Carbontetrachloride
Ethylbenzene
Napthalene
Tetrachloroethene
Toluene
1,2,4-Trimethylbenzene
o-Xylene
m&p -Xylene

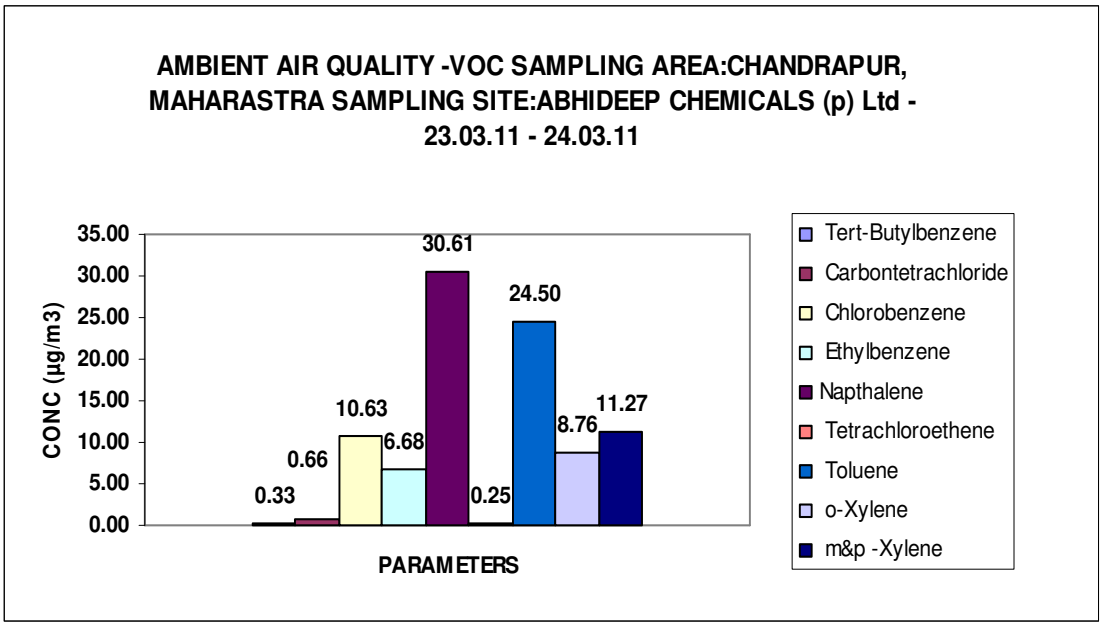

AMBIENT AIR QUALITY - VOC MONITORING SAMPLING AREA:
CHANDRAPUR MAHARASTRA SAMPLING SITE:MULTI ORGANICS (P)
Ltd.23.03.11 - 24.03.11
6%
2%
8%
9%
29%
43%
Tert-Butylbenzene
Carbontetrachloride
Ethylbenzene
Napthalene
Tetrachloroethene
Toluene
1,2,4-Trimethylbenzene
o-Xylene
m&p -Xylene

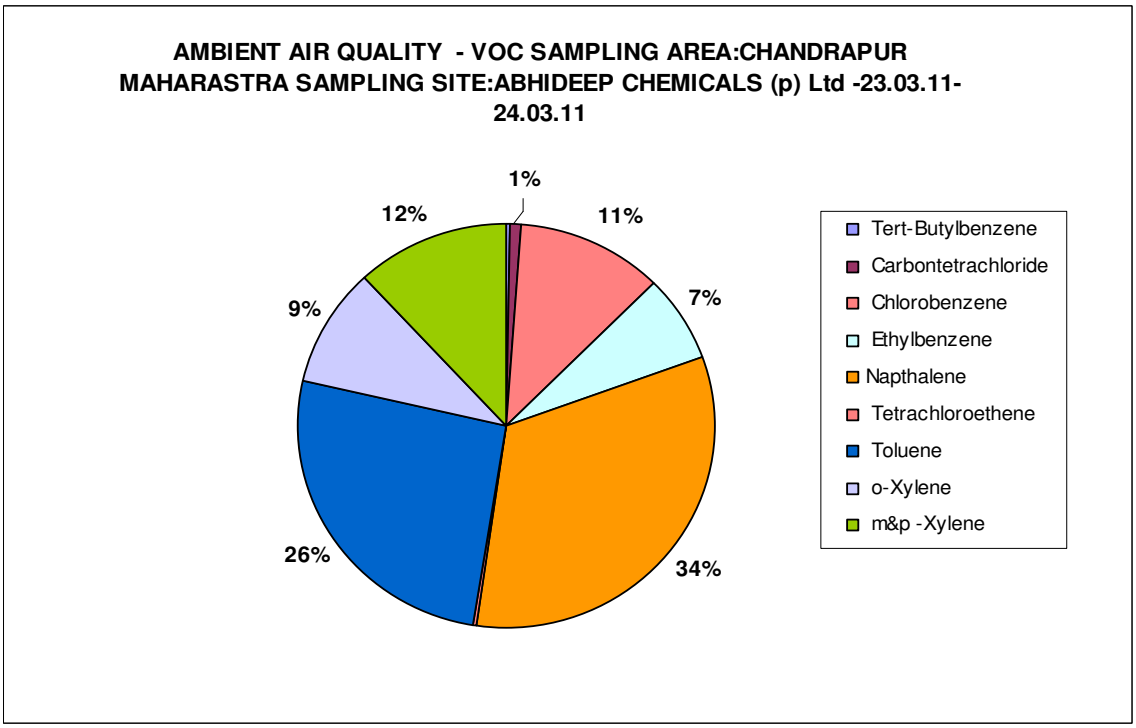
Station 2: Premises of Abhideep Chemicals Pvt Ltd in the North East direction of industrial area.

The AAQ station-2 is identified as down-wind station as per prevailing wind direction at the time of the study. 7 VOCs are detected in this location. The wind direction was South-West to North-East and some time South to North. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 75%. Approximate height from ground level is 25 feet.

S.No.	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: CHANDRAPUR,MAHARASTRA				
	SAMPLING SITE:M/S ABHIDEEP CHEMICALS (P) Ltd 23.03.11 - 24.03.11				
	PARAMETERS	LOCATION I TIME:13.30 -21.30	LOCATION II TIME:21.30 - 5.30	LOCATION III TIME: 5.30 -13.30	AVERAGE
		RESULTS (µg/m3)			
1	Carbontetrachloride	BDL	1.97	BDL	0.66
2	Chlorobenzene	BDL	31.88	BDL	10.63
3	Ethylbenzene	BDL	BDL	20.05	6.68
4	Naphthalene	BDL	91.82	BDL	30.61
5	Toluene	BDL	27.32	46.17	24.50
6	o-Xylene	BDL	8.52	17.76	8.76
7	m&p -Xylene	BDL	18.18	15.63	11.27
TOTAL VOC		**BDL**	**179.69**	**101.33**	**93.67**

7 VOC were found common in the two cycles of monitoring in which no VOCs are detected in the first cycle. Naphthalene, Chlorobenzene and Toluene concentration was found maximum in the second & thrid cycle in this location followed by other detected VOCs. Naphthalene concentration (91.8 µg/m3) is found maximum in the second cycle in this location followed by Toluene and o-Xylene.


AMBIENT AIR QUALITY -VOC SAMPLING AREA:CHANDRAPUR, MAHARASTRA SAMPLING SITE:ABHIDEEP CHEMICALS (p) Ltd - 23.03.11 - 24.03.11
CONC (µg/m3)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.33
0.66
10.63
6.68
30.61
0.25
24.50
8.76
11.27
PARAMETERS
Tert-Butylbenzene
Carbontetrachloride
Chlorobenzene
Ethylbenzene
Napthalene
Tetrachloroethene
Toluene
o-Xylene
m&p -Xylene

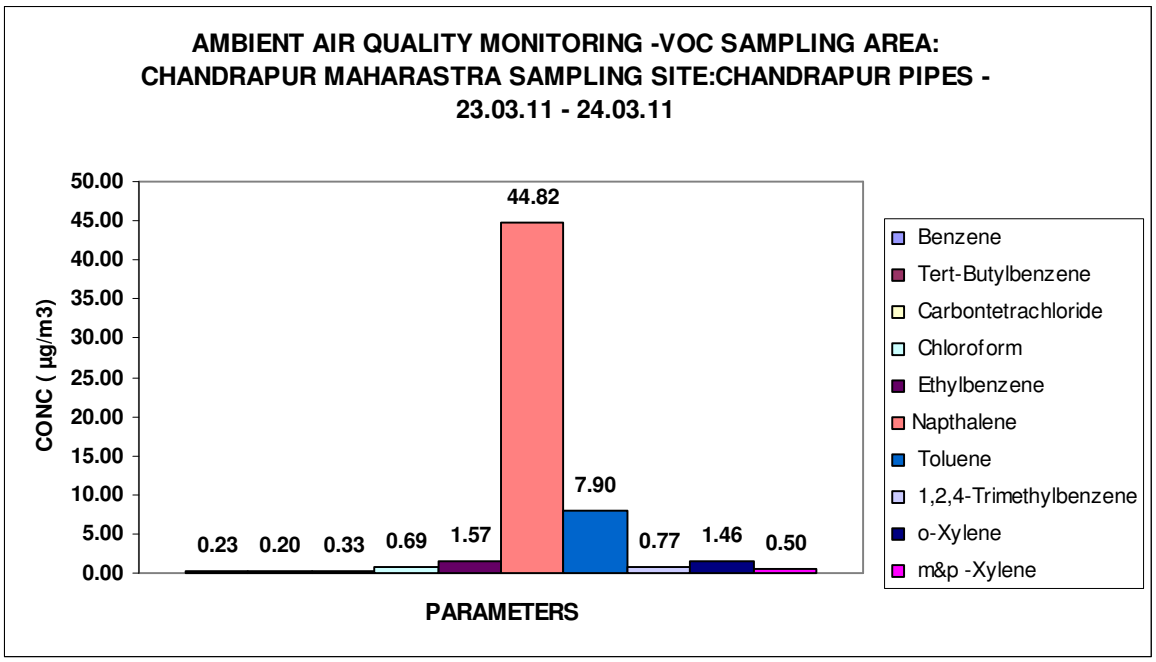

AMBIENT AIR QUALITY - VOC SAMPLING AREA:CHANDRAPUR MAHARASTRA SAMPLING SITE:ABHIDEEP CHEMICALS (p) Ltd -23.03.11- 24.03.11
1%
11%
7%
34%
26%
9%
12%
Tert-Butylbenzene
Carbontetrachloride
Chlorobenzene
Ethylbenzene
Napthalene
Tetrachloroethene
Toluene
o-Xylene
m&p -Xylene

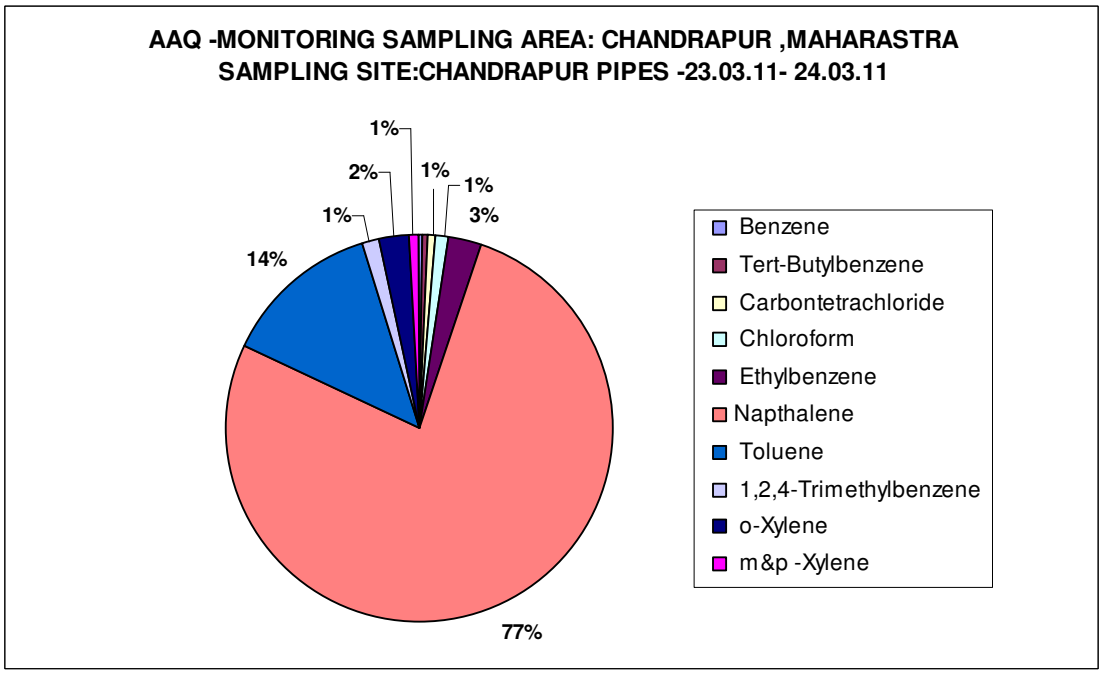
Station 3: Premises of M/s Chandrapur Pipes, G-59 (G-Zone) in East direction of industrial area.

The AAQ station-3 is identified as cross-wind station as per the prevailing wind direction at the time of the study.

S.No.	AMBIENT AIR QUALITY – VOC SAMPLING AREA: CHANDRAPUR,MAHARASTRA SAMPLING SITE:M/S CHANDRAPUR PIPES 23.03.11 - 24.03.11 PARAMETERS	LOCATION I TIME:16.00 - 24.00	LOCATION II TIME:24.00 - 8.00	LOCATION III TIME: 8.00 - 16.00	AVERAGE
		RESULTS (µg/m3)			
1	Benzene	BDL	BDL	0.7	0.23
2	Carbontetrachloride	BDL	BDL	1	0.33
3	Chloroform	BDL	BDL	2.06	0.69
4	Ethylbenzene	BDL	4.71	BDL	1.57
5	Naphthalene	20.79	98.18	15.5	44.82
6	Toluene	2.33	8.36	13	7.90
7	o-Xylene	BDL	3.18	1.2	1.46
8	m&p -Xylene	BDL	1.5	BDL	0.50
TOTAL VOC		23.12	117.83	34.46	58.47

10 VOCs are found in this location in which Naphthalene is detected almost all the cycles of monitoring followed by Toluene.


AMBIENT AIR QUALITY MONITORING -VOC SAMPLING AREA: CHANDRAPUR MAHARASTRA SAMPLING SITE:CHANDRAPUR PIPES - 23.03.11 - 24.03.11
CONC (µg/m3)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.23
0.20
0.33
0.69
1.57
44.82
7.90
0.77
1.46
0.50
PARAMETERS
Benzene
Tert-Butylbenzene
Carbontetrachloride
Chloroform
Ethylbenzene
Napthalene
Toluene
1,2,4-Trimethylbenzene
o-Xylene
m&p -Xylene

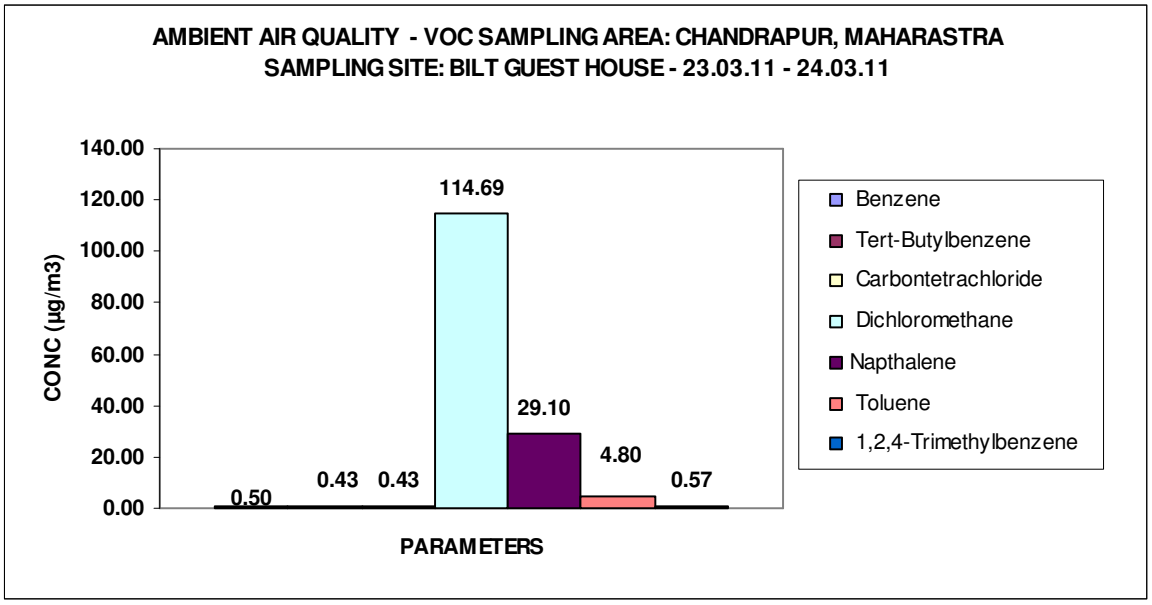

AAQ -MONITORING SAMPLING AREA: CHANDRAPUR ,MAHARASTRA SAMPLING SITE:CHANDRAPUR PIPES -23.03.11- 24.03.11
1%
2%
1%
1%
1%
3%
14%
77%
Benzene
Tert-Butylbenzene
Carbontetrachloride
Chloroform
Ethylbenzene
Napthalene
Toluene
1,2,4-Trimethylbenzene
o-Xylene
m&p -Xylene

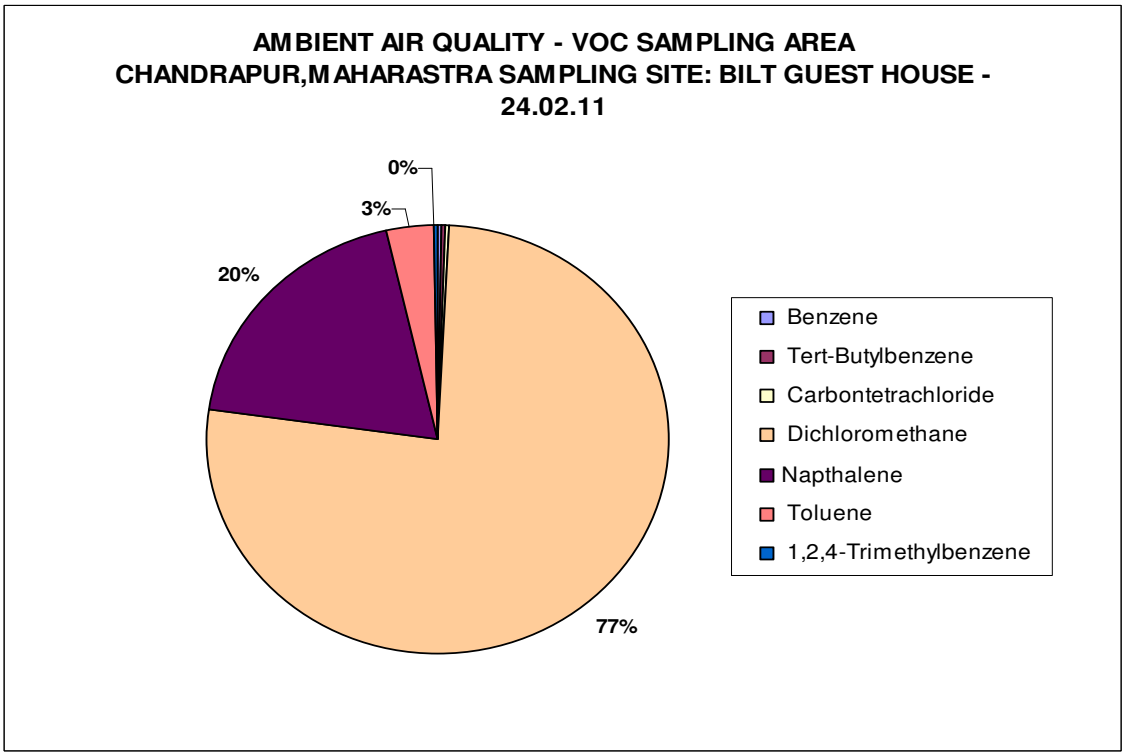
Station 4: Premises of M/s BILT Guest House in the North west direction of industrial area.

The AAQ station-4 is identified as cross-wind station as per prevailing wind direction at the time of the study.

S.No.	AMBIENT AIR QUALITY – VOC				
	SAMPLING AREA: CHANDRAPUR,MAHARASTRA				
	SAMPLING SITE:M/S BILT GUEST HOUSE 23.03.11 - 24.03.11				
	PARAMETERS	LOCATION I TIME:17.35 -1.35	LOCATION II TIME:1.35 - 9.35	LOCATION III TIME: 9.35 -17.35	AVERAGE
		RESULTS (µg/m3)			
1	Benzene	0.81	BDL	0.68	0.50
2	Tert-Butylbenzene	1.3	BDL	BDL	0.43
3	Carbontetrachloride	BDL	0.64	0.64	0.43
4	Dichloromethane	BDL	344.08	BDL	114.69
5	Naphthalene	8.1	BDL	79.2	29.10
6	Toluene	9.1	BDL	5.31	4.80
7	1,2,4-Trimethylbenzene	1.3	BDL	0.41	0.57
	TOTAL VOC	**20.61**	**344.72**	**86.24**	**150.52**

7 VOCs are found in this location in which Dichloromethane concentration (344.08 µg/m3) is found maximum in the second cycle and Naphthalene(79.2 µg/m3) is found maximum in third cycle in this location.


AMBIENT AIR QUALITY - VOC SAMPLING AREA: CHANDRAPUR, MAHARASTRA
SAMPLING SITE: BILT GUEST HOUSE - 23.03.11 - 24.03.11
CONC (µg/m3)
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
0.50
0.43
0.43
114.69
29.10
4.80
0.57
PARAMETERS
Benzene
Tert-Butylbenzene
Carbontetrachloride
Dichloromethane
Napthalene
Toluene
1,2,4-Trimethylbenzene

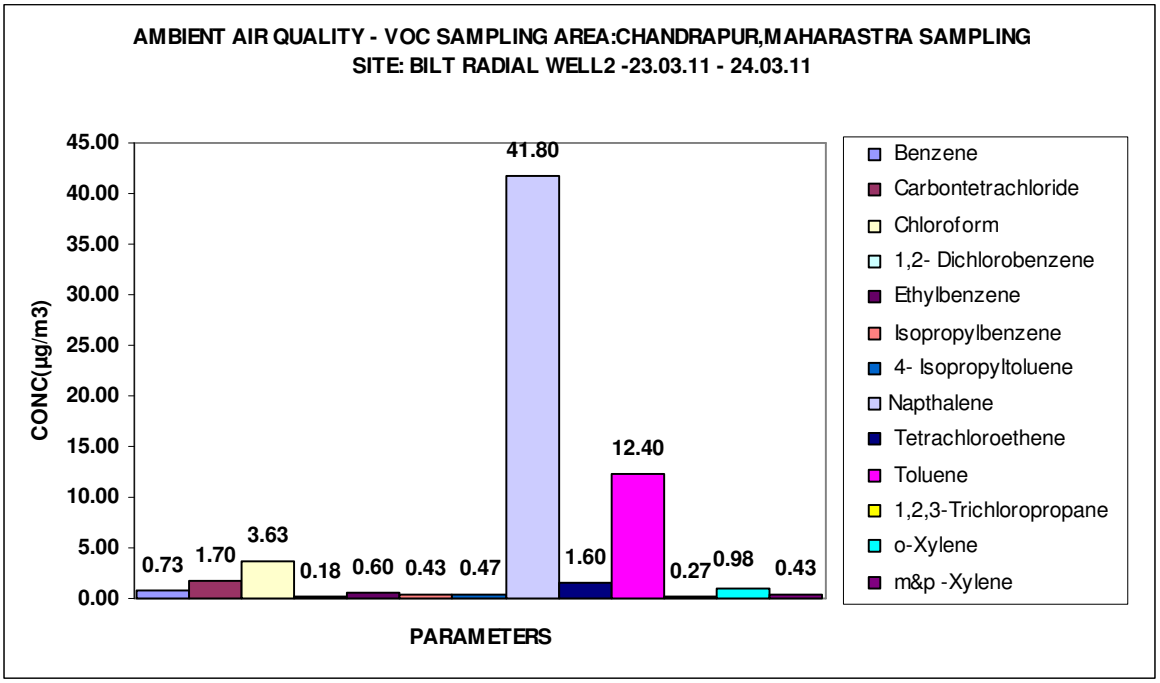

AMBIENT AIR QUALITY - VOC SAMPLING AREA
CHANDRAPUR,MAHARASTRA SAMPLING SITE: BILT GUEST HOUSE -
24.02.11
0%
3%
20%
77%
Benzene
Tert-Butylbenzene
Carbontetrachloride
Dichloromethane
Napthalene
Toluene
1,2,4-Trimethylbenzene

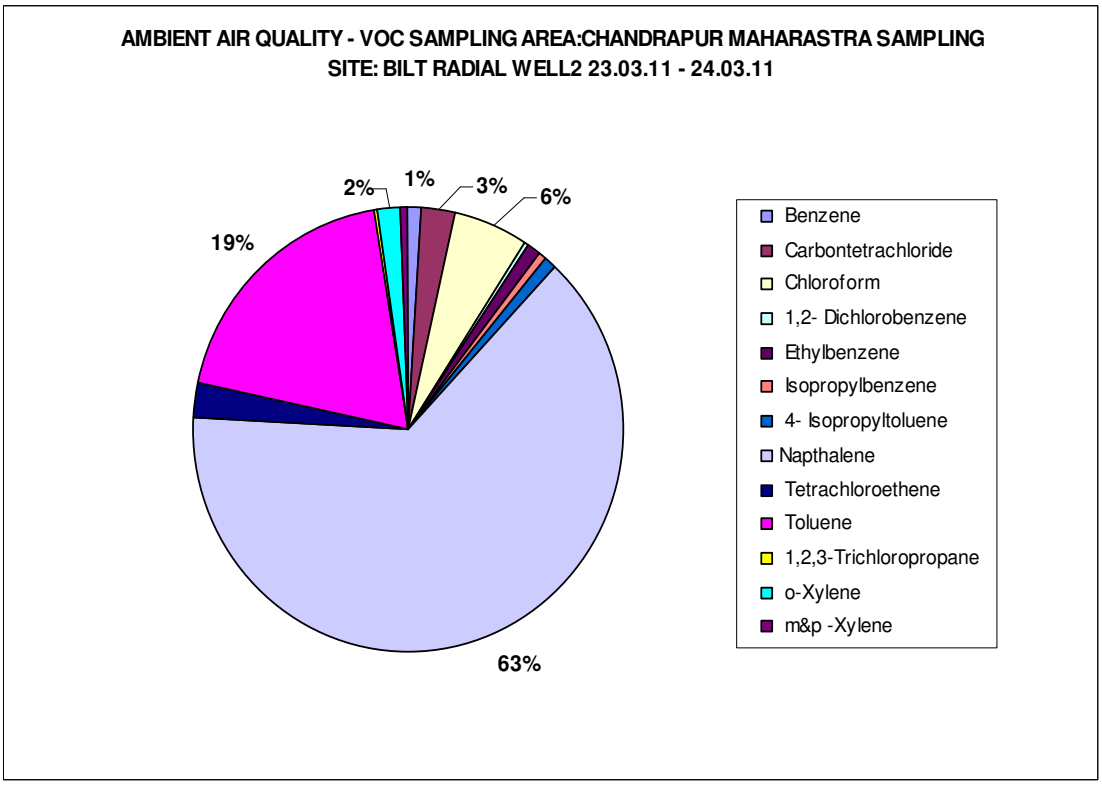
Station 5: Premises of M/S BILT RADIAL WELL in the South West direction of industrial area.

The AAQ station-5 is identified as up-wind station as per prevailing wind direction at the time of the study.

S.No.	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: CHANDRAPUR,MAHARASTRA				
	SAMPLING SITE:M/S BILT RADIAL WELL 2 23.03.11 - 24.03.11				
	PARAMETERS	LOCATION I TIME:18.00 -2.00	LOCATION II TIME:2.00 - 10.00	LOCATION III TIME: 10.00 -18.00	AVERAGE
		RESULTS (µg/m3)			
1	Benzene	0.2	1.1	0.9	0.73
2	Carbontetrachloride	1	3	1.1	1.70
3	Chloroform	2.68	4.8	3.4	3.63
4	1,2- Dichlorobenzene	0.53	BDL	BDL	0.18
5	Ethylbenzene	BDL	1.8	BDL	0.60
6	Isopropylbenzene	BDL	1.3	BDL	0.43
7	4- Isopropyltoluene	BDL	1.4	BDL	0.47
8	Naphthalene	12.2	8.7	104.5	41.80
9	Tetrachloroethene	BDL	4.8	BDL	1.60
10	Toluene	4.6	31.3	1.3	12.40
11	1,2,3-Trichloropropane	BDL	0.8	BDL	0.27
12	o-Xylene	0.55	2.4	BDL	0.98
13	m&p –Xylene	BDL	1.3	BDL	0.43
	TOTAL VOC	**21.76**	**62.7**	**111.2**	**65.22**

13 VOCs are detected in this location in which Naphthalene concentration (104.5 µg/m^3) is found maximum in the third cycle in this location followed by Toluene.


AMBIENT AIR QUALITY - VOC SAMPLING AREA:CHANDRAPUR,MAHARASTRA SAMPLING
SITE: BILT RADIAL WELL2 -23.03.11 - 24.03.11
CONC(µg/m3)
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.73
1.70
3.63
0.18
0.60
0.43
0.47
41.80
1.60
12.40
0.27
0.98
0.43
PARAMETERS
Benzene
Carbontetrachloride
Chloroform
1,2- Dichlorobenzene
Ethylbenzene
Isopropylbenzene
4- Isopropyltoluene
Napthalene
Tetrachloroethene
Toluene
1,2,3-Trichloropropane
o-Xylene
m&p -Xylene


AMBIENT AIR QUALITY - VOC SAMPLING AREA:CHANDRAPUR MAHARASTRA SAMPLING
SITE: BILT RADIAL WELL2 23.03.11 - 24.03.11
2%
1%
3%
6%
19%
63%
Benzene
Carbontetrachloride
Chloroform
1,2- Dichlorobenzene
Ethylbenzene
Isopropylbenzene
4- Isopropyltoluene
Napthalene
Tetrachloroethene
Toluene
1,2,3-Trichloropropane
o-Xylene
m&p -Xylene

AMBIENT AIR QUALITY MONITORING ANALYSIS REPORT: CHANDRAPUR

(23/03/11 - 24/03/11)

24 hours' average concentration of total VOCs at each location with average of each cycle is depicted in following Table for the ease of comparison.

Station No	Sampling Locations	TVOCs Concentrations (micro gram / cubic meters)		
1	Premises of M/s.Multi organics (p) Ltd in the North direction of industrial area. **(23/03/11 - 24/03/11)**	131.24 (12:30 Hrs - 20:30Hrs)	102.66 (20:30 Hrs - 04:30 Hrs)	0.0 (04:30 Hrs - 12:00Hrs)
		Average Concentration : 81.65		
2	Premises of M/s. Abhideep chemicals (P) Ltd in the North East of industrial area. **(23/03/11 - 24/03/11)**	0.0 (13:30 Hrs - 21:30Hrs)	179.69 (21:30 Hrs - 05:30Hrs)	101.33 (05:30 Hrs - 13:30Hrs)
		Average Concentration : 93.67		
3	Premises of M/s Chandrapur Pipes, (G-Zone) in East direction of industrial area. **(23/03/11 - 24/03/11)**	23.12 (16:00 Hrs - 24:00Hrs)	117.83 (24:00 Hrs - 08:00Hrs)	34.46 (08:00 Hrs - 16:00Hrs)
		Average Concentration : 58.47		
4	Premises of M/s BILT guest house E-25 (E-Zone) in the North West direction of industrial area. **(23/03/11 - 24/03/11)**	20.61 (17:35 Hrs - 1:35Hrs)	344.72 (1:35 Hrs - 09:35Hrs)	86.24 (09:35 Hrs - 17:35Hrs)
		Average Concentration : 150.52		
5	Premises of BILT Radial well-2 (A-Zone) in the South West direction of industrial area). **(23/02/11 - 2402/11)**	21.76 (18:00 Hrs - 2:00Hrs)	62.7 (2:00 Hrs - 10:00Hrs)	111.2 (10:00 Hrs - 18:00Hrs)
		Average Concentration : 65.22		

A A Q M Station in up wind direction : Station-5
A A Q M Station in down wind direction : Station-2
A A Q M Station in Cross wind direction : Station- 1, 3 & 4

Land Use Classification	Industrial Zone
Sky Conditions	Sunny Sky
Ambient Temperature	22°C to 30°C
Predominant Wind Directions	South West to North North East and South to North

Sampling and Analysis Methodology Adopted: EPA TO-17

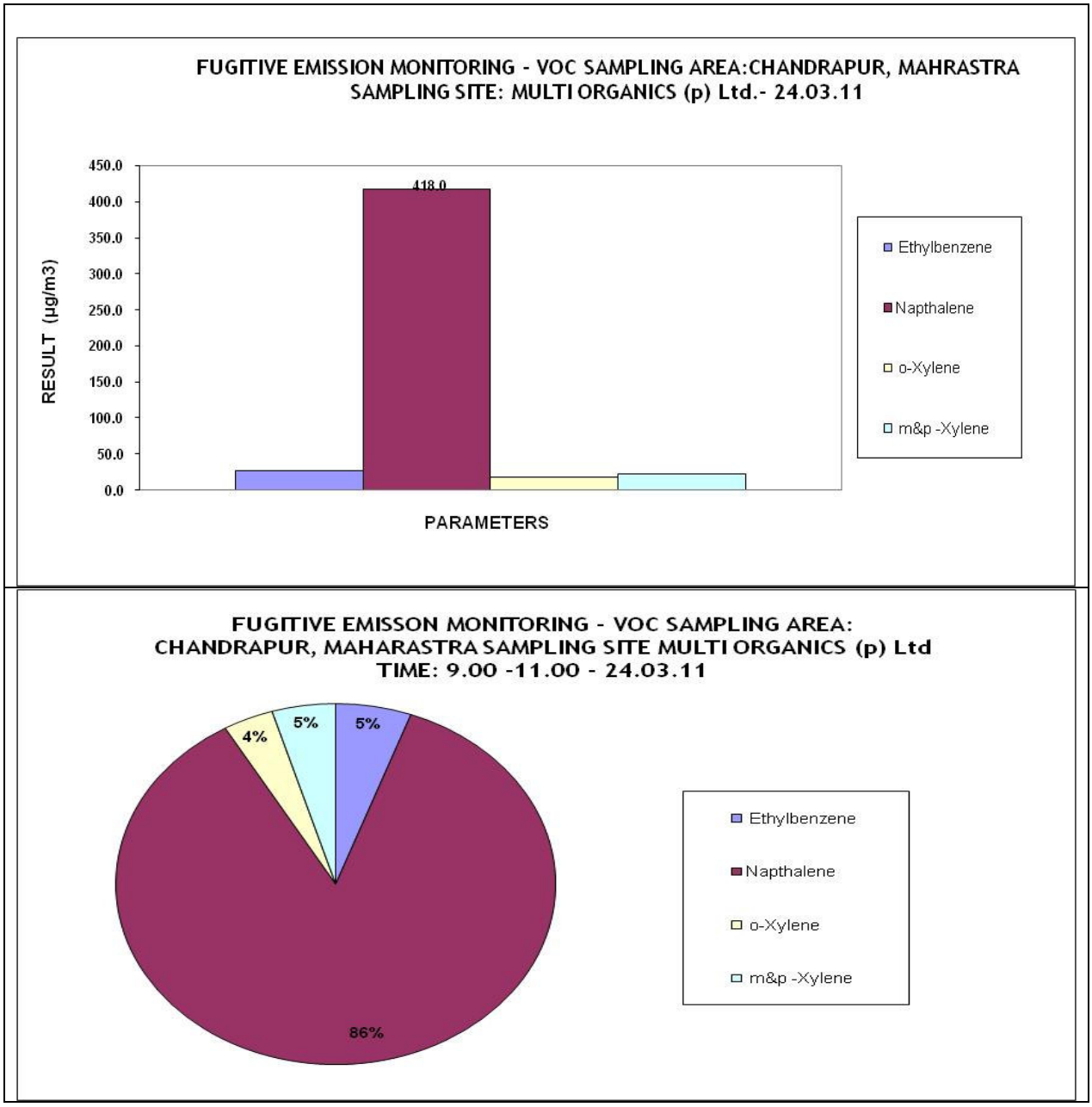
Change in the concentration of VOCs observed in each cycle of the entire 24 hours monitoring at almost all stations. That may due to the change in batch process steps of the industries, weekly shutdown, and maintenance/repair in the plants/storages/machineries could be the probable causes of the same. Dichloromethane, Chloromethane, Chloroform, Styrene, Ethyl benzene and Chlorobenzene are having pre-dominant presence among other VOCs at these locations.

7.3 Result of Monitoring at Industries:

7.3.1 M/s MULTI ORGANICS

Samples of fugitive emissions were collected from the unit and analysed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be in the range of 14 to 485.7µg/m^3. Napthalene is highest concentration was found at the location near Neutralisation area when compared to other detected VOCs.

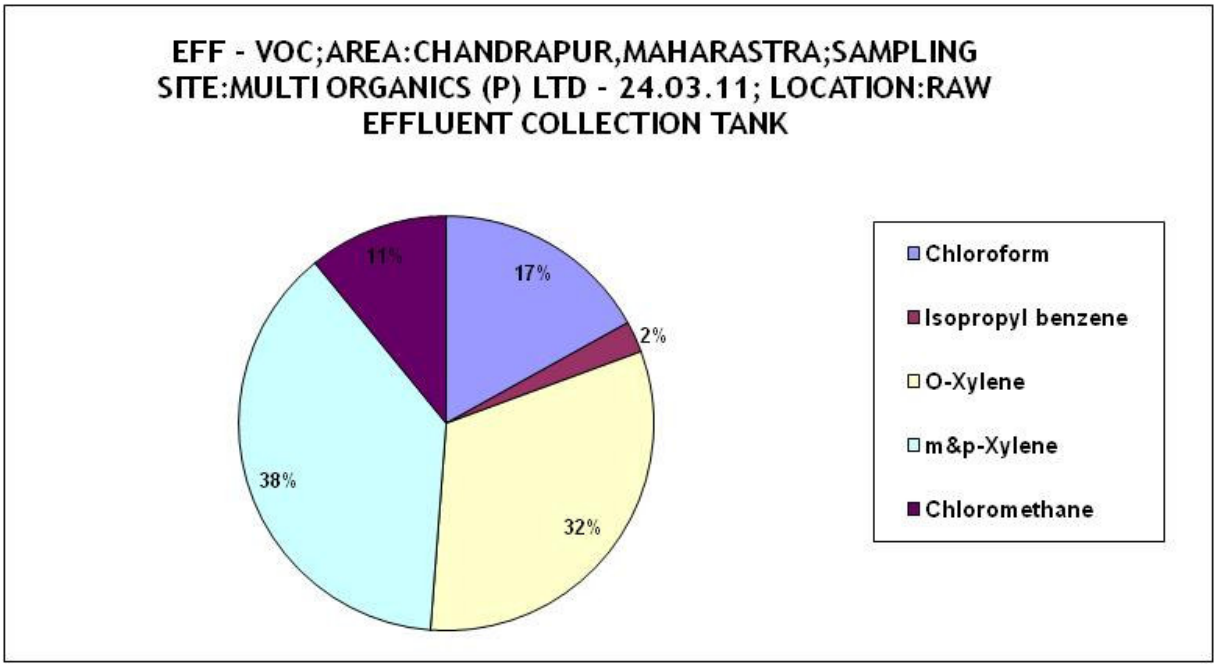
S.No.	FUGITIVE EMISSION MONITORING - VOC		
	SAMPLING AREA:CHANDRAPUR , MAHARASTRA		
	SAMPLING SITE:MULTI ORGANICS (P) Ltd. - 24.03.11		
	PARAMETERS	NEUTRALISATION AREA - TIME:9.00 -11.00	PRODUCTION BLOCK TIME:11.00-1.00
		RESULTS (µg/m3)	
1	Ethylbenzene	27.0	BDL
2	Napthalene	418.0	14.0
3	o-Xylene	18.0	BDL
4	m&p -Xylene	22.7	BDL
TOTAL VOC		**485.7**	**14.0**


FUGITIVE EMISSION MONITORING - VOC SAMPLING AREA:CHANDRAPUR, MAHRASTRA
SAMPLING SITE: MULTI ORGANICS (p) Ltd.- 24.03.11
RESULT (µg/m3)
450.0
400.0
350.0
300.0
250.0
200.0
150.0
100.0
50.0
0.0
418.0
PARAMETERS
Ethylbenzene
Napthalene
o-Xylene
m&p -Xylene
FUGITIVE EMISSON MONITORING - VOC SAMPLING AREA:
CHANDRAPUR, MAHARASTRA SAMPLING SITE MULTI ORGANICS (p) Ltd
TIME: 9.00 -11.00 - 24.03.11
5%
5%
4%
86%
Ethylbenzene
Napthalene
o-Xylene
m&p -Xylene

Effluent Water Analysis:

The sample was collected in the raw effluent collection tank and found less concentration of few VOCs detected.

S.No.	EFFLUENT WATER - VOC SAMPLING AREA:CHANDRAPUR , MAHARASTRA SAMPLING SITE:MULTI ORGANICS (P) Ltd. - 24.03.11	
	PARAMETERS	RAW EFFLUENT COLLECTION TANK - 24.03.11 RESULTS (µg/l)
1	Chloroform	1.18
2	Isopropyl benzene	0.17
3	O-Xylene	2.22
4	m&p-Xylene	2.64
5	Chloromethane	0.76
TOTAL VOC		7.0

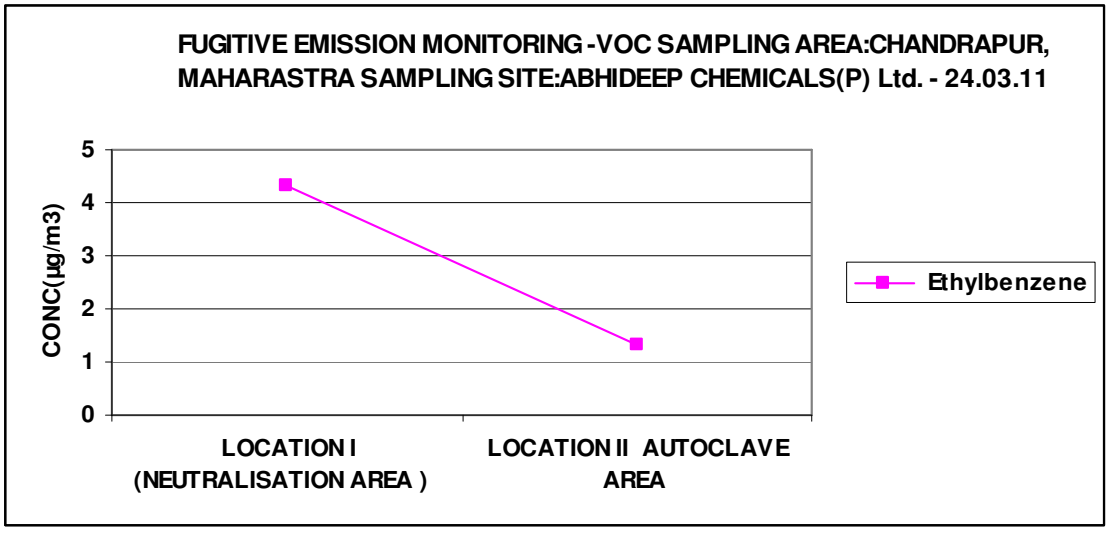


7.3.2 M/s ABHIDEEP CHEMICALS (P) Ltd

FUGITIVE EMISSION MONITORING :

Samples of fugitive emissions were collected from the unit and analysed for VOCs. The concentrations of VOCs in fugitive emission monitoring samples were found to be in the range of 1.33 to 4.3µg/m^3 for which only Ethyl benzene is detected in both the locations.

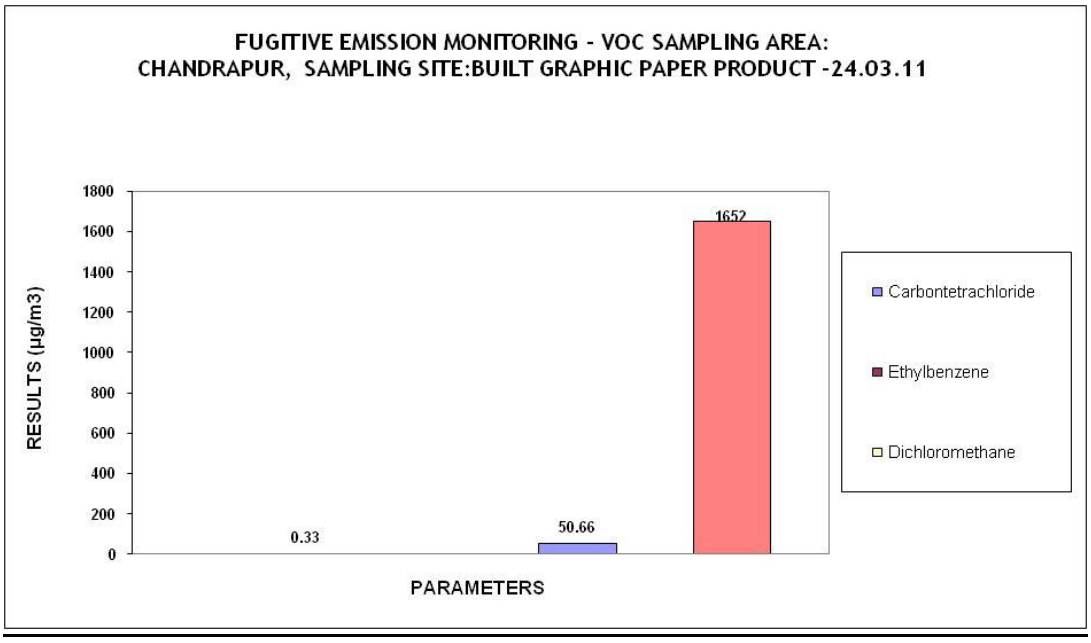
S.No.	FUGITIVE EMISSION MONITORING - VOC		
	SAMPLING AREA:CHANDRAPUR , MAHARASTRA		
	SAMPLING SITE:ABHIDEEP CHEMICALS (P) Ltd. - 24.03.11		
	PARAMETERS	NEUTRALISATION AREA TIME:12.30 -14.30	AUTOCLAVE AREA TIME:12.40-14.40
		RESULTS (µg/m3)	
1.0	Ethylbenzene	4.3	1.3
TOTAL VOC		4.3	1.3



7.3.3 M/s. BUILT GRAPHIC PAPER PRODUCT

Sample of fugitive emissions was collected from the unit and analysed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be in the range 0.33 -1652µg/m^3 in which Dichloromethane is found to higher concentration compared to other VOCs.

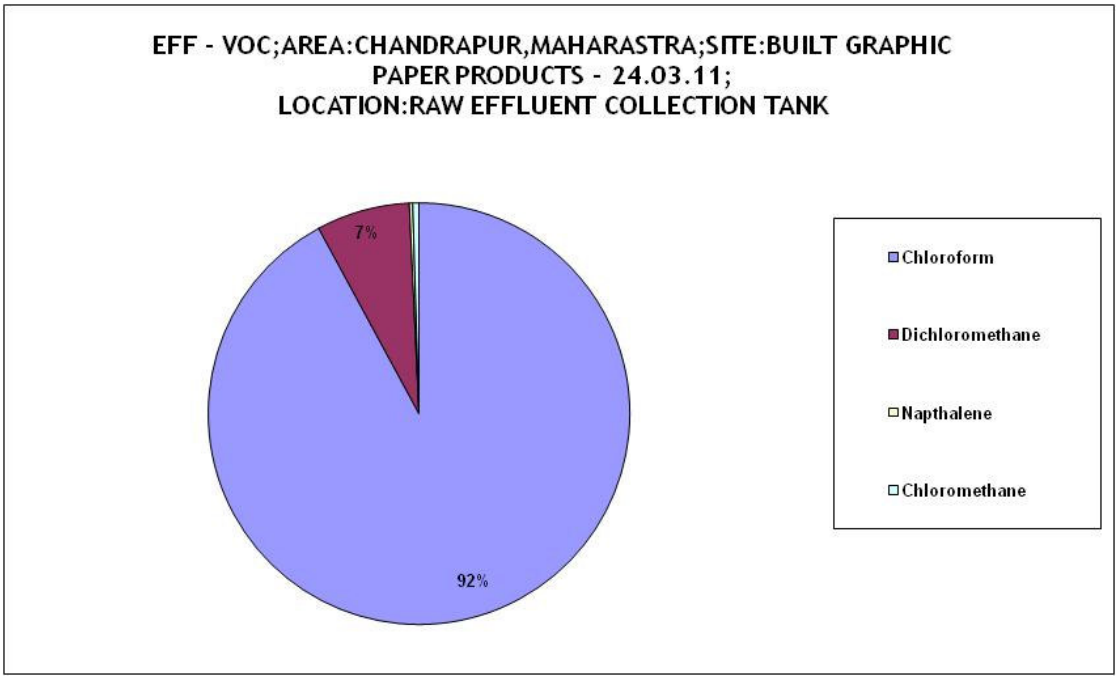
S.No.	FUGITIVE EMISSION MONITORING - VOC		
	SAMPLING AREA:CHANDRAPUR , MAHARASTRA		
	SAMPLING SITE:BUILT GRAPHIC PAPER PRODUCT - 24.03.11		
	PARAMETERS	SOLVENT RECOVERY AREA TIME:9.00 -11.00	RAW MATERIAL STORAGE AREA TIME:11.30-13.30
		RESULTS (µg/m3)	RESULTS (µg/m3)
1	Carbontetrachloride	BDL	50.66
2	Ethylbenzene	0.33	BDL
3	Dichloromethane	BDL	1652
TOTAL VOC		0.33	1702.66



Effluent Water Analysis:

The concentration of the VOCs in sample collected from raw effluent collection tank (i.e. effluent receiving sump) was detected Chloroform of high concentration followed by Dichloromethane.

S.No.	EFFLUENT WATER - VOC SAMPLING AREA:CHANDRAPUR , MAHARASTRA SAMPLING SITE:BUILT GRAPHIC PAPER PRODUCTS	
	PARAMETERS	RAW EFFLUENT COLLECTION TANK - 24.03.11 RESULTS (µg/l)
1	Chloroform	482.78
2	Dichloromethane	37.53
3	Napthalene	1.34
4	Chloromethane	2.52
TOTAL VOC		524.2



7.3.4 Results of Monitoring at Water Samples:

CHANDRAPUR - MIDC, Chandrapur:

CETP – Collection Tank

The concentration of the VOCs in sample collected from CETP's raw effluent collection tank (i.e. effluent receiving sump) was found to be BDL.

VOLATILE ORGANIC COMPOUND (BOREWELL WATER)	
SAMPLING AREA:CHANDRAPUR, MAHRASTRA	
SAMPLING SITE:CHANDRAPUR - MIDC - 23.03.11	
LOCATION:ASHOK GEDAM HOUSE	
PARAMETERS	**RESULTS (µg/l)**
TOTAL VOC	BDL

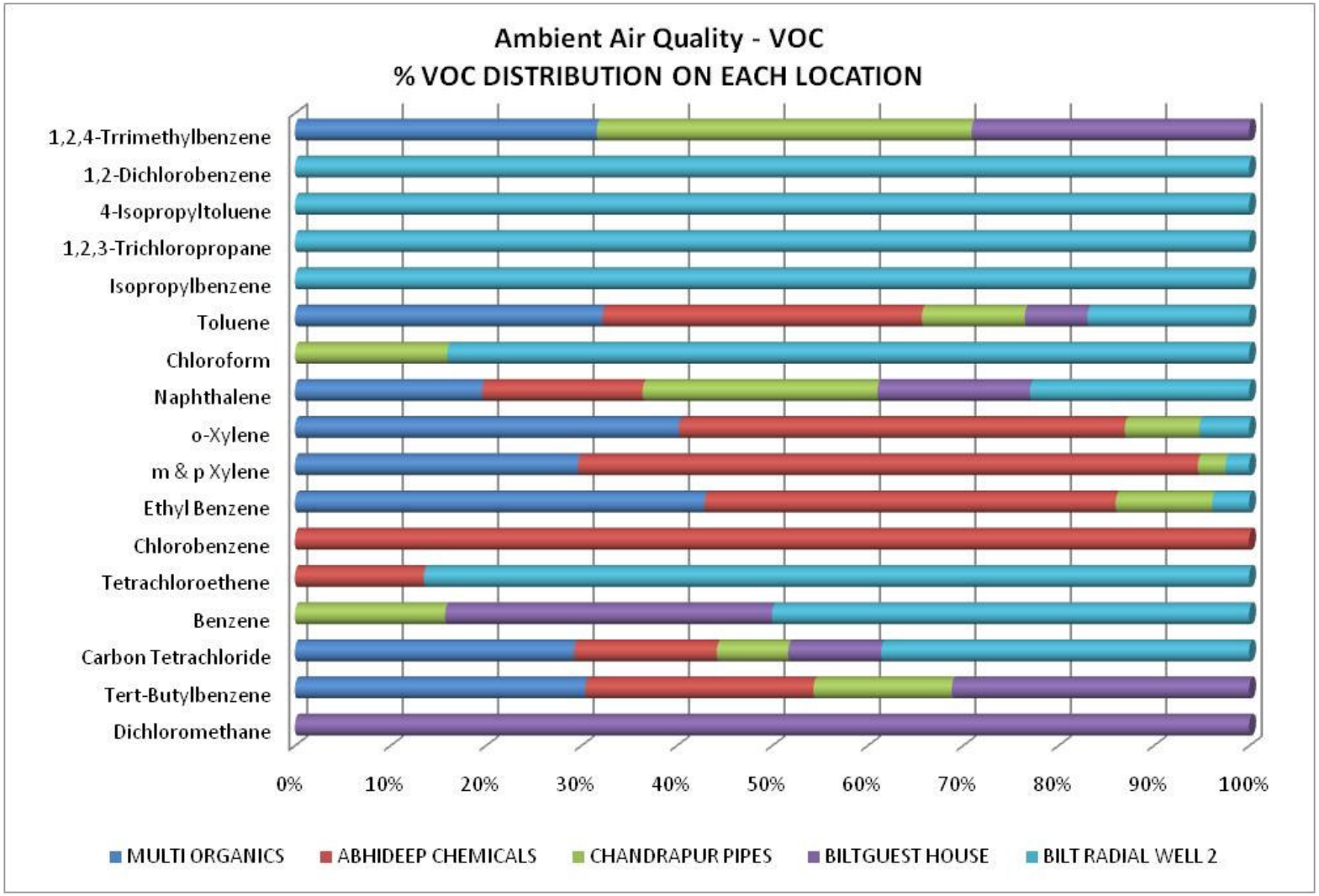
VOLATILE ORGANIC COMPOUND 2110015606 (WATER)	
SAMPLING AREA:CHANDRAPUR & BALLARPUR, MAHRASTRA	
SAMPLING SITE:BALLARPUR - 24.03.11	
LOCATION:WARDHA RIVER	
PARAMETERS	**BDL**
TOTAL VOC	BDL

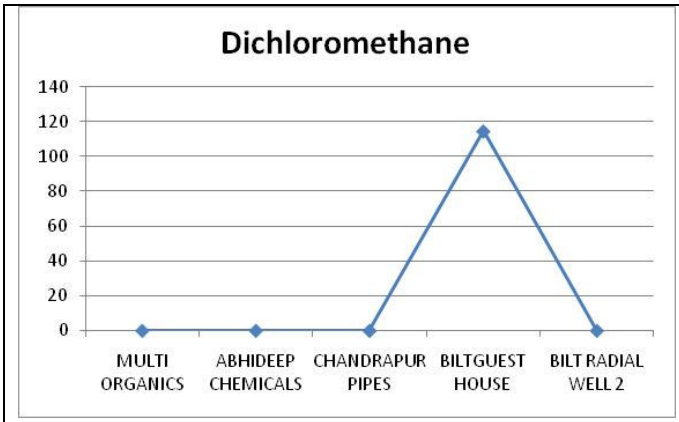
The water samples collected from Ashok Gedam House and Wardha River shows BDL

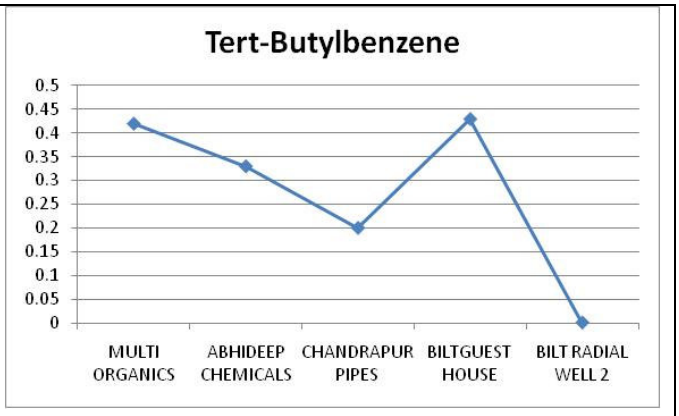
7.4 Observation and Findings on CHANDRAPUR Industrial Area

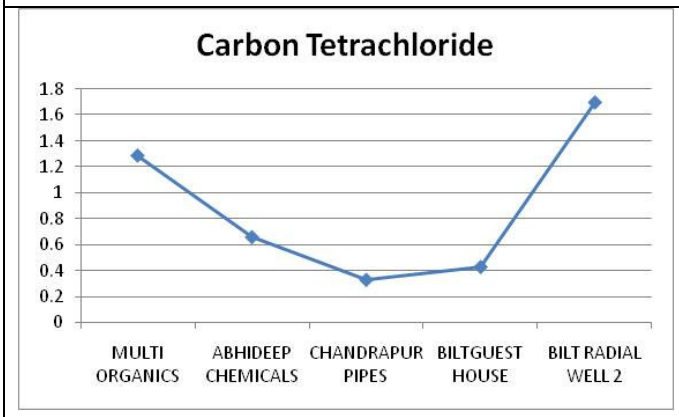
- The order of the pollutant in Ambient Air is Dichloromethane, Benzene, Chloroform, Tetrachloroethane, Xylene, Ethylbenzene, Naphthalene, Chlorobenzene and Carbon tetrachloride and the presence of these compounds was observed at almost all the monitored locations.
- Concentration of Toluene and Napthalene observed to be more in almost all the locations among the VOCs detected whereas at some cycle of monitoring and few locations Tetrachloroethene, Carbon tetrachloride, Ethylebenzene, 1,2,4-Trimethyl benzene and Xylene were also found with less concentration.
- The probable places of loss of VOCs are Centrifuging, filtration, glands, charging material into the reactors, solvent storage area, distillation and ETP area.
- Total 12 VOCs including 4 highly toxic and suspected carcinogenic compounds are found during monitoring at Chandrapur.
- The total VOCs concentration was measured at all locations, in the range of 1.25 ug/m3 – minimum to 344 ug/m3.
- ATD method found to have reported many compounds which are relevant to the industries used solvents and some have no relevance to solvents used in industries, because of may be the impurities in their used solvents.
- Average concentration of predominant and total VOCs found in each locations and the % distribution of individual VOCs in each locations is depicted in the following table and chart.

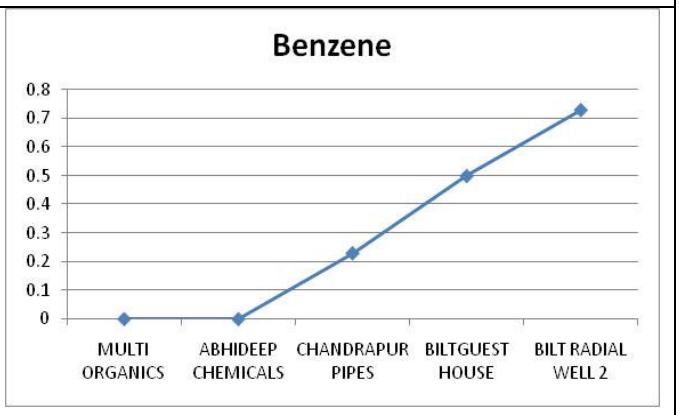
AMBIENT AIR QUALITY - VOC [Results µg/m3]					
PRESENCE OF VOC IN PARAMETER WISE FOR ALL LOCATIONS					
Parameter	MULTI ORGANICS	ABHIDEEP CHEMICALS	CHANDRAPUR PIPES	BILTGUEST HOUSE	BILT RADIAL WELL 2
Dichloromethane	BDL	BDL	BDL	114.69	BDL
Tert-Butylbenzene	0.42	0.33	0.2	0.43	BDL
Carbon Tetrachloride	1.29	0.66	0.33	0.43	1.7
Benzene	BDL	BDL	0.23	0.5	0.73
Tetrachloroethene	BDL	0.25	BDL	BDL	1.6
Chlorobenzene	BDL	10.63	BDL	BDL	BDL
Ethyl Benzene	6.66	6.68	1.57	BDL	0.6
m & p Xylene	5.15	11.27	0.5	BDL	0.43
o-Xylene	7.54	8.76	1.46	BDL	0.98
Naphthalene	35.74	30.61	44.82	29.1	41.8
Chloroform	BDL	BDL	0.69	BDL	3.63
Toluene	23.59	24.5	7.9	4.8	12.4
Isopropylbenzene	BDL	BDL	BDL	BDL	0.43
1,2,3-Trichloropropane	BDL	BDL	BDL	BDL	0.27
4-Isopropyltoluene	BDL	BDL	BDL	BDL	0.47
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	0.18
1,2,4-Trrimethylbenzene	0.62	BDL	0.77	0.57	BDL

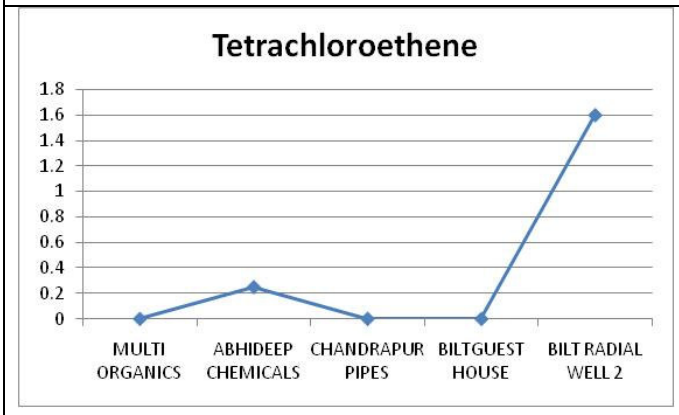

Ambient Air Quality - VOC
% VOC DISTRIBUTION ON EACH LOCATION
1,2,4-Trrimethylbenzene
1,2-Dichlorobenzene
4-Isopropyltoluene
1,2,3-Trichloropropane
Isopropylbenzene
Toluene
Chloroform
Naphthalene
o-Xylene
m & p Xylene
Ethyl Benzene
Chlorobenzene
Tetrachloroethene
Benzene
Carbon Tetrachloride
Tert-Butylbenzene
Dichloromethane
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2

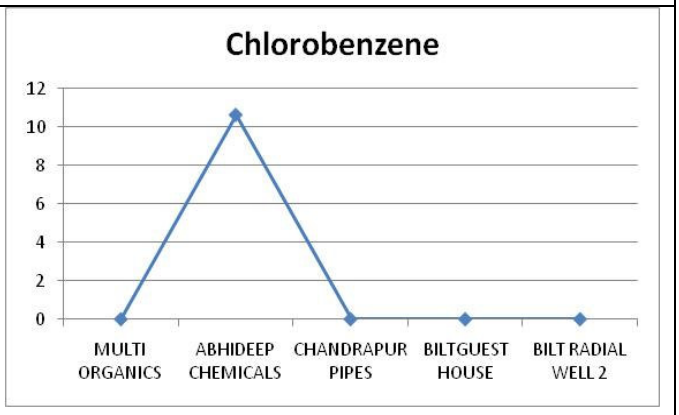

Dichloromethane
140
120
100
80
60
40
20
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2

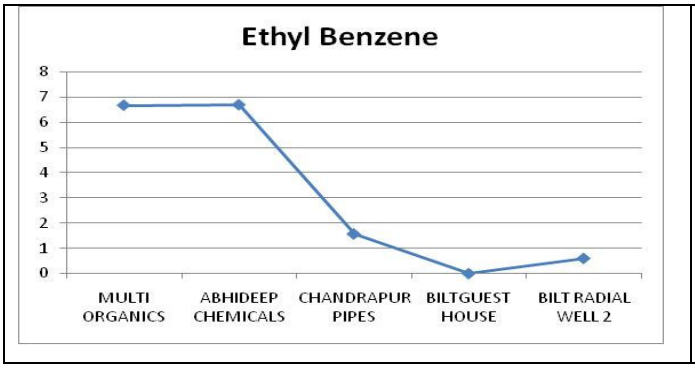

Tert-Butylbenzene
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2

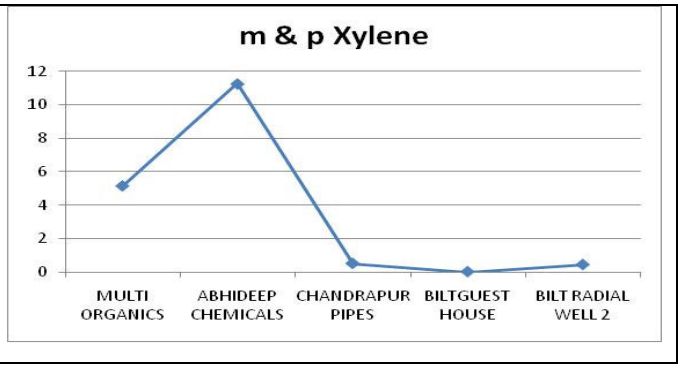

Carbon Tetrachloride
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2

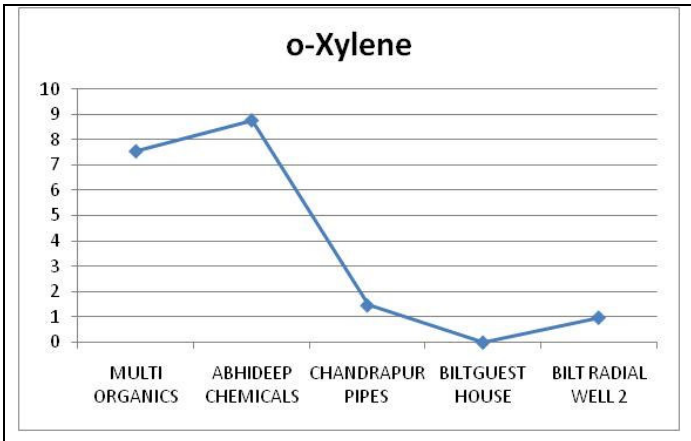

Benzene
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2

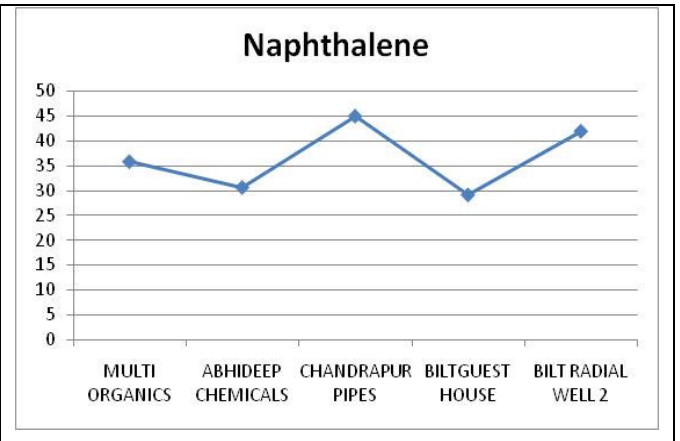

Tetrachloroethene
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2

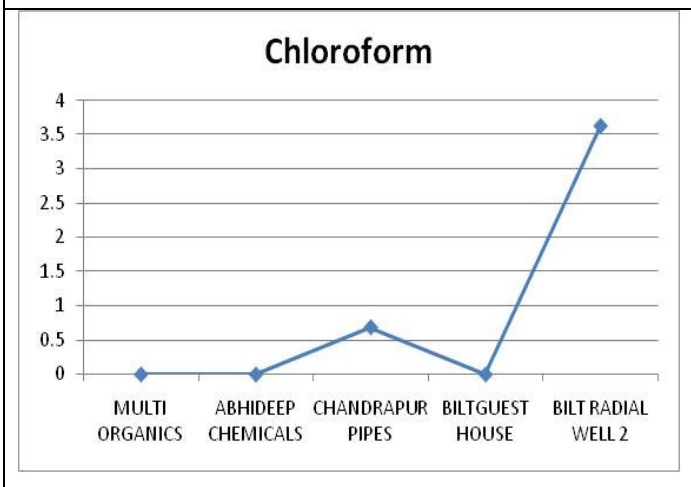

Chlorobenzene
12
10
8
6
4
2
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2

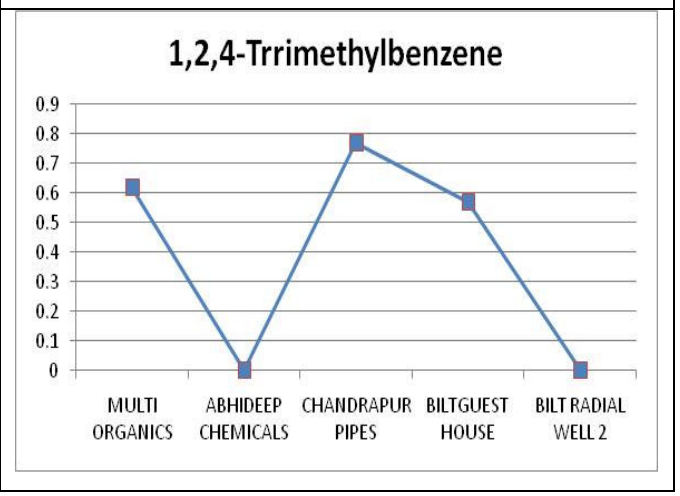

Ethyl Benzene
8
7
6
5
4
3
2
1
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2


m & p Xylene
12
10
8
6
4
2
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2


o-Xylene
10
9
8
7
6
5
4
3
2
1
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2


Naphthalene
50
45
40
35
30
25
20
15
10
5
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2


Chloroform
4
3.5
3
2.5
2
1.5
1
0.5
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2

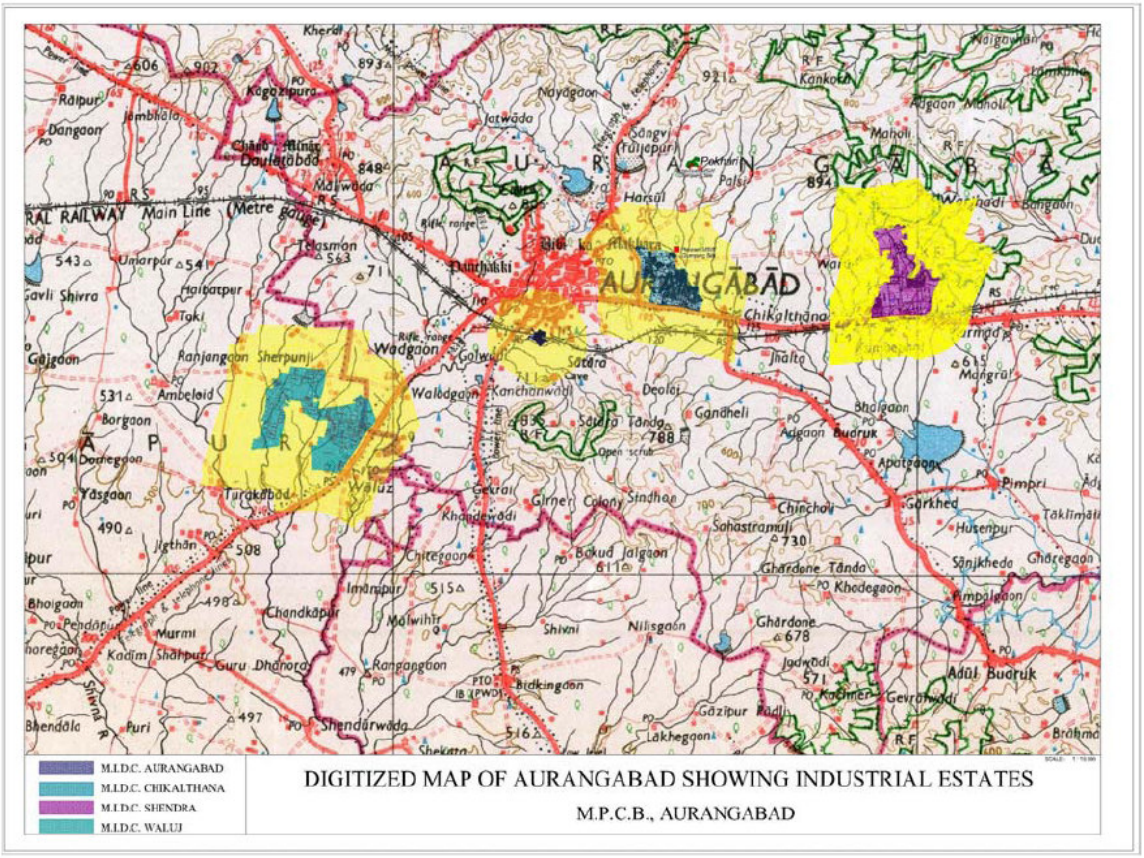

1,2,4-Trrimethylbenzene
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
MULTI ORGANICS
ABHIDEEP CHEMICALS
CHANDRAPUR PIPES
BILTGUEST HOUSE
BILT RADIAL WELL 2

VOC PROJECT REPORT ON AURANGABAD INDUSTRIAL AREA

CHAPTER – VIII

8.0 About Aurangabad Industrial Estate:

Aurangabad District is located mainly in the Godavari River Basin and partly in the Tapi River Basin. The district is from 19 to 20 degrees north longitude and 74 to 76 degrees east latitude. Aurangabad city is situated on the bank of river Kham a tributary of the Godavari River. The entire city is situated at the latitude of 19o53'50" N and longitude of 75o22'46" E. It is located 512 meters above Sea Level. The city is surrounded by hills of the Vindhya Ranges and the river Kham passes through it.



Industry classification and distribution (no. of industries per 10 sq.km area or fraction).

There are four clusters of industries in Aurangabad district. However, also there is scattered Industrial development along the periphery of Aurangabad city along beed Road and Paithan road. Renowned companies such as Wockhardt Ltd, United Spirits Ltd, Bajaj Auto Ltd, Orchid Chemicals & Pharmaceuticals Ltd., Skoda Ltd, Johnson & Johnson Ltd., Colgate Palmolive Ltd, Garware Polyesters Ltd, Sterlite Technologies Ltd., etc are in operation in Aurangabad.

Details of Industrial Cluster of Aurangabad

Sr No	Name of Industrial Cluster	Distance from Aurangabad	Area in Hectares	Remarks
1	Shendra MIDC Area,	15 Km	600	New developing area SEZ units
2.	Railway Station MIDC	Within AMC area	20	Very small industrial area also having many sick units
3.	Chikalthana MIDC Area	Within AMC area	400	Old industrial area having mostly sick units
4	Waluj MIDC Area	12 Km	1520	Major Ind. Area near A'bad city

.7.2 Red category industries (54 categories)

Sr. No.	MIDC	No. of industries in red category
1.	Shendra	07
2.	Chikalthana	24
3.	Waluj	257
4.	Rly. Stn. MIDC	5
	Total	293

1.7.3 Orange and Green category industries

Sr. No.	MIDC	Orange category	Green category	Total
1	Shendra	04	15	19
2	Chikalthana	11	181	192
3	Waluj	181	962	1143
4	Rly. Stn. MIDC	05	14	19
	Total	201	1162	1363

1.7.4 Grossly Polluting industries

Sr. No.	Type of Industries	No. of industries
	Nil	

There are 05 effluent generating industries in Shendra MIDC. The total trade effluent generation in the area is 700 CMD. Industries have provided adequate effluent

treatment for treatment of trade effluent. The treated effluent is applied on land for gardening / irrigation purposes. Most of the industries have provided septic tank/STP for treatment of domestic waste. The run-offs from the treated, domestic and trade effluent may find its way into the Sukhna river. Hence, upstream and downstream of this confluence point needs to be considered for water quality monitoring. This MIDC is categorized as 5-star MIDC. New units are coming up here and it is incumbent upon them to strictly adhere to the air, water and soil pollution norms that have been laid down, right from inception.

Chikhalthana MIDC houses 21 trade effluent generating industries. This is an old industrial estate and within the Aurangabad Municipal Corporation limits. Most of the units are closed down and a few sick units are operational. Owing to escalating cost of land within the municipal corporation limits, many industries are now monetizing their land assets by selling to commercial developers who want to construct malls and commercial complexes on erstwhile industrial land. The effluent, trade/domestic, to the tune of 200 CMD finds its way into the Sukhna river. Of this, only a very small percentage is completely treated waste.

The MIDC at Waluj has the maximum concentration of industries in Aurangabad District. Of these, many are newly developing industries. The number of industries is 105 and the effluent generated is about 10.72 MLD. Large and medium scale industries have provided primary / secondary effluent treatment plants and most of them have septic tanks or sewage treatment plants for domestic waste water. The run-offs/seepages/percolates enter the river Kham. This river ultimately confluences with the Godavari upstream of Jaikwadi dam. A CETP is completed and is awaiting

8.1 RESULTS & DISCUSSIONS:

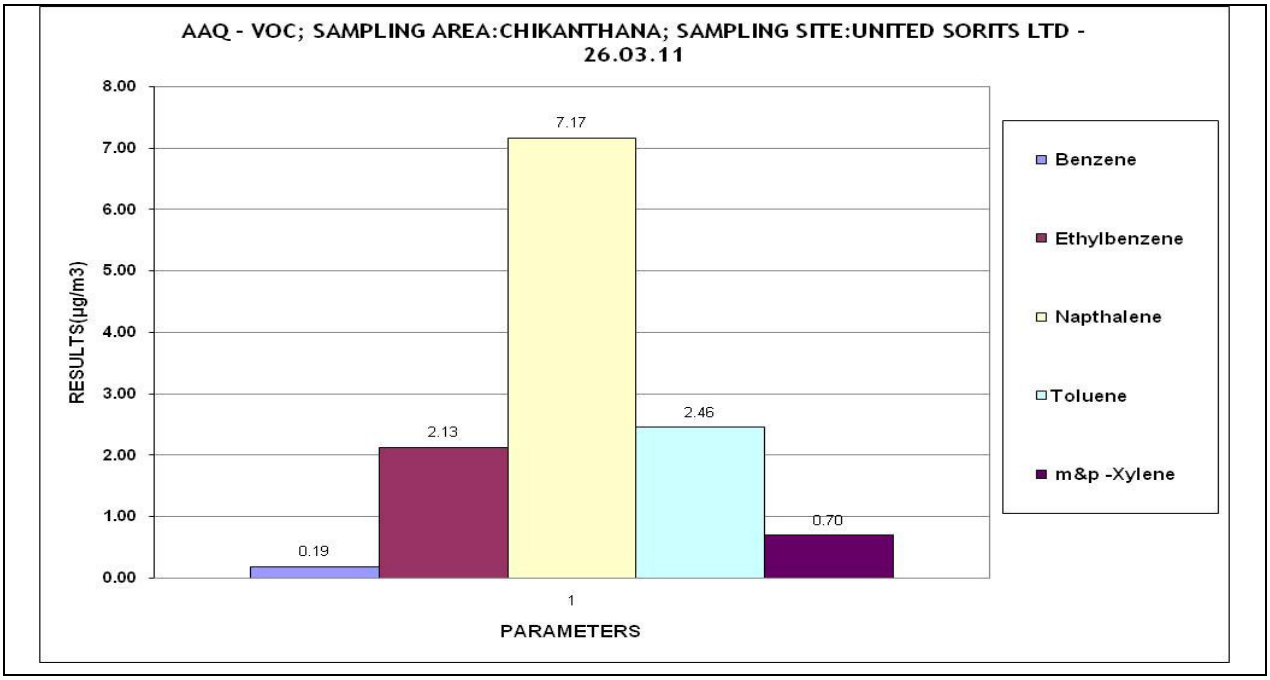
8.1.1 Results & Discussion for Ambient Air Quality Monitoring at Aurangabad:-

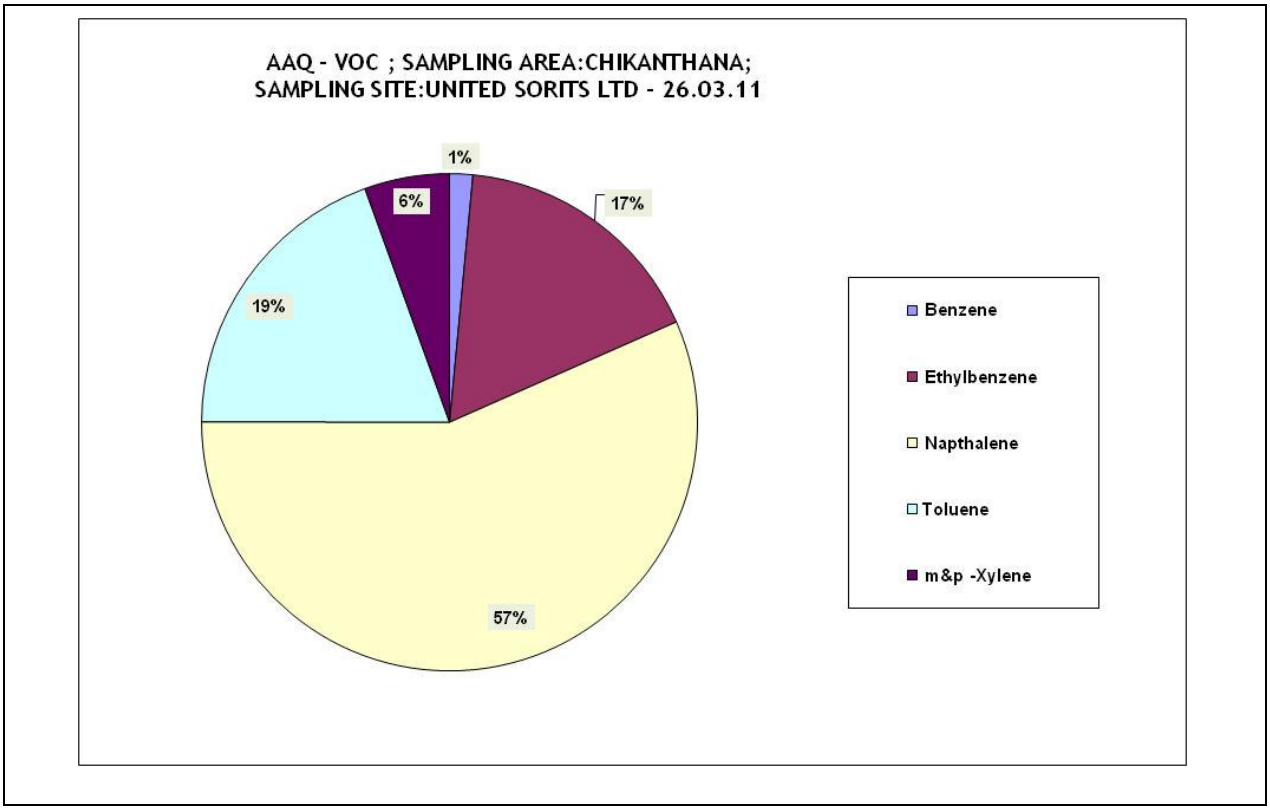
Station 1: Premises of United Sprits Ltd is in the South West direction of industrial area.

This station is located in up-wind direction of the industrial estate. 5 VOCs are detected in this location. The AAQM Station-1 was identified as up-wind station as per the prevailing wind direction at the time of the study. The wind direction was South West to North East and some time South to North. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 75%. Approximate height from ground level is 20 feet.

S.No	AMBIENT AIR QUALITY – VOC				
	SAMPLING AREA: CHIKANTHANA&WALUJ,MAHARASTRA				
	SAMPLING SITE: UNITED SPRITS LTD – 26.03.11 TO 27.03.11				
	PARAMETERS	TIME:10.45-18.45	TIME:18.45-02.45	TIME:02.45-10.45	AVERAGE
		RESULTS (µg/m^3)			
1	Benzene	0.57	BDL	BDL	0.19
2	Ethylbenzene	6.40	BDL	BDL	2.13
3	Napthalene	21.50	BDL	BDL	7.17
4	Toluene	7.37	BDL	BDL	2.46
5	m&p –Xylene	2.10	BDL	BDL	0.70
TOTAL VOC =		**37.94**	**0.00**	**0.00**	**12.65**

Total 5 VOCs was found in the first cycle of the monitoring and rest of the cycle was not detected any VOCs. Concentration of Napthalene was found to be highest in the detected VOCs.



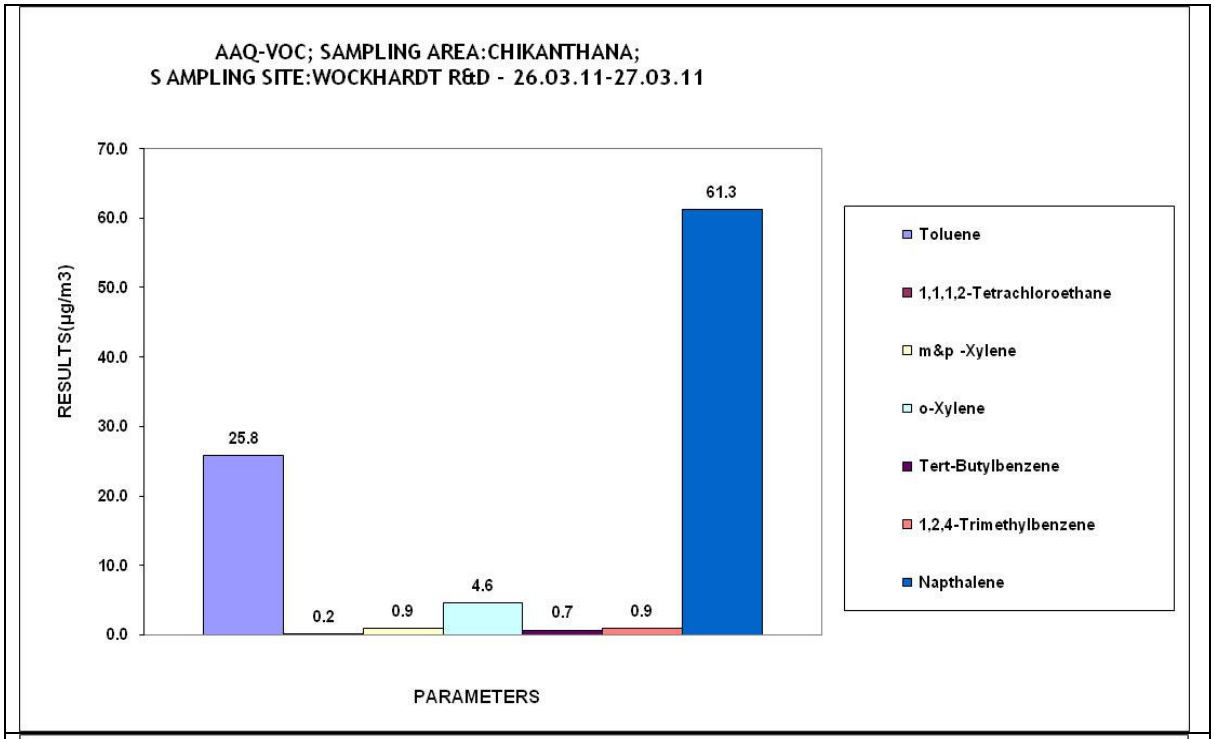

AAQ - VOC ; SAMPLING AREA:CHIKANTHANA;
SAMPLING SITE:UNITED SORITS LTD - 26.03.11
1%
17%
6%
19%
57%
Benzene
Ethylbenzene
Napthalene
Toluene
m&p -Xylene

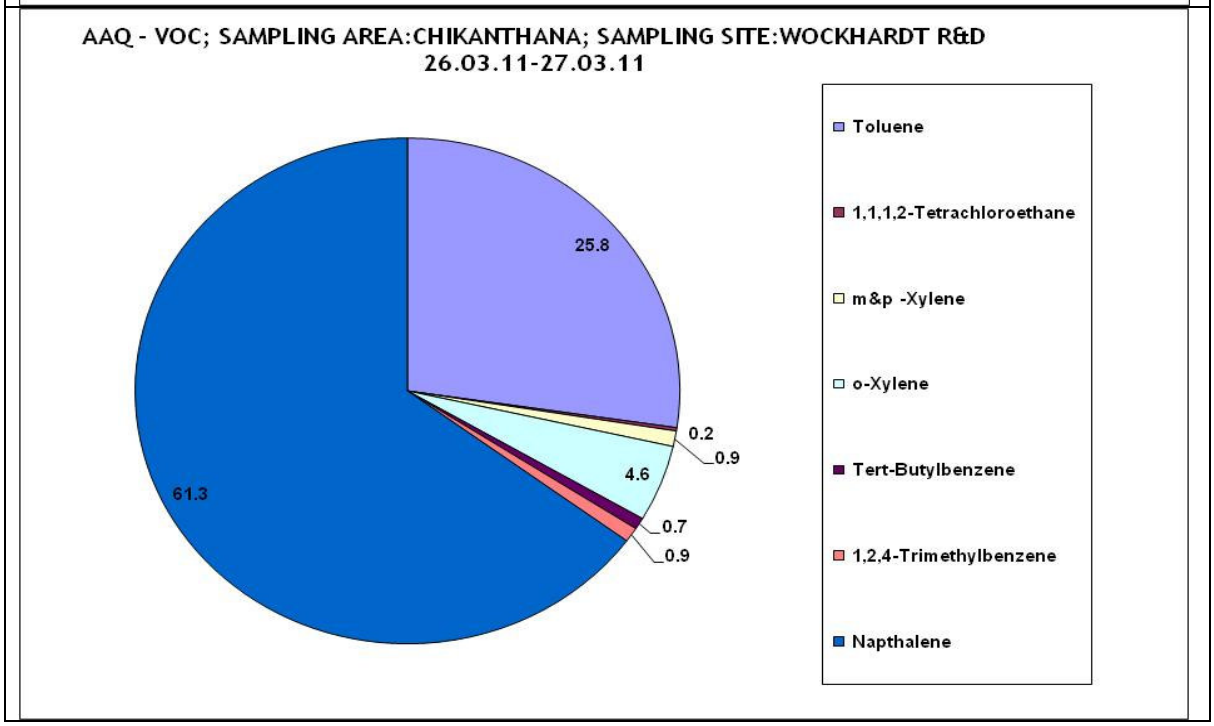
Station 2: Premises of WOCKHARDT R&D in the North East direction of industrial area.

The AAQ station-2 is identified as Down-wind station as per prevailing wind direction at the time of the study. Total 7 VOCs are detected in this location. The wind direction was South-West to North-East and some time South to North. The ambient temperature was in the range between 22 – 30°C and the Relative humidity in the range of 50 – 75%. Approximate height from ground level is 15 feet.

S.No	AMBIENT AIR QUALITY – VOC				
	SAMPLING AREA: CHIKANTHANA,MAHARASTRA				
	SAMPLING SITE:WOCKHARDT R&D - 26.03.11 TO 27.03.11				
	PARAMETERS	TIME:11.45-19.45	TIME:19.45-03.45	TIME:03.45-11.45	AVERAGE
		RESULTS (µg/m^3)			
1	Toluene	70.1	BDL	7.33	25.81
2	1,1,1,2-Tetrachlororethane	0.6	BDL	BDL	0.2
3	m&p -Xylene	2.82	BDL	BDL	0.94
4	o-Xylene	13.87	BDL	BDL	4.62
5	Tert-Butylebenzene	0.91	BDL	1.2	0.70
6	1,2,4-Trimethylbenzene	BDL	BDL	2.65	0.88
7	Napthalene	48.9	BDL	135	61.3
TOTAL VOC =		**137.2**	**BDL**	**138.85**	**94.46**

Napthalene is found maximum concentration in the third cycle of the monitoring followed by Toluene, 1,1,1,2-Tetrachloroethane, m&p-Xylene, o-Xylene, Tert-Butylbenzene, and 1,2,4-Trimethylbenzene .


AAQ-VOC; SAMPLING AREA:CHIKANTHANA;
S AMPLING SITE:WOCKHARDT R&D - 26.03.11-27.03.11
RESULTS(µg/m3)
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
25.8
0.2
0.9
4.6
0.7
0.9
61.3
PARAMETERS
Toluene
1,1,1,2-Tetrachloroethane
m&p -Xylene
o-Xylene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
Napthalene

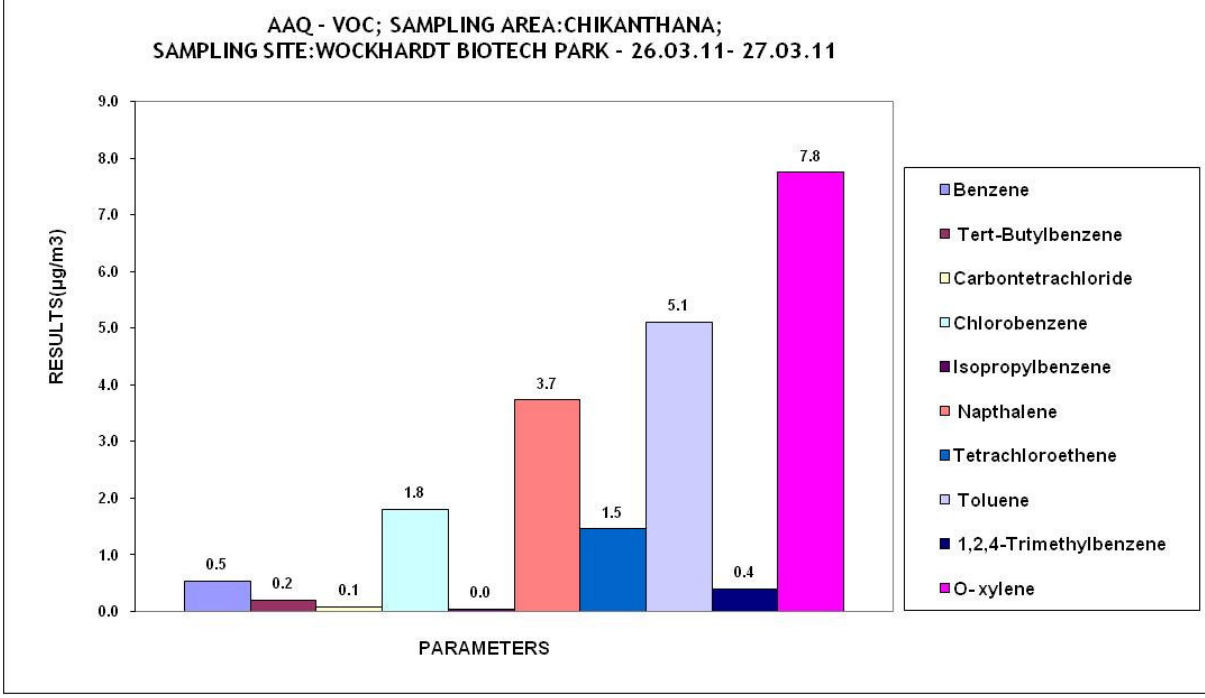

AAQ - VOC; SAMPLING AREA:CHIKANTHANA; SAMPLING SITE:WOCKHARDT R&D
26.03.11-27.03.11
25.8
0.2
0.9
4.6
0.7
0.9
61.3
Toluene
1,1,1,2-Tetrachloroethane
m&p -Xylene
o-Xylene
Tert-Butylbenzene
1,2,4-Trimethylbenzene
Napthalene

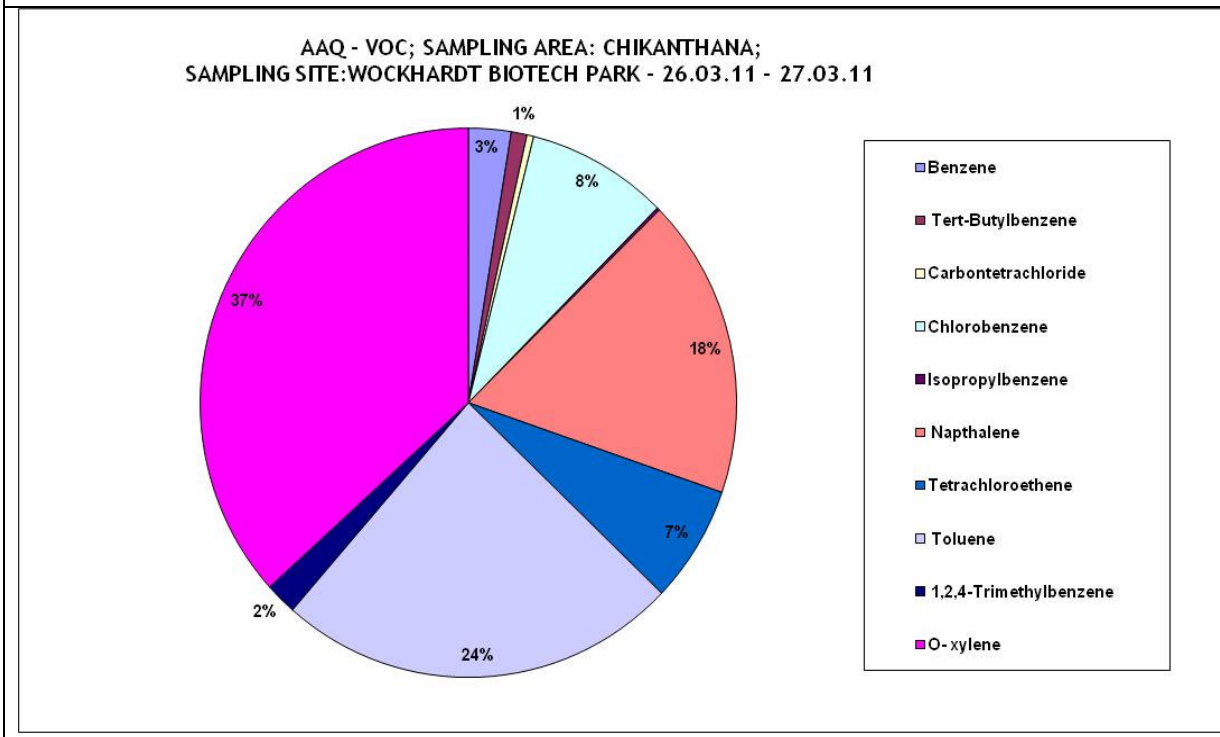
Station 3: Premises of Wockhardt Biotech park in East direction of industrial area.

The AAQ station-3 is identified as Cross-wind station as per prevailing wind direction at the time of the study.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: CHIKANTHANA,MAHARASTRA				
	SAMPLING SITE:WOCKHARDT BIOTECH PARK - 26.03.11 TO 27.03.11				
	PARAMETERS	TIME:13.50-21.50	TIME:21.50-05.50	TIME:05.50-13.50	AVERAGE
		RESULTS (µg/m3)			
1	Benzene	1.6	BDL	BDL	0.5
2	Tert-Butylbenzene	0.6	BDL	BDL	0.2
3	Carbontetrachloride	0.3	BDL	BDL	0.09
4	Chlorobenzene	5.4	BDL	BDL	1.8
5	Isopropylbenzene	0.1	BDL	BDL	0.04
6	Napthalene	11.2	BDL	BDL	3.7
7	Tetrachloroethene	4.4	BDL	BDL	1.5
8	Toluene	15.3	BDL	BDL	5.1
9	1,2,4-Trimethylbenzene	1.2	BDL	BDL	0.4
10	o-Xylene	23.3	BDL	BDL	7.7
TOTAL VOC =		40.1	0.0	0.0	13.4

Totally 10 VOCs are detected in this location in which Napthalene, Toluene, and o-Xylene is detected with little high concentration out of 10 detected VOCs. But overall the VOC concentrations are very less and that too detected only one cycle of the monitoring and other two cycles no VOCs are detected.


AAQ - VOC; SAMPLING AREA:CHIKANTHANA;
SAMPLING SITE:WOCKHARDT BIOTECH PARK - 26.03.11- 27.03.11
RESULTS(µg/m3)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.5
0.2
0.1
1.8
0.0
3.7
1.5
5.1
0.4
7.8
PARAMETERS
Benzene
Tert-Butylbenzene
Carbontetrachloride
Chlorobenzene
Isopropylbenzene
Napthalene
Tetrachloroethene
Toluene
1,2,4-Trimethylbenzene
O- xylene


AAQ - VOC; SAMPLING AREA: CHIKANTHANA;
SAMPLING SITE:WOCKHARDT BIOTECH PARK - 26.03.11 - 27.03.11
1%
3%
8%
18%
7%
24%
2%
37%
Benzene
Tert-Butylbenzene
Carbontetrachloride
Chlorobenzene
Isopropylbenzene
Napthalene
Tetrachloroethene
Toluene
1,2,4-Trimethylbenzene
O- xylene

Station 4: Premises of Orchid pharmaceuticals in the West direction of industrial area.

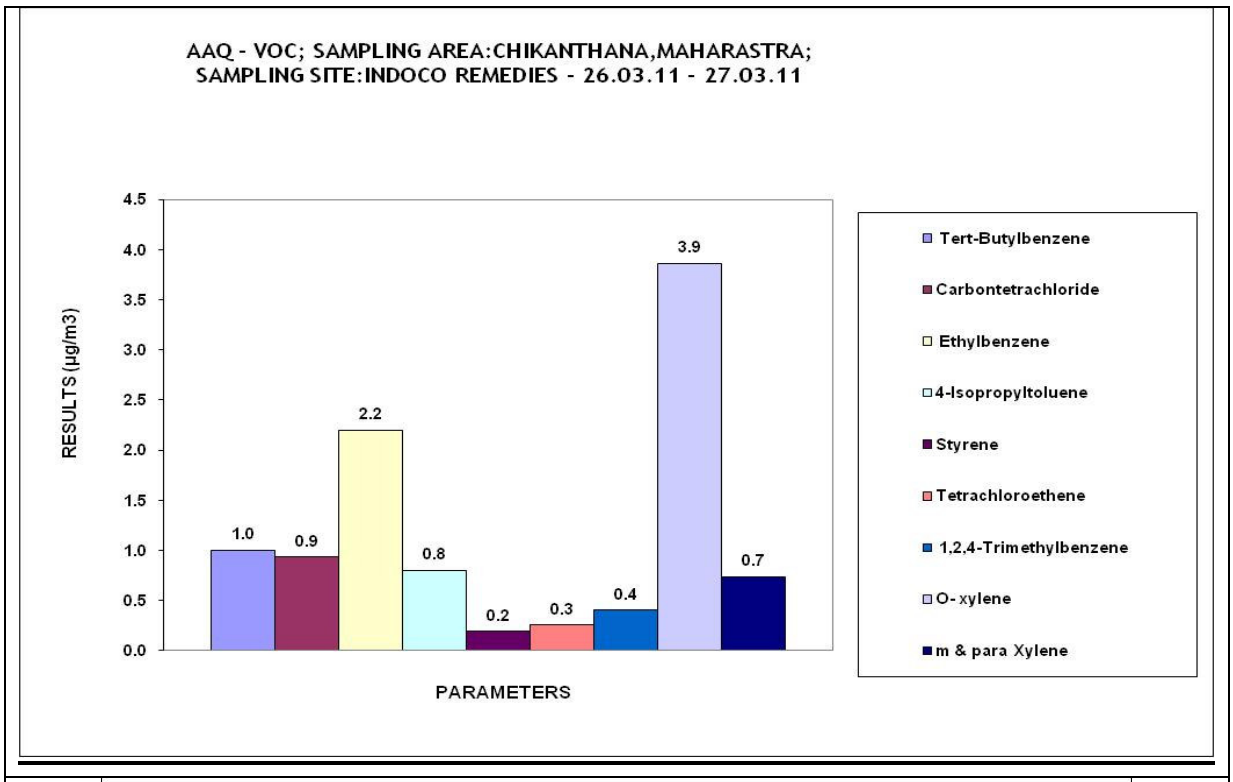
The AAQ station-4 is identified as Cross-wind station as per prevailing wind direction at the time of the study. Only Chloromethane was detected (212.1µg/m3) in the second cycle of the monitoring and rest locations no VOCs are detected.

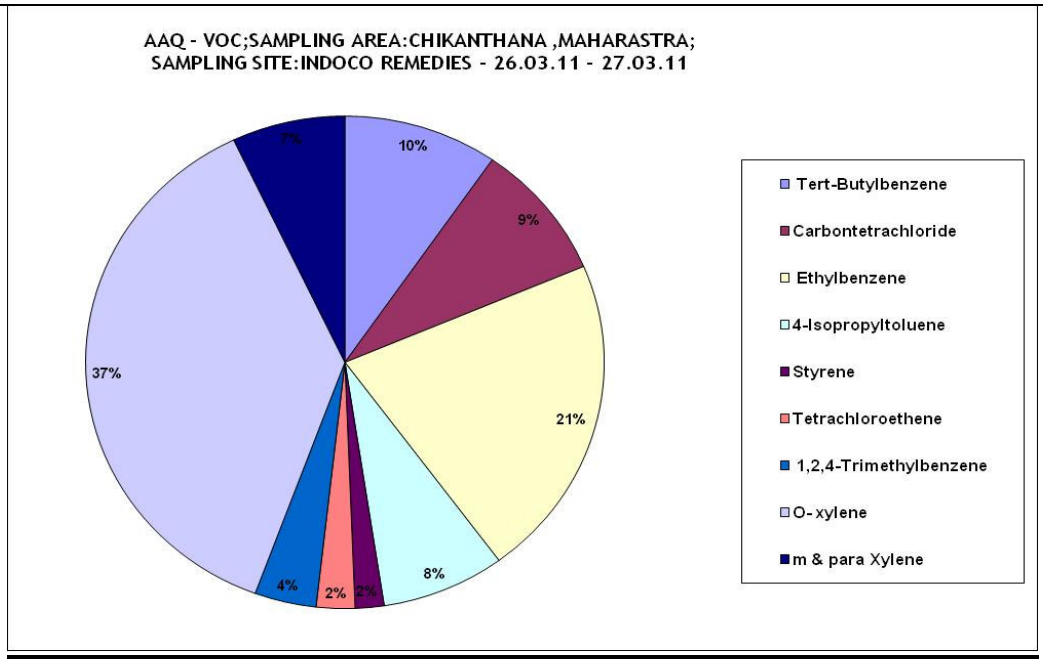
S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: AURANGABAD INDUSTRIAL ESTATE,MAHARASTRA				
	SAMPLING SITE:ORCHID PHARMA LTD - 26.03.11 TO 27.03.11				
	PARAMETERS	TIME:02.30-10.00	TIME:10.30-06.30	TIME:06.30-02.30	AVERAGE
		RESULTS (µg/m3)			
1	Chloromethane	BDL	212.1	BDL	70.66
TOTAL VOC =		BDL	212.1	BDL	70.66

Station 5: Premises of Indoco Remedies in the South direction of the industrial area.The AAQ station-5 is identified as cross wind station of the industrial area.

S.No	AMBIENT AIR QUALITY - VOC				
	SAMPLING AREA: AURANGABAD INDUSTRIAL ESTATE,MAHARASTRA				
	SAMPLING SITE:INDOCO REMEDIES - 26.03.11 TO 27.03.11				
	PARAMETERS	TIME:03.40-11.40	TIME:11.40-07.40	TIME:07.40-03.40	AVERAGE
		RESULTS (µg/m3)			
1	Tert-Butylbenzene	3	BDL	BDL	1.0
2	Carbontetrachloride	2.8	BDL	BDL	0.93
3	Ethylbenzene	6.6	BDL	BDL	2.20
4	4-Isopropyltoluene	2.4	BDL	BDL	0.8
5	Styrene	0.56	BDL	BDL	0.19
6	Tetrachloroehtene	0.75	BDL	1.30	0.25
7	1,2,4-Trimethylbenzene	1.2	BDL	BDL	0.4
8	O-Xylenne	11.6	BDL	BDL	3.87
9	m&p-Xylene	2.2	BDL	BDL	0.73
TOTAL VOC =		13.8	BDL	BDL	4.60

9 VOCs are detected in this location in which o-Xylene was found to have high concentration when compared to other detected VOCs. Only cycle of the monitoring getting detected VOCs and other two cycles no VOCs are detected.


AAQ - VOC; SAMPLING AREA:CHIKANTHANA,MAHARASTRA;
SAMPLING SITE:INDOCO REMEDIES - 26.03.11 - 27.03.11
RESULTS (µg/m3)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1.0
0.9
2.2
0.8
0.2
0.3
0.4
3.9
0.7
PARAMETERS
Tert-Butylbenzene
Carbontetrachloride
Ethylbenzene
4-Isopropyltoluene
Styrene
Tetrachloroethene
1,2,4-Trimethylbenzene
O- xylene
m & para Xylene


AAQ - VOC;SAMPLING AREA:CHIKANTHANA ,MAHARASTRA;
SAMPLING SITE:INDOCO REMEDIES - 26.03.11 - 27.03.11
10%
9%
21%
8%
2%
2%
4%
37%
7%
Tert-Butylbenzene
Carbontetrachloride
Ethylbenzene
4-Isopropyltoluene
Styrene
Tetrachloroethene
1,2,4-Trimethylbenzene
O- xylene
m & para Xylene

AMBIENT AIR QUALITY MONITORING ANALYSIS REPORT: AURANGABAD

(26/03/11 - 27/03/11)

24 hours' average concentration of total VOCs at each location with average of each cycle is depicted in following Table for the ease of comparison.

Station No	Sampling Locations	TVOCs Concentrations (micro gram / cubic meters)		
1	Premises of United - spirits Ltd in the South West direction of industrial area. **(26/03/11 - 27/03/11)**	37.94 (10:45 Hrs - 18:45Hrs)	BDL (18:45 Hrs - 02:45 Hrs)	BDL (02:45 Hrs - 10:45Hrs)
		Average Concentration : 12.65		
2	Premises of Wockhardt R&D, in the North East direction of industrial area. **(26/03/11 - 27/03/11)**	137.2 (11:45 Hrs - 19:45Hrs)	BDL (19:45 Hrs - 03:45Hrs)	138.85 (03:45 Hrs - 11:45Hrs)
		Average Concentration : 94.46		
3	Premises of Wockhardt Biotech park in East direction of industrial area. **(26/03/11 - 27/03/11)**	40.09 (13:50 Hrs - 21:50Hrs)	BDL (21:50 Hrs - 05:50Hrs)	BDL (04:00 Hrs - 12:00Hrs)
		Average Concentration : 13.36		
4	Premises of Orchid Pharma in the West direction of industrial area. **(26/03/11 - 27/03/11)**	BDL (14:20 Hrs - 22:20Hrs)	212.1 (22:20 Hrs - 06:20Hrs)	BDL (06:20 Hrs - 14:20Hrs)
		Average Concentration : 70.66		
5	Premises of Indoco remedies in the South direction of industrial area. **(26/03/11 - 26/03/11)**	13.8 (14:50 Hrs - 22:50Hrs)	BDL (22:50 Hrs - 06:50Hrs)	BDL (06:50 Hrs - 14:50Hrs)
		Average Concentration : 4.60		

A A Q M Station in up wind direction : Station-1
A A Q M Station in down wind direction : Station-2
A A Q M Station in Cross wind direction : Station-3, 4 & 5

Land Use Classification	Industrial Zone
Sky Conditions	Sunny Sky
Ambient Temperature	22°C to 30°C
Predominant Wind Directions	South West to North East and South to North

Sampling and Analysis Methodology Adopted: EPA TO-17

8.2 Result of Monitoring at Industries:

8.2.1 M/s Wockhardt R&D – 26.03.11

Samples of fugitive emissions and wastewater were collected from the unit and analysed for VOCs. The concentration of VOCs in fugitive emission monitoring sample was found to be 2.3µg/m^3. The highest concentration was found at the location near solvent storage area is 2.3µg/m3 and other location no VOCs are detected.

SAMPLING AREA:CHIKANTHANA & WALUJ , MAHARASTRA		
SAMPLING SITE:WOCKHARDT R&D - 26.03.11		
PARAMETERS	**NEAR SOLVENT STORAGE AREA TIME:12.05-14.05**	**AREATION TANK TIME:12.10-14.10**
Chloromethane	BDL	2.33
TOTAL VOC =	**BDL**	**2.33**

S.No	FUGITIVE EMISSION MONITORING - VOC	
	SAMPLING AREA:CHIKANTHANA & WALUJ , MAHARASTRA	
	SAMPLING SITE:WOCKHARDT BIOTECH - 26.03.11	
	PARAMETERS	**AERATION TANK TIME 17.20 - 19.20 Hrs**
		RESULTS (µg/m3)
1	**Chloromethane**	1.7
TOTAL VOC		**1.7**

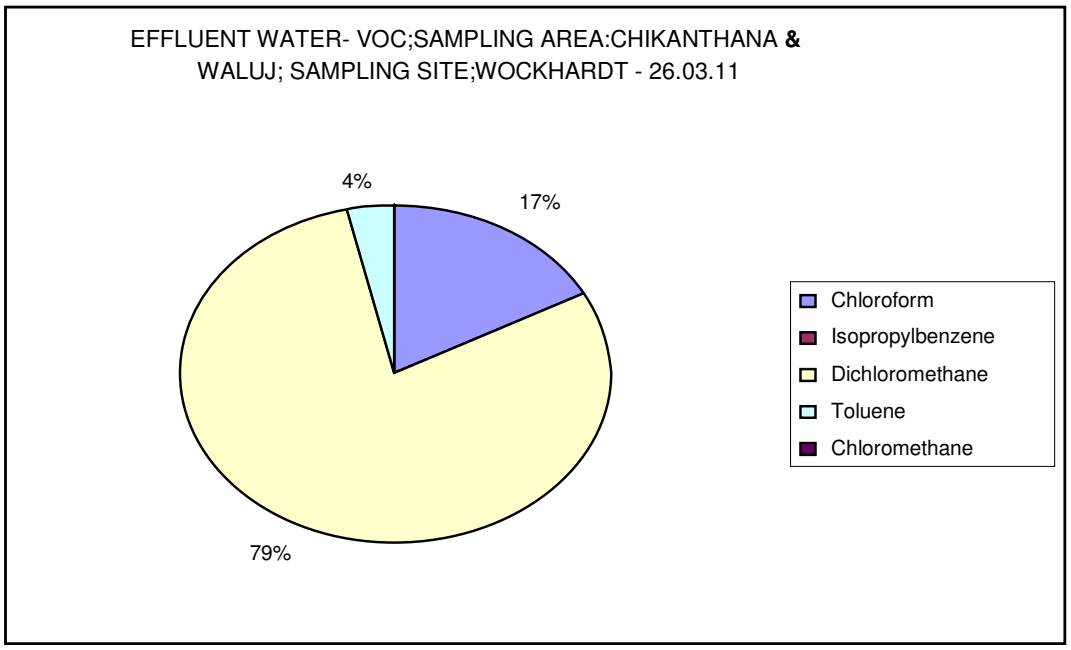
S.No	FUGITIVE EMISSION MONITORING - VOC		
	SAMPLING AREA:CHIKANTHANA & WALUJ , MAHARASTRA		
	SAMPLING SITE:ORCHID PHARMACEUTICAL - 27.03.11		
	PARAMETERS	**SOLVENT RECOVERY AREA - TIME:12.00 -14.00**	**SOLVENT TRANSPERMATION TANK TIME:12.10-14.10**
		RESULTS (µg/m3)	**RESULTS (µg/m3)**
1	**Chloromethane**	2.33	0.33
TOTAL VOC		**2.33**	**0.33**

S.No	FUGITIVE EMISSION MONITORING - VOC SAMPLING AREA:CHIKANTHANA & WALUJ , MAHARASTRA SAMPLING SITE:INDOCO REMEDIES Ltd - 27.03.11 PARAMETERS	ORALS LIQUID FORMATION AREA TIME:15.00- 17.00- RESULTS (µg/m3)	ISO PROTURON PLANT TIME:15.05-17.05 RESULTS (µg/m3)	CMAC PLANT TIME:15.10 -17.10 RESULTS (µg/m3)	AVERAGE RESULTS (µg/m3)
1	Chloromethane	**BDL**	23	**BDL**	23.00
2	1,3-Dichlorobenzene	43	**BDL**	**BDL**	43
3	1,4-Dichlorobenzene	51.7	**BDL**	**BDL**	51.7
TOTAL VOC		**94.7**	**23**	**BDL**	**117.7**

EFFLUENT WATER SAMPLE ANLAYSIS:

The concentration of VOCs in effluent sample taken from equalization tank of ETP was found to be 33.34 mg/l. The higher concentration may be due to improper separation of intermediate/solvents/products at different process stages, which also affects the treatment efficiency of the ETP.

VOLATILE ORGANIC COMPOUND (EFFLUENT WATER) SAMPLING AREA :CHIKANTHANA & WALUJ, MAHARASTRA SAMPLING SITE:WOCKARDT -26.03.11 LOCATION:RAW EFFLUENT COLLECTION TANK PARAMETERS	RESULTS (µg/l)
Choloroform	5759.00
Isopropylbenzene	1.55
Dichloromethane	26406
Toluene	1168.40
Chloromethane	9.63
TOTAL VOC =	**33.34**



ORCHID PHARMA - EFFLUENT SAMPLE ANALYSIS:

The concentration of VOCs in effluent sample taken from collection tank of ETP was found to be 5.16µg/l. comparatively it shows lower concentration may be due to fresh effluent and pumped out all the collected effluent during sampling.

VOLATILE ORGANIC COMPOUND - EFFLUENT WATER	
SAMPLING SITE:ORCHID PHARMACEUTICAL - 27.03.11	
LOCATION:RAW EFFLUENT COLLECTION TANK	
PARAMETERS	**RESULTS (µg/l)**
Chloroform	5.2
TOTAL VOC =	**5.2**

8.3 Observation and Findings on AURANGABAD Industrial Area

- The order of the pollutant in Ambient Air is Naphthalene, Toluene, Xylene, Chloromethane are found little high values and all the other detected VOCs are in very low concentrations. The presences of these compounds were observed not in all the monitored locations.

- Concentration of Toluene, Napthalene and Xylene observed in almost all the locations among the VOCs detected whereas at some cycle of monitoring and few locations Benzene, Chloromethane, 1,2,4-Trimethylbenzene, Carbon tetrachloride and Styrene were also found in few locations.

- The probable places of loss of VOCs are Centrifuging, filtration, glands, charging material into the reactors, solvent storage area, distillation and ETP area.

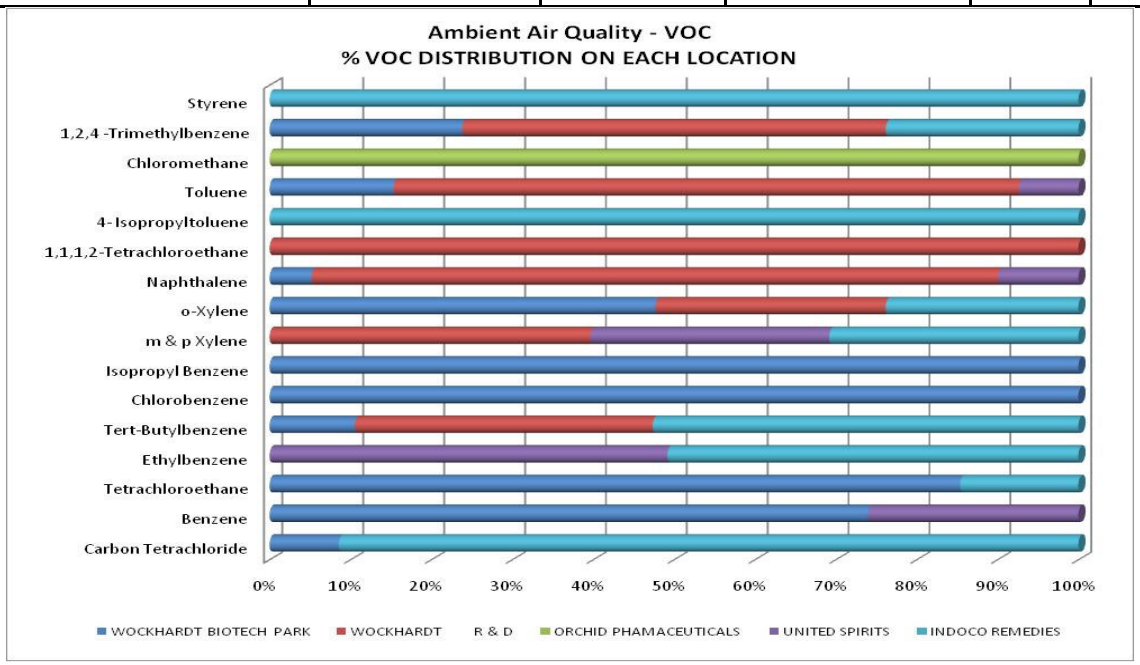
- Total 10 VOCs including 2 highly toxic and suspected carcinogenic compounds are found during monitoring at Aurangabad.

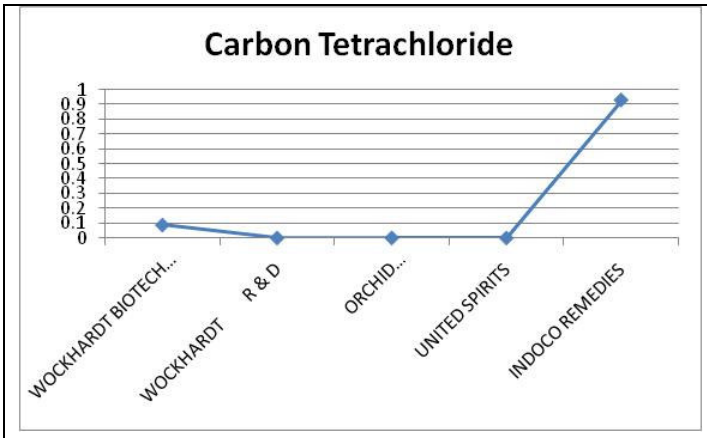
- The total VOCs concentration was measured at all locations, in the range of 4.6µg/m3 – minimum at Station-5 (INDOCO REMEDIES) to 94.5µg/m3 – maximum at Station - 2 (WOCKHARDT R&D)

- ATD method found to have reported many compounds which are relevant to the industries used solvents and some have no relevance to solvents used in industries, because of may be the impurities in their used solvents.

- Average concentration of predominant and total VOCs found in each locations and the % distribution of individual VOCs in each locations is depicted in the following table and chart.

AMBIENT AIR QUALITY - VOC (Results µg/m3)					
PRESENCE OF VOC IN PARAMETER WISE FOR ALL LOCATIONS					
Parameter	**WOCKHARDT BIOTECH PARK**	**WOCKHARDT R & D**	**ORCHID PHAMACEUTICALS**	**UNITED SPIRITS**	**INDOCO REMEDIES**
Carbon Tetrachloride	0.087	BDL	BDL	BDL	0.93
Benzene	0.54	BDL	BDL	0.19	BDL
Tetrachloroethane	1.46	BDL	BDL	BDL	0.25
Ethylbenzene	BDL	BDL	BDL	2.13	2.2
Tert-Butylbenzene	0.2	0.7	BDL	BDL	1
Chlorobenzene	1.8	BDL	BDL	BDL	BDL
Isopropyl Benzene	0.037	BDL	BDL	BDL	BDL
m & p Xylene	BDL	0.94	BDL	0.7	0.73
o-Xylene	7.75	4.62	BDL	BDL	3.87
Naphthalene	3.73	61.3	BDL	7.17	BDL
1,1,1,2-Tetrachloroethane	BDL	0.2	BDL	BDL	BDL
4- Isopropyltoluene	BDL	BDL	BDL	BDL	0.8
Toluene	5.11	25.81	BDL	2.46	BDL
Chloromethane	BDL	BDL	70.6	BDL	BDL
1,2,4 -Trimethylbenzene	0.4	0.88	BDL	BDL	0.4
Styrene	BDL	BDL	BDL	BDL	0.19




Carbon Tetrachloride
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0.8
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0.4
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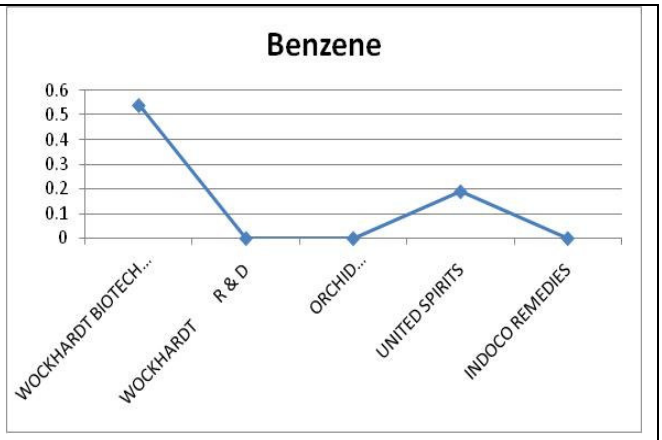
INDOCO REMEDIES
WOCKHARDT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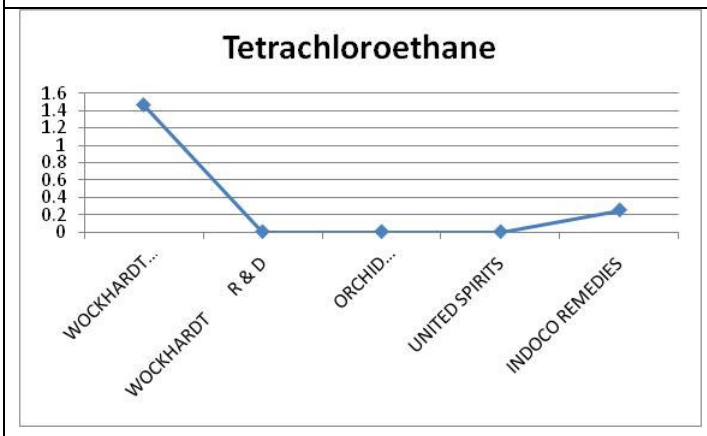
Tetrachloroethane
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1.2
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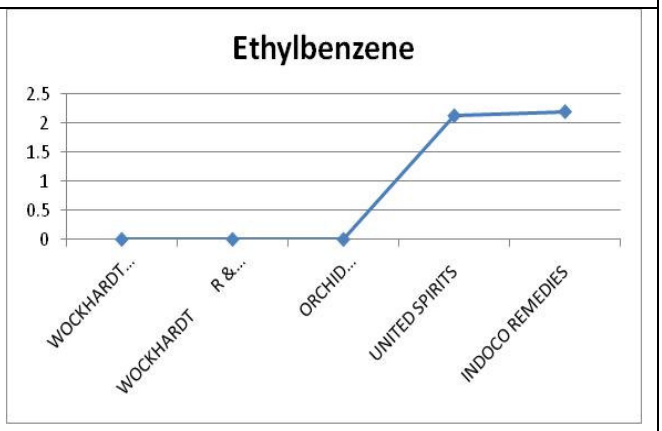
Ethylbenzene
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2
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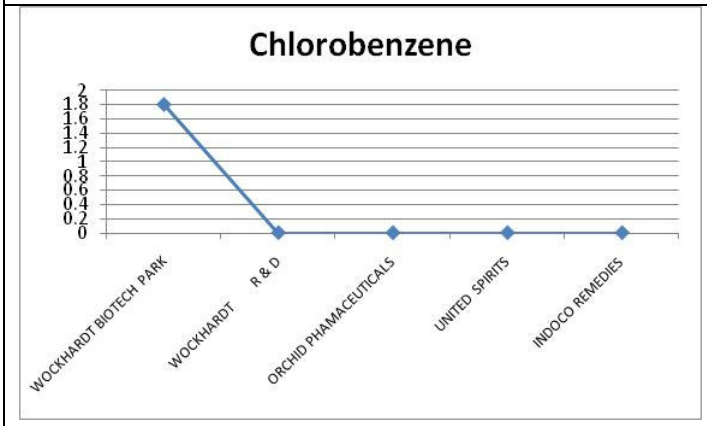
Chlorobenzene
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1.8
1.6
1.4
1.2
1
0.8
0.6
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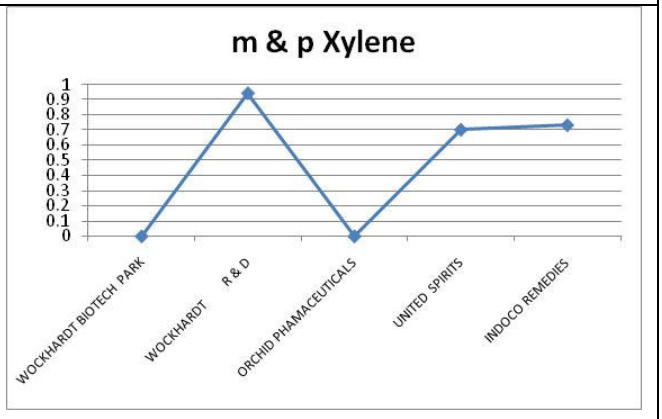
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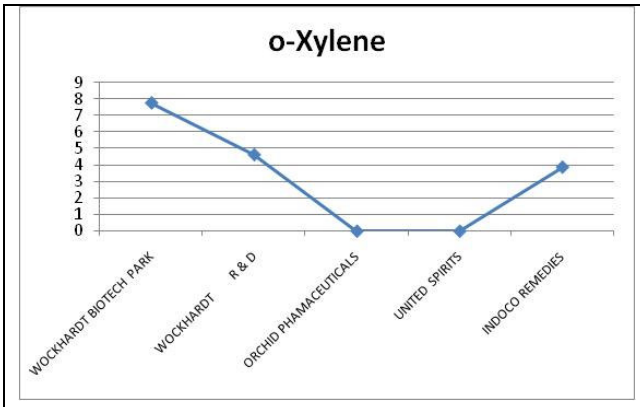
o-Xylene
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5
4
3
2
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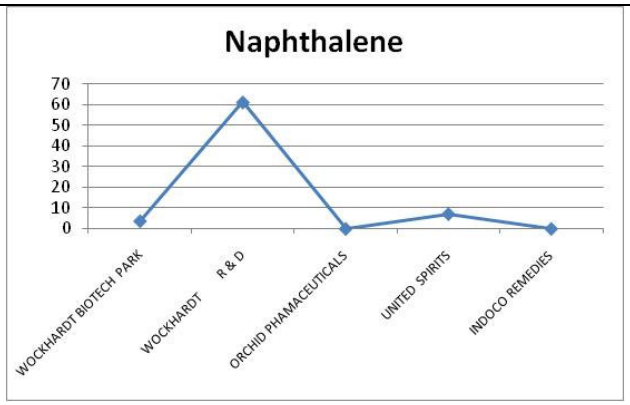
UNITED SPIRITS
INDOCO REMEDIES


Naphthalene
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60
50
40
30
20
10
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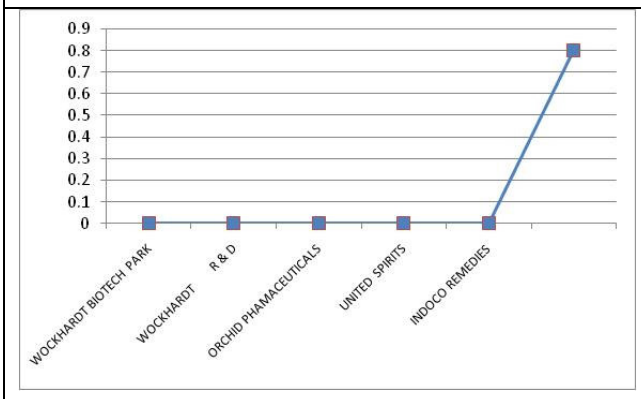
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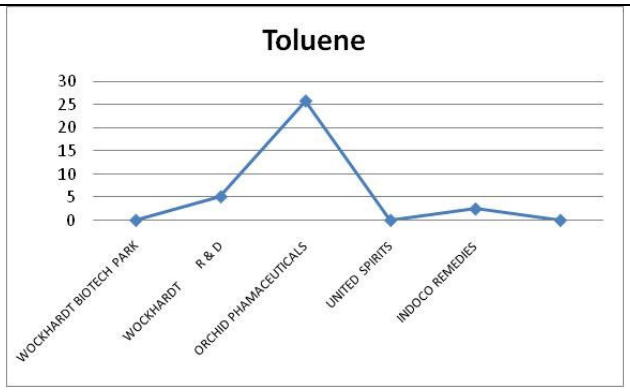
INDOCO REMEDIES


Toluene
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25
20
15
10
5
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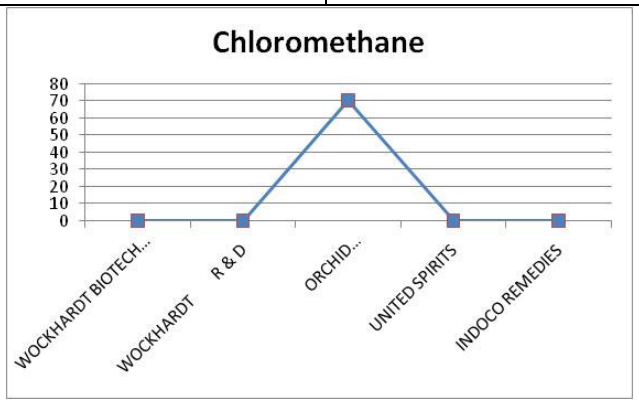
UNITED SPIRITS
INDOCO REMEDIES


Chloromethane
80
70
60
50
40
30
20
10
0
WOCKHARDT BIOTECH...
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INDOCO REMEDIES

CHAPTER - IX

9.0 RECOMMENDATIONS

The MPCB suggested following recommendations during deliberation on the findings of the monitoring. The aspect of VOCs emissions, control and presence in ambient is still at primary stage in the country. There is a need for development of common protocol of sampling and analysis based on Indian conditions. So that uniform database can be generated for further course of action on development of standard & technology as well.

More laboratories should be encouraged to come up with advanced facilities for sampling and analysis of VOCs which, may help in increasing the capabilities and thereby cost of monitoring will reduce.

Buffer zone with green belt around the industrial estates should be ensured to minimize the impact on the surroundings.

The workers in the industrial units should be made aware about effects of VOCs of environment and human health. They should also be properly trained to handle the solvents so as to minimize the escape of VOCs in to atmosphere.

Strategic road-map is required to be prepared for development of standards/guidelines, LDAR programmes for various industrial sectors and creation of awareness on VOCs.

The industries can look more closely in to following aspects for control of VOCs:

- Closed handling system for chemicals;
- Improved solvent recovery by the use of some special condensers and sub cooling system.
- Mechanical seal for chemical handling pumps;
- LDAR system;
- Venting of storages with trap receiver & condenser; and
- Training to the labors and staff.

- Proper system of loading and unloading of solvents
- Proper solvent recovery systems
- Work environment monitoring with respect to VOC has to conduct and compare with Factories act's occupational health standards.

All the emissions emitting sources are to be channelized through ducts to a common conduit, after advanced condensers and/ or scrubbing with relevant or proper scrubbing, the treated emissions to be let into the air.

CHAPTER – X

10.0 CONCLUSIONS

Following conclusions are drawn from the field observations, monitoring results and above discussions:

- There is escape of VOCs from industries through fugitive emissions, effluent discharge and hazardous waste generation but units normally pay least attention to identify & quantify such losses & discharge of VOCs. Limited available analysis facility, absence of emission/discharge standards, no mandatory LDAR programme and cost involved in assessment & control are the major factors on part of the emissions of VOCs from industrial units.
- Companies change the products with respect to demand in the market accordingly the solvent type and quantity will also vary. Due to these variations the concentrations of VOC in AAQ, Fugitive, wastewater and solid waste may vary.
- There are cases, where number of VOCs detected in the samples collected during fugitive emission and wastewater sampling found to be more than what units reported in their consumption details. Units have to understand the importance of transparency in information sharing as their employees are first to get the adverse health impact of VOCs if not controlled properly.
- The probable reasons for escape of solvent in to atmosphere are:
  - Inadequate storage facilities for material. (e.g. leakages from store.

- Use of small carboys for temporary storages of solvents and residues.
- Inadequate closure of reactor vessels.
- Crude temperature control methods for process.
- Evaporation from filtration, centrifuge, layer separation due to improper equipment specifications.
- Improper maintenance of pumps, flanges, valves, compressors, condensers, coolers.
- Limited efficiency of reflux condensers.
- Lack of awareness among labors/workers is also responsible on part of escape of VOCs in atmosphere due to human error or negligence.
- Fume extraction systems of all the possible emission sources and that can be treated.

For developing the standard protocol, standards and guidelines for control of VOCs in ambient environment, it is required to generate data-base for substantial time-span in different industrial regions by similar type of studies.

Annexure-1 (List of 60 Volatile Organic Compounds (VOC s))

S.NO	VOC	S.NO	VOC
1	Benzene	31	Trans-1,3-Dichloropropene
2	Bromobenzene	32	Ethyl Benzene
3	Bromochloromethane	33	Hexachloro-1,3-butadiene
4	Bromodichloromethane	34	Isopropylbenzene
5	Chloroform	35	Para-Isopropyltoluene
6	Bromoform	36	Methylenechloride
7	n-Butylbenzene	37	Naphthalene
8	Sec-Butylbenzene	38	2-Propylbenzene
9	Ter-Butylbenzene	39	Styrene
10	Carbon Tetra chloride	40	1,1,1,2-Tetrachloroethane
11	Chlorobenzene	41	1,1,2,2-Tetrachloroethane
12	2-Chlorotoluene	42	Tetrachloroethene
13	4-Chlorotoluene	43	Toluene
14	Dibromochloromethane	44	1,2,3-Trichlorobenzene
15	1,2-Dibromo-3-chloropropane	45	1,2,4-Trichlorobenzene
16	1,2-Dibromoethane	46	1,1,1-Trichloroethane
17	Dibromomethane	47	1,1,2-Trichloroethane
18	1,2-Dichlorobenzene	48	Trichloroethylene
19	1,3-Dichlorobenzene	49	1,2,3-Trichloropropane
20	1,4-Dichlorobenzene	50	1,2,4-Trimethylbenzene
21	1,1-Dichloroethane	51	1,3,5-Trimethylbenzene
22	1,2-Dichloroethane	52	Xylene
23	1,1-Dichloroethene	53	Meta-Xylene
24	Cis-1,2-Dichloroethene	54	Para-Xylene
25	Trians-1,2-Dichloroethene	55	Chloroethane
26	1,2-Dichloropropane	56	Chloromethane
27	1,3-Dichloropropane	57	Trichlorofluoromethane
28	2,2-Dichloropropane	58	Bromomethane
29	1,1-Dichloropropene	59	Vinyl Chloride
30	Cis-1,3-Dichloropropene	60	Dichlorofluoromethane

Annexure-II

S.No.	Name of VOC	Mol.Wt.	Solubility water. at 20 (ml /100 ml)	Boiling Point ▫C
1	Dichlorofluoromethane Name: Fluorodichloromethane Formula: CHCl2F MW: 102	102		
2	Chloromethane Name: Methane, chloro- Formula: CH3Cl MW: 50	50	303 (Slightly soluble)	-23.7
3	Vinyl chloride Name: Ethene, chloro- Formula: C2H3Cl MW: 62	62	Slightly soluble	-13.37
4	Bromomethane Name: Methane, bromo- Formula: CH3Br MW: 94	94	1.75 g / 100 g water	3.56
5	Ethylchloride Name: Ethyl Chloride Formula: C2H5Cl MW: 64	64	0.574 g / 100 ml	12.3
6	Name: Trichloromonofluoromethane Formula: CCl3F MW: 136	136	insol. In water	23.7
7	Name: Ethene, 1,1-dichloro- Formula: C2H2Cl2 MW: 96	96	Practically insoluble in water.	31.7
8	Name: Methylene Chloride Formula: CH2Cl2 MW: 84	84	~ 50 parts water.	39.75
9	Trans 1,2 Dichloroethene Name: Ethene, 1,2-dichloro-, (E)- Formula: C2H2Cl2 MW: 96	96	Insol. In water.	59.6
10	1,1 Dichloroethane Name: Ethane, 1,1-dichloro- Formula: C2H4Cl2 MW: 98	98	Soluble in about 200 parts water.	57.3
11	Cis 1,2 - Dichloroethene Name: Ethene, 1,2-dichloro-, (Z)- Formula: C2H2Cl2	96	insol.in water.	59.6

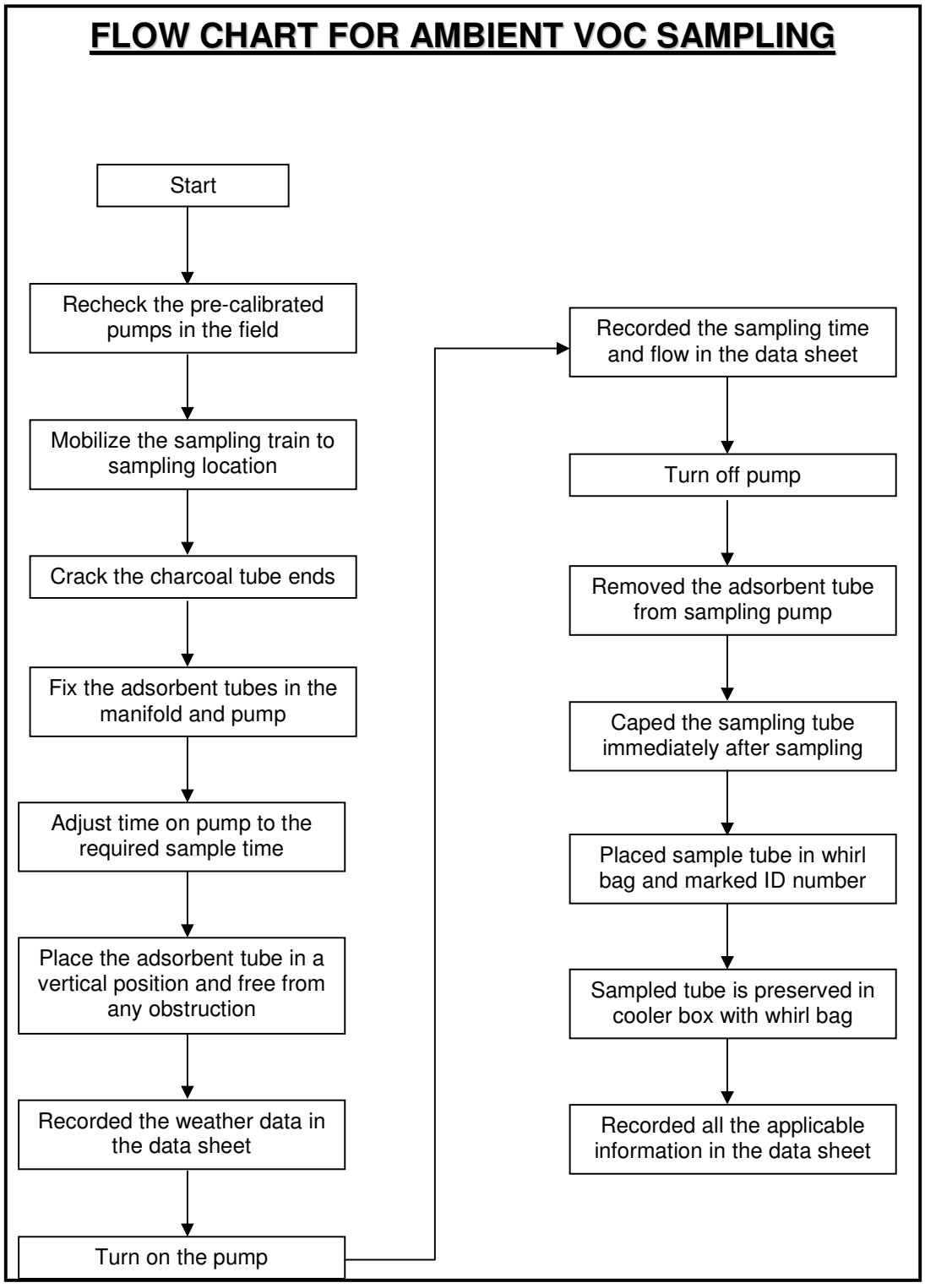
	MW: 96			
12	**Bromochloromethane** **Name: Methane, bromochloro-** **Formula: CH2BrCl** **MW: 128**	128		
13	**Chloroform** **Name: Trichloromethane** **Formula: CHCl3** **MW: 118**	118	1 ml / 200 ml water	61-62
14	**Name: Propane, 2,2-dichloro-** **Formula: C3H6Cl2** **MW: 112**	112	Slightly sol. In water	95-96
15	**Name: Ethane, 1,2-dichloro-** **Formula: C2H4Cl2** **MW: 98**	98	sol. In 120 parts water	83-84
16	**Name: Ethane, 1,1,1-trichloro-** **Formula: C2H3Cl3** **MW: 132**	132	insol. In water	74.1
17	**Name: 1-Propene, 1,1-dichloro-** **Formula: C3H4Cl2** **MW: 110**	110	--	108
18	**Carbon Tetrachloride** **Name: Carbon Tetrachloride** **Formula: CCl4** **MW: 152**	152	1 ml / 2000 ml water	76.7
19	**Name: Benzene** **Formula: C6H6** **MW: 78**	78	0.188%	80.1
20	**Name: Methane, dibromo-** **Formula: CH2Br2** **MW: 172**	172	11.93 g / 1000g water	97
21	**1,2 dichloropropane** **Name: Propane, 1,2-dichloro-** **Formula: C3H6Cl2** **MW: 112**	112	Slightly soluble in water.	95 - 96
22	**Trichloroethylene** **Name: Trichloroethylene** **Formula: C2HCl3** **MW: 130**	130	0.11 g / 100 g.	86.9
23	**Bromodichloromethane** **Name: Methane, bromodichloro-** **Formula: CHBrCl2** **MW: 162**	162	--	91-92
24	**1,3 dichloropropene** **Name: 1-Propene, 1,3-dichloro-** **Formula: C3H4Cl2**	110	--	108

	MW: 110			
25	**Trans 1,3 dichloropropene** **Name: 1-Propene, 1,3-dichloro-, (E)-** **Formula: C3H4Cl2** **MW: 110**	110	--	112
26	**1,1,2-Trichloroethane** **Name: Ethane, 1,1,2-trichloro-** **Formula: C2H3Cl3** **MW: 132**	132	in soluble in water	113-114
27	**Name: Toluene** **Formula: C7H8** **MW: 92**	92	0.067% very slightly sol. in water.	110.6
28	**Name: Propane, 1,3-dichloro-** **Formula: C3H6Cl2** **MW: 112**	112		
29	**Dibromochloromethane** **Name: Methane, dibromochloro-** **Formula: CHBr2Cl** **MW: 206**	206	--	121.3-121.8
30	**1,2 Dibromomethane** **Name: Ethane, 1,2-dibromo-** **Formula: C2H4Br2** **MW: 186**	186	11.93 g / 1000 g water	97
31	**Tetrachloroethylene** **Name: Tetrachloroethylene** **Formula: C2Cl4** **MW: 164**	164	10000 vol water	121
32	**1,1,1,2-Tetrachloroethane** **Name: Ethane, 1,1,1,2-tetrachloro-** **Formula: C2H2Cl4** **MW: 166**	166	1 g in 350 ml water (sparingly sol. In water)	146.5
33	**Chlorobenzene** **Name: Benzene, chloro-** **Formula: C6H5Cl** **MW: 112**	112	Insol. In water.	131-132
34	**Ethyl Benzene** **Name: Ethylbenzene** **Formula: C8H10** **MW: 106**	106	Practically insoluble in water.	136.25
35	**Bromoform** **Name: Methane, tribromo-** **Formula: CHBr3** **MW: 250**	250	sol. In about 800 parts water.	149-150
36	**p-Xylene** **Name: p-Xylene** **Formula: C8H10**	106	insol. In water.	137-138

	MW: 106			
37	**M-Xylene** **Name: Benzene, 1,3-dimethyl-** **Formula: C8H10** **MW: 106**	106	insol. In water.	139.3
38	**Styrene** **Name: Styrene** **Formula: C8H8** **MW: 104**	104		
39	**Name: Ethane, 1,1,2,2-tetrachloro-** **Formula: C2H2Cl4** **MW: 166**	166	1 g / 350 ml water. (sparingly soluble)	146.5
40	**O - Xylene** **Name: o-Xylene** **Formula: C8H10** **MW: 106**	106	insol. In water.	144
41	**1,2,3-Trichloropropane** **Name: Propane, 1,2,3-trichloro-** **Formula: C3H5Cl3** **MW: 146**	146		
42	**Isopropylbenzene** **Name: Benzene, (1-methylethyl)-** **Formula: C9H12** **MW: 120**	120	Insol. In water.	152-153
43	**Bromobenzene** **Name: Benzene, bromo-** **Formula: C6H5Br** **MW: 156**	156	0.045 g / 100 g water Practically insoluble in water.	156.2
44	**n-Propylbenzene** **Name: Benzene, propyl-** **Formula: C9H12** **MW: 120**	120	0.06 g / L water Very slightly sol. in water.	159.2
45	**2-chlorotoluene** **Name: Benzene, 1-chloro-2-methyl-** **Formula: C7H7Cl** **MW: 126**	126	Slighly sol. In water	158.97
46	**4-chlorotoluene** **Name: Benzene, 1-chloro-4-methyl-** **Formula: C7H7Cl** **MW: 126**	126	Slightly sol.In water	161.75
47	**1,3,5-Trimethylbenzene** **Name: Benzene, 1,3,5-trimethyl-** **Formula: C9H12** **MW: 120**	120	0.002 g / 100g water Practically insoluble in water.	164.7
48	**Tert-butyl benzene** **Name: Benzene, tert-butyl-**	134	insoluble in water.	168.5

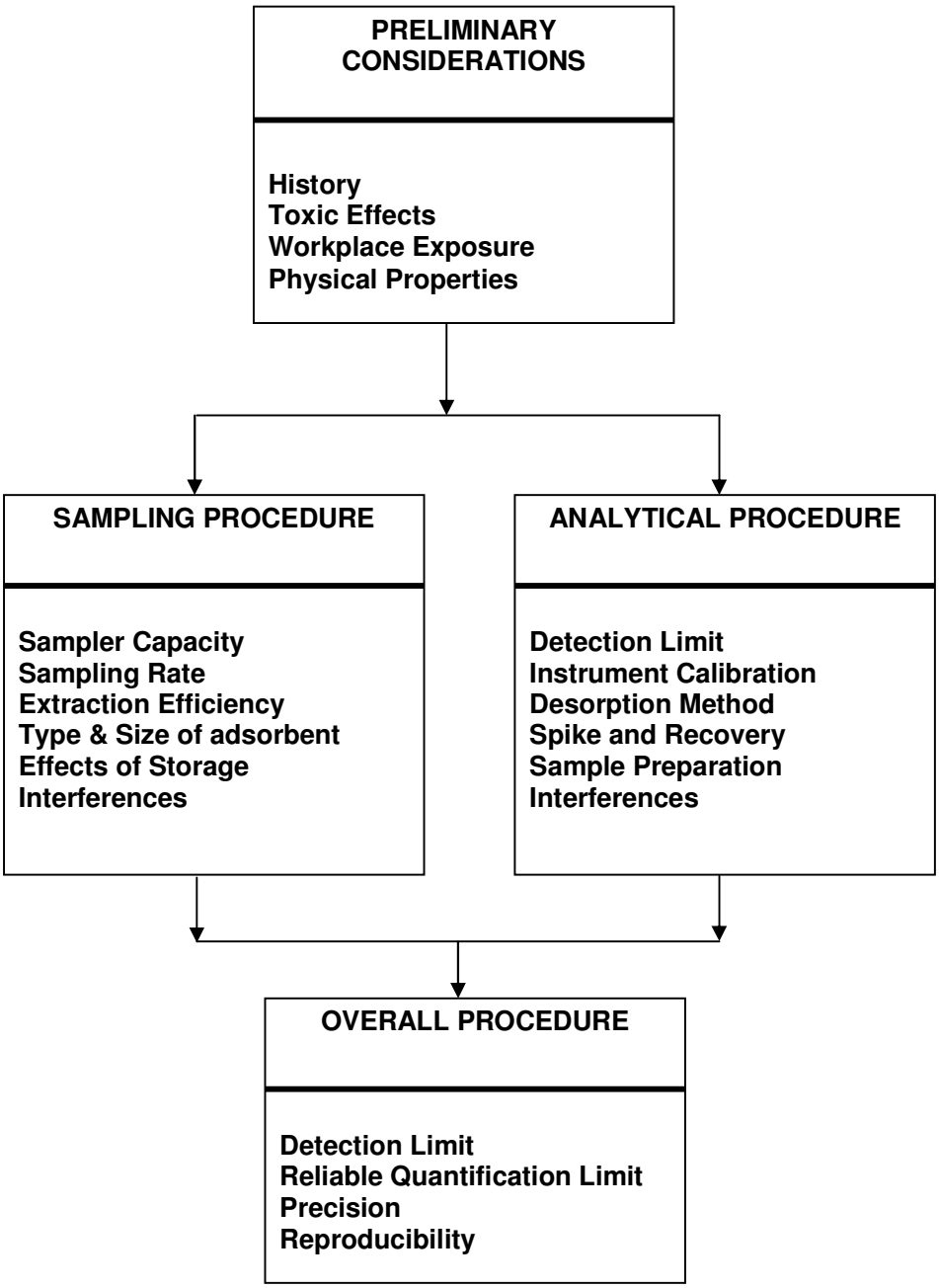
	Formula: C10H14 **MW: 134**			
49	**1,2,4 - Trimethylbenzene** **Name: Benzene, 1,2,4-trimethyl-** **Formula: C9H12** **MW: 120**	120	Practically insoluble in water.	169-171
50	**Sec-Butylbenzene** **Name: Benzene, (1-methylpropyl)-** **Formula: C10H14** **MW: 134**	134	Insolu. In water.	173.5
51	**1,3-Dichlorobenzene** **Name: Benzene, 1,3-dichloro-** **Formula: C6H4Cl2** **MW: 146**	146	Practically insoluble in water.	173
52	**1,4-Dichlorobenzene** **Name: Benzene, 1,4-dichloro-** **Formula: C6H4Cl2** **MW: 146**	146	Practically insoluble in water.	174.12
53	**4-Isopropyltoluene** **Name: Benzene, 1-methyl-** **4-(1-methylethyl)-** **Formula: C10H14** **MW: 134**	134	Practically insoluble in water.	175.14
54	**1,2-Dichlorobenzene** **Name: Benzene, 1,2-dichloro-** **Formula: C6H4Cl2** **MW: 146**	146	Practically insoluble in water.	180.5
55	**Name: Benzene, butyl-** **Formula: C10H14** **MW: 134**	134	Insol. In water.	183.1
56	**1,2-dibromo 3, chloropropane** **Formula: C3H5Br2Cl** **MW: 234**	234	slightly sol. In	196
57	**1,2,4-trichlorobenzene** **Formula: C6H3Cl3** **MW: 180**	180	insol. In water.	213
58	**Naphthalene** **Formula: C10H8** **MW: 128**	128	Insol. In water	217.9
59	**Hexachlorobutadiene** **Formula: C4Cl6** **MW: 258**	258		
60	**1,2,3-trichlorobenzene** **Formula: C6H3Cl3; MW: 180**	180	Insol. In water.	221

Annexure - III A



Annexure - III

EVALUATION SCHEME FOR VOC MONITORING AND



Annexure-IV A

VOC Sampling Details – Tarapur						
S.No	Date of Sampling	Time of Sampling	Sampling Location	Flow rate	Sampling Duration	Volume of air Sampled
Ambient Air Quality Monitoring - 1 Round						
1	21/02/2011	12:00 – 20:00 Hrs	M/s.Galaxy Surfactants Ltd.,	500ml/min	8 hours	240 Litres
2	21/02/2011	14.30 - 22.30 Hrs	M/s.Mandhana Dyeing	500ml/min	8 hours	240 Litres
3	21/02/2011	15.00 - 23.00 Hrs	M/s.Palgar - Dahanu Talaka Sports Association	500ml/min	8 hours	240 Litres
4	21/02/2011	15.40 - 23.40 Hrs	M/s.Tata Steel Wire Division,	500ml/min	8 hours	240 Litres
5	21/02/2011	16.30 - 00.30 Hrs	M/s.Kumbawali Naka Police Chocki	500ml/min	8 hours	240 Litres
Ambient Air Quality Monitoring – 2 Round						
1	21 - 22/02/2011	20:00 – 04:00 Hrs	M/s.Galaxy Surfactants Ltd.,	500ml/min	8 hours	240 Litres
2	21 - 22/02/2011	22.30 - 06.30 Hrs	M/s.Mandhana Dyeing	500ml/min	8 hours	240 Litres
3	21 - 22/02/2011	23.00 - 07.00 Hrs	M/s.Palgar - Dahanu Talaka Sports Association	500ml/min	8 hours	240 Litres
4	21 - 22/02/2011	23.40 - 07.40 Hrs	M/s.Tata Steel Wire Division,	500ml/min	8 hours	240 Litres
5	21 - 22/02/2011	00.30 - 08.30 Hrs	M/s.Kumbawali Naka Police Chocki	500ml/min	8 hours	240 Litres
Ambient Air Quality Monitoring – 3 Round						
1	22/02/2011	04:10 – 12:10 Hrs	M/s.Galaxy Surfactants Ltd.,	500ml/min	8 hours	240 Litres
2	22/02/2011	06.30 - 14.30 Hrs	M/s.Mandhana Dyeing	500ml/min	8 hours	240 Litres
3	22/02/2011	07.00 - 15.00 Hrs	M/s.Palgar - Dahanu Talaka Sports Association	500ml/min	8 hours	240 Litres
4	22/02/2011	07.40 - 15.40 Hrs	M/s.Tata Steel Wire Division,	500ml/min	8 hours	240 Litres
5	22/02/2011	08.30 - 16.30 Hrs	M/s.Kumbawali Naka Police Chocki	500ml/min	8 hours	240 Litres

Annexure - IV B

VOC Sampling Details - AURANGABAD

S.No	Date of sampling	Time of sampling	Sampling Location	Flow rate	Sampling Duration	Volume of air sampled
Ambient Air Quality Monitoring - 1 Round						
1	3/26/2011	10.45Hrs - 18.45Hrs	M/S. United - spirits Ltd.,	500ml/min	8hrs	240Litres
2	3/26/2011	11.45Hrs - 19.45Hrs	M/S. Wockhardt R&D	500ml/min	8hrs	240Litres
3	3/26/2011	13.50Hrs - 21.50Hrs	M/S. Wockhardt Biotech	500ml/min	8hrs	240Litres
4	3/26/2011	14.20Hrs - 22.20Hrs	M/S. Orchid pharma	500ml/min	8hrs	240Litres
5	3/26/2011	14.50Hrs - 22.50Hrs	M/S. Indoco remedies	500ml/min	8hrs	240Litres
Ambient Air Quality Monitoring - 2 Round						
1	26 - 27/03/2011	18.45Hrs - 02.45Hrs	M/S. United - spirits Ltd.,	500ml/min	8hrs	240Litres
2	26 - 27/03/2011	19.45Hrs - 03.45Hrs	M/S. Wockhardt R&D	500ml/min	8hrs	240Litres
3	26 - 27/03/2011	21.50Hrs - 5.50Hrs	M/S. Wockhardt Biotech	500ml/min	8hrs	240Litres
4	26 - 27/03/2011	22.20Hrs - 06.20Hrs	M/S. Orchid pharma	500ml/min	8hrs	240Litres
5	26 - 27/03/2011	22.50Hrs - 06.50Hrs	M/S. Indoco remedies	500ml/min	8hrs	240Litres
Ambient Air Quality Monitoring - 3 Round						
1	27/03/2011	02.45Hrs - 10.45Hrs	M/S. United - spirits Ltd.,	500ml/min	8hrs	240Litres
2	27/03/2011	03.45Hrs - 11.45Hrs	M/S. Wockhardt R&D	500ml/min	8hrs	240Litres
3	27/03/2011	04.00Hrs - 12.00Hrs	M/S. Wockhardt Biotech	500ml/min	8hrs	240Litres
4	27/03/2011	06.20Hrs - 14.20Hrs	M/S. Orchid pharma	500ml/min	8hrs	240Litres
5	27/03/2011	06.50Hrs - 14.50Hrs	M/S. Indoco remedies	500ml/min	8hrs	240Litres

Annexure - IV C

VOC Sampling Details - Dombivili

S.No	Date of sampling	Time of sampling	Sampling Location	Flow rate	Sampling Duration	Volume of air sampled
Ambient Air Quality Monitoring - 1 Round						
1	2/23/2011	13.00Hrs - 21.00Hrs	M/S. MIDC Office	500ml/min	8hrs	240Litres
2	2/23/2011	13.20Hrs - 21.20Hrs	M/S. Alchemie Laboratories Ltd.,	500ml/min	8hrs	240Litres
3	2/23/2011	13.35Hrs - 21.35Hrs	M/S. Runa Chemicals	500ml/min	8hrs	240Litres
4	2/23/2011	14.20Hrs - 22.20Hrs	M/S. Arthi Health Care Ltd.,	500ml/min	8hrs	240Litres
5	2/23/2011	14.45Hrs - 22.45Hrs	M/S. Premises of CETP	500ml/min	8hrs	240Litres
Ambient Air Quality Monitoring - 2 Round						
1	23 - 24/02/2011	21.00Hrs - 05.00Hrs	M/S. MIDC Office	500ml/min	8hrs	240Litres
2	23 - 24/02/2011	21.20Hrs - 05.20Hrs	M/S. Alchemie Laboratories Ltd.,	500ml/min	8hrs	240Litres
3	23 - 24/02/2011	21.35Hrs - 5.35Hrs	M/S. Runa Chemicals	500ml/min	8hrs	240Litres
4	23 - 24/02/2011	22.20Hrs - 06.20Hrs	M/S. Arthi Health Care Ltd.,	500ml/min	8hrs	240Litres
5	23 - 24/02/2011	22.45Hrs - 06.45Hrs	M/S. Premises of CETP	500ml/min	8hrs	240Litres
Ambient Air Quality Monitoring - 3 Round						
1	2/24/2011	05.00Hrs - 13.00Hrs	M/S. MIDC Office	500ml/min	8hrs	240Litres
2	2/24/2011	05.20Hrs - 13.20Hrs	M/S. Alchemie Laboratories Ltd.,	500ml/min	8hrs	240Litres
3	2/24/2011	05.35Hrs - 13.35Hrs	M/S. Runa Chemicals	500ml/min	8hrs	240Litres
4	2/24/2011	06.20Hrs - 14.20Hrs	M/S. Arthi Health Care Ltd.,	500ml/min	8hrs	240Litres
5	2/24/2011	06.45Hrs - 14.45Hrs	M/S. Premises of CETP	500ml/min	8hrs	240Litres

Annexure - IV D

VOC Sampling Details – Navi Mumbai

S.No	Date of sampling	Time of sampling	Sampling Location	Flow rate	Sampling Duration	Volume of air sampled
Ambient Air Quality Monitoring - 1 Round						
1	2/18/2011	12.30Hrs - 20.30Hrs	M/S. Viking Exports Ltd.,	500ml/min	8hrs	240Litres
2	2/18/2011	16.20Hrs - 00.00Hrs	M/S. Expanded Polymer System (P) Ltd.,	500ml/min	8hrs	240Litres
3	2/18/2011	16.30Hrs - 00.30Hrs	M/S. SandoZ India Pvt Ltd.,	500ml/min	8hrs	240Litres
4	2/18/2011	19.00Hrs - 03.00Hrs	M/S. Regenz India Pvt Ltd.,	500ml/min	8hrs	240Litres
Ambient Air Quality Monitoring - 2 Round						
1	18 - 19/02/2011	20.30Hrs - 04.30Hrs	M/S. Viking Exports Ltd.,	500ml/min	8hrs	240Litres
2	18 - 19/02/2011	00.10Hrs - 08.10Hrs	M/S. Expanded Polymer System (P) Ltd.,	500ml/min	8hrs	240Litres
3	18 - 19/02/2011	00.30Hrs - 08.30Hrs	M/S. SandoZ India Pvt Ltd.,	500ml/min	8hrs	240Litres
4	18 - 19/02/2011	03.00Hrs - 11.00Hrs	M/S. Regenz India Pvt Ltd.,	500ml/min	8hrs	240Litres
Ambient Air Quality Monitoring - 3 Round						
1	2/19/2011	04.30Hrs - 12.30Hrs	M/S. Viking Exports Ltd.,	500ml/min	8hrs	240Litres
2	2/19/2011	08.10Hrs - 16.10Hrs	M/S. Expanded Polymer System (P) Ltd.,	500ml/min	8hrs	240Litres
3	2/19/2011	08.30Hrs - 16.30Hrs	M/S. SandoZ India Pvt Ltd.,	500ml/min	8hrs	240Litres
4	2/19/2011	11.00Hrs - 19.00Hrs	M/S. Regenz India Pvt Ltd.,	500ml/min	8hrs	240Litres

Annexure - IV E

VOC Sampling Details - Chandrapur

S.No	Date of sampling	Time of sampling	Sampling Location	Flow rate	Sampling Duration	Volume of air sampled
Ambient Air Quality Monitoring - 1 Round						
1	3/23/2011	12.30Hrs - 20.30Hrs	M/S. Multi organic (P) Ltd.,	500ml/min	8hrs	240Litres
2	3/23/2011	13.30Hrs - 21.30Hrs	M/S.Abhideep Chemicals (P) Ltd.,	500ml/min	8hrs	240Litres
3	3/23/2011	16.00Hrs - 24.00Hrs	M/S. Chandrapur pipes	500ml/min	8hrs	240Litres
4	3/23/2011	17.35Hrs - 01.35Hrs	M/S. Built Guest house	500ml/min	8hrs	240Litres
5	3/23/2011	18.00Hrs - 02.00Hrs	M/S. Built Radial well	500ml/min	8hrs	240Litres
Ambient Air Quality Monitoring - 2 Round						
1	23 - 24/03/2011	20.30Hrs - 04.30Hrs	M/S. Multi organic (P) Ltd.,	500ml/min	8hrs	240Litres
2	23 - 24/03/2011	21.30Hrs - 05.30Hrs	M/S.Abhideep Chemicals (P) Ltd.,	500ml/min	8hrs	240Litres
3	23 - 24/03/2011	24.00Hrs - 08.00Hrs	M/S. Chandrapur pipes	500ml/min	8hrs	240Litres
4	23 - 24/03/2011	01.35Hrs - 09.35Hrs	M/S. Built Guest house	500ml/min	8hrs	240Litres
5	23 - 24/03/2011	02.00Hrs - 10.00Hrs	M/S. Built Radial well	500ml/min	8hrs	240Litres
Ambient Air Quality Monitoring - 3 Round						
1	3/24/2011	04.30Hrs - 12.30Hrs	M/S. Multi organic (P) Ltd.,	500ml/min	8hrs	240Litres
2	3/24/2011	05.30Hrs - 13.30Hrs	M/S.Abhideep Chemicals (P) Ltd.,	500ml/min	8hrs	240Litres
3	3/24/2011	08.00Hrs - 16.00Hrs	M/S. Chandrapur pipes	500ml/min	8hrs	240Litres
4	3/24/2011	09.35Hrs - 17.35Hrs	M/S. Built Guest house	500ml/min	8hrs	240Litres
5	3/24/2011	10.00Hrs - 18.00Hrs	M/S. Built Radial well	500ml/min	8hrs	240Litres

Annexure - VII

METHOD OF ANALYSIS

Ambient Air Quality & Fugitive Emission Samples

Method - EPA TO - 17

Method Validation Document

Table of contents

1.0 Purpose

To validate the GC-MS(P&T) and GC-MS-ATD method for the determination of VOC's. in Air Samples.

2.0 Scope

This protocol provides guidance to validate the method of analysis to evaluate its reliability and suitability for its intended purpose.

3.0 Terms and abbreviations

The following table lists terms and abbreviations and their descriptions which are used in the protocol.

Terms	Abbreviations
GC-MS	Gas Chromatography with Mass Spectrometer
RSD	Relative Standard Deviation
ATD	Automated Thermal desorber
P&T	Purge and Trap
LOQ	Limit of quantification

4.0 Validation Program and Acceptance Criteria

Validation parameters: Following performance parameters will be assessed during validation.

- Selectivity/Specificity
- Sensitivity (LOQ)
- Linearity
- Precision & Accuracy
- Recovery
- Measurement of Uncertainty

4.1 Selectivity/Specificity

The selectivity/specificity of the present method will be established by checking the reagent blank and matrix blank (without spiking VOC Standard) and comparing the interference at the retention time or mass transition (m/z) of analytes against solvent LOQ.

Acceptance Criteria:

If the reagent blank and Matrix blank contains significant interference at the retention time or mass transition (m/z) of analytes in question, that will be rejected. (Criteria ≤ 30% of LOQ).

4.2 Sensitivity

Sensitivity of the method will be expressed as limit of quantification.

Acceptance Criteria:

Lowest level for which it has been demonstrated that criteria for accuracy and precision have been met .

4.3 Recovery

Recovery of an analyte in an assay is the instrument responses obtained from the amount of analyte added to and recovered from sample matrix, compared to detector response obtained from pure authentic reference standard. The percentage recoveries are determined by measuring the peak area of recovery samples at concentrations of LOQ. Comparing with the responses of the un-extracted solvent standards.

Acceptance criteria:

Accuracy should be 70 to 120% at LOQ level (As per the FDA Guidelines)

CV % of the recovery of analyte at each concentration level shall be ≤ 20.

If the above criteria are not met, repeat the recovery experiment.

4.4 Linearity

Determination of the relationship between the observed signal (response produced by the detection system) from the target analyte in the sample extract and known quantities of the analyte prepared as standard solutions is called as calibration curve. The no. of standards used in constructing a calibration curve will be a function of the anticipated range of analytical values. Concentrations of standards should be chosen on the basis of the concentration range expected in the samples.

A calibration curve consists of reagent and matrix blank and 7 non-zero calibration standards covering the expected range (coded as CC1 (LLOQ) through to CC7 (~20xLOQ)). A linear equation will be determined to produce the best fit for the concentration /response relationship.

Acceptance criteria

Maximum allowed deviation of the CC1 from actual concentration shall be ±20% and standards other than CC1 from actual concentration shall be ± 15%

'r' shall be ≥0.99 (or) 'r2' shall be ≥ 0.98

At least 3 out of 7 non-zero standards shall meet the above criteria, including the CC1 and the calibration standards at the highest concentration (CC7). Any two consecutive points shall not be excluded. (As per FDA Guidelines)

4.5 Precision and Accuracy

Precision:

Under each calibration curve analyze 6 sets of each of LOQ,~3Xloq and ~5xLOQ samples.

The precision of the method is represented by % Coefficient of variation of analyzed samples under recovery experiment and calculated as follows.

CV % = (SD/Mean) x 100,

Where CV% = coefficient of variation and SD = standard deviation

Acceptance criteria:

The precision denoted by CV % at each concentration level should be $\leq$ 15% expect for LLOQ where it should not be $\leq$ 20%.

Accuracy:

The accuracy of method is represented by % recovery of the analytes and will be calculated as follows:

% Accuracy = (Mean of obtained concentrations /Actual concentration) x 100

Acceptance criteria:

The % accuracy obtained should be within 70-120%

4.6 Measurement of Uncertainty :

A range around the reported result within which the true value can be expected to lie with a specified probability (confidence level, usually 95%). Uncertainty data should encompass trueness (bias) and reproducibility

Measurand : Determination of Pesticide Residues in Grape Fruit

- Instrument used: …..
- Balance ID : ….
- Volumetric flask ID :…..
- Method of testing: In house method
- Standard used: All neat standards procured from known source
- Micropipettes used: …..
- Sources of Uncertainty:
    1. Uncertainty due to Standard Preparation
        a) Reference standard purity
        b) Balance uncertainty
        c) Glassware uncertainty
        d) Micropipette uncertainty (10-100µL)
        e) Micropipette uncertainty (100-1000µL)
    2. Repeatability uncertainty (Type-A): Sample preparation

Calculations:

As per EURACHEM/CITAC Guide CG4

5.0 Analytical Procedure GC-MS(P&T):

5.1 Instrument & equipment

- GC –MS
- Data system – Chem Station
- VRX, length 20m x ID 0.18mm, Film thickness 1.0µm
- Micropipette
- Analytical Balance

5.2 Reagents

- Methanol – AR grade
- Reagent Water – Milli-Q water (with reference to the specification of Water for Laboratory ISO3696:1987 Electrical conductivity and TOC are within the specifications)

5.3 Standards

Reference standards procure from Sharalu Chem or Equivalent

5.4 Preparation of Standards for calibration curve:

Standards for calibration curve were prepared from stock of 2000µg/mL (AccuStandard)

Prepration of Stock Solutions

Conc. Of Stock Solution (mg/L)	Volume of Stock (mL)	Volume of Diluent* (mL)	Made up Volume (mL)	Final Conc. (mg/L)
2000	1	9	10	200
200	2.5	7.5	10	50
200	1.25	8.75	10	25
50	4	6	10	20
20	5	5	10	10
10	5	5	10	5
10	1	9	1	1

Preparation of pesticide residues for calibration curves: Prepare CC1 toCC7 daily ranging from 1 to 20 ng/mL with Water.

Conc. Of Stock Solution (µg/mL	Volume of Stock (µL)	Made up Volume (mL)	Final Conc(µg/L	Lable
20	43	43	20	CC7
15	43	43	15	CC6
20	43	43	10	CC5
10	43	43	8	CC4
5	43	43	5	CC3
1	43	43	1	CC2
0.1	43	43	0.1	CC1

5.5 **Preparation of Stock Solution other than 60compounds:**

Preparation of stock dilutions of mixed standard solution.10,000 ppm mix standard prepared based on the specific gravity (g/cc) mentioned on the solvent bottles.

For eg : Acetone 1L - 0.79Kg

1000ml – 790gm

10ml - 7.9gm

? - 1gm

1.2658ml for 1gm ⇒ 1265.82µL for 1 gm

` 1265.8µL for 1000mg

For 10mg = 12.65µL ⇒ 1000ppm

126.5µL for 10,000ppm

Similarly all the remaining solvents were calculated and mix of 10,000ppm was prepared.by adding DCM-75.75µL(1L - 1.32Kg), Chloroform- 67.1141µL(1L - 1.49Kg), Ethyl acetate – 111.23µL, Tetrahydrofuran-112.36µL.(1L - 0.89Kg) in a 10ml volumetric flask.

6.0 Analytical Procedure GC-MS(ATD)

6.1 Instrument & equipment

- GC –MS
- Data system – Chem Station
- ATD
- Data system – Unity
- VF-624, length 60m x ID 0.25mm, Film thickness 1.4µm
- Micropipettes
- Analytical Balance

6.2 Preperation of Calibratin Curve Standards

For TDS

Conc. Of Stock Solution (mg/L)	Volume of Stock (mL)	Volume of Diluent* (mL)	Made up Volume (mL)	Final Conc. (mg/L)
2000	1	9	10	200
200	5	5	10	100

100	5	5	10	50
50	5	5	10	25
100	1	9	10	10
10	5	5	10	5
10	1	9	10	1

1ppm == 1µg - 1ml
1µg - 1000µL = 1000ng - 1000µL

Depending on this relation for getting 5ng concentration inject 5µL of 1ppm std.

Similarly

5ppm - 5µL - 5ng

10ppm - 5µL - 50ng

25ppm - 5µL - 125ng

50ppm - 5µL - 250ng

100ppm - 5µL - 500ng

200ppm - 5µL - 1000ng

6.3 Sample Preservation

On receipt of samples, store them at about 4°C.

6.4 Sample preparation

Before preparing the sample allow the charcoal tube to get room temperature, then break the charcoal tube just above the glass wool plug. Carefully transfer the charcoal into a vial, add 5ml of chromatographic pure methanol, cap the container or vial tightly such that no volatilization occur, sonicate it for 30sec settle for 20-30min.

Then take 43µL of supernatant methanol into a VOC vial containing 43ml of Milli-Q water, swirl 2-3 times and place the vial in auto sampler of purge and trap system. Same manner do the blank without charcoal.

6.5 Analytes :

Dichlorodifluoromethane, Chloromethane, Vinylchloride, Bromomethane, Ethylchloride, Trichloromonofluromethane, 1,1-Dichloroethane, Methylenechloride, trans-1,2-dichloroethane, 1-1,dichloroethane, cis-1,2-dichloroethene, Bromochloromethane, Chloroform, 2,2-dichloropropane, 1,2-dichloroethane, 1,1,1-trichloroethane, 1,1-dichloropropene, carbontetrachloride, Benzene, Dibrmomethane, 1,2-dichloropropane, Trichloroethylene, Bromodichloromethane, 1,3-dichloropropene, trans-1,3-dichloropropene,1,1,2-trichloroethane, Toluene, dichlorpropane, Dibromochlormethane, 1,2-dibromoethane, Tetrachloroethylene, 1,1,1,2-tetrachloroethane, Chlorobenzene, ethylbenzene, Bromoform, m&p-xylene, Styrene, 1,1,2,2-tetrachloroethane, o-xylene, dichloropropane, isopropylbenzene, bromobenzene, n-propylbenzene, 2-chlorotoluene, chlorotoluene, 1,3,5trimethylbenzene, tert-butylbenzene, 1,2,4-trimethylbenzene, sec-butlbenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 4-isopropyltoluene, 1,2-dichlorobenzene, butylbenzene, 1,2-dibromo-3,-chloropropane, 1,2,4-trichlorobenzene, Naphthalene, Hexachlorobutadiene, 1,2,3-trichlorobenzene.

6.6 Details of GC/MS Method :

Instrument Details: Model Used:- 6890 GC-MSD (Make:- Agilent Technologies Ltd.)

GC conditions:-

Oven

Initial Temperature	: 40 ºC (On)	Maximum Temp	: 260ºC
Initial Time	: 3.00 Min.	Equilibrium Time	: 0.50 min.

Ramps:

#	Rate	Final Temp.	Final Time
1	10	100	0.00
2	25	225	3.00
3	0.0 (off)		

Post Temp : 0 ºC
Post Time : 0.00 min.
Run Time : 17.00 min.

Oven

Initial Temperature	: 40 ºC (On)	Maximum Temp	: 300 ºC

Initial Time : 3.00 Min. Equilibrium Time : 0.50 min.
Ramps:

Rate	Final Temp.	Final Time
1	8.00 90	2.00
2	6.00 240	3.00
3	0.0 (off)	

Post Temp : 0 ºC
Post Time : 0.00 min.
Run Time : 39.25 min.

Front Inlet (Split / Split less)

Mode : Split
Inlet Temp : 250 °C (On)
Pressure : 23.20 psi (On)
Split : 50:1
Split flow : 49.6 mL / min.
Total flow : 53.1 mL / min.
Gas saver : ON
Gas Type : Helium

Column 1

Capillary Column
Model Number: J&W US5270225H
DB-VRX,20m x 0.18mm x 1µm
Intial flow : 1.0mL/min
Inlet : Front Inlet
Outlet : MSD
Outlet pressure : vacuum

Column 2

Model No.: J&W US5215021H
DB-624,60m x 0.25mm x 1.4µm
Intial flow : 1.5mL/min
Inlet : Back
Outlet : MSD
Outlet pressure : Vaccum

Thermal Aux 2 (Transfer line)

Use : MSD Transfer Line Heater
Initial temp : 260 ºC
Initial time : 0.00 min.

MS Acquisition Parameters

General Information

Tune File : atune.u
Acquisition Mode : Scan

Name	Quantification ion
Dichlorodifluoromethane	85
Chloromethane	50
Vinyl chloride	62
Bromomethane	94
Ethylchloride	64
Trichloromonofluoromethane	101
1,1-dichloroethene	96
Methylene chloride	84
Trans-1,2-Dichloroethene	96
1,1-dichloroethane	63
Cis-1,2-Dichloroethene	96
Bromochloromethane	128
Chloroform	83
2,2-dichloropropane	77
1,2-dichloroethane	62
1,1,1-Trichloroethane	97
1,1-dichloropropene	75
Carbon Tetrachloride	117
Benzene	78
Dibromomethane	93
1,2-dichloropropane	63
Trichloroethylene	95
Bromodichloromethane	83
1,3-dichloropropene	75
Trans-1,3-dichloropropene	75
1,1,2-Trichloroethane	83
Toluene	91
1,3-Dichloropropane	76
Dibromochloromethane	129
1,2-Dibromoethane	107
Tetrachloroethylene	166
1,1,1,2-Tetrachloroethane	131
Chlorobenzene	112
Ethylbenzene	91
Bromoform	173
m & p - Xylene	106
Styrene	104
1,1,2,2-Tetrachloroethane	83

O-Xylene	106
1,2,3-Trichloropropane	75
Isopropyl benzene	105
Bromobenzene	156
n-Propylbenzene	91
2-Chlorotoluene	91
4-Chlorotoluene	91
1,3,5-trimethylbenzene	105
Tert-Butylbenzene	119
1,2,4-trimethylbenzene	105
Sec-Butylbenzene	105
1,3-dichlorobenzene	146
1,4-dichlorobenzene	146
4-isopropyltoluene	119
1,2-dichlorobenzene	146
Butylbenzene	91
1,2-dibromo-3,-chloropropane	75
1,2,4-trichlorobenzene	118
Naphthalene	128
Hexachlorobutadiene	225
1,2,3-trichlorobenzene	180

Purge & Trap Conditions:- Velocity XPT (with AQUATEK 70) method

Variable	Value	Variable	Value
Valve Oven Temp.	150ºC	Dry Purge Temp.	40ºC
Transfer Line Temp.	150ºC	Dry Purge Flow	200 mL / min.
Sample Mount Temp.	90ºC	GC Start	Start of Desorb
Purge Ready Temp.	45ºC	Desorb Preheat Temp.	245ºC
Dry Flow Standby Temp.	175ºC	Desorb Drain	On
Standby Flow	10 mL / min.	Desorb Time	1.00 min.
Pressurize Time	0.25 min.	Desorb Temp.	250ºC
Fill I.S. Time	0.00 min.	Desorb Flow	200 mL / min.
Sample Transfer Time	0.25 min.	Bake Rinse	On
Pre-purge Time	0.00 min.	Number of Bake Rinses	3
Pre-Purge Flow	40 mL / min.	Bake Drain Time	0.50 min.
Sample Heater	Off	Bake Drain Flow	400 mL / min.
Sample Preheat Time	1.00 min.	Bake Time	3.00 min.
Preheat Temp.	40ºC	Bake Temp.	270ºC
Purge Time.	11.00 min.	Dry Flow Bake Temp.	175ºC
Purge Temp.	0ºC	Bake Flow	400 mL / min.
Purge Flow	40 mL/min.	Focus Temp.	-150ºC

Purge Rinse Time	0.25 min.	Inject Time	1 min.
Purge Line Time	0.25 min.	Inject Temp.	180ºC
Dry Purge Time	0.00 min.	Standby Temp.	100ºC

Unity Thermal desorber Conditions :

Desorption temp : 275°C

Desorption time : 5 min

Cold trap packing : Tennax TA

Cold trap focusing temp : -10°C

Cold trap (secondary) desorption temp : 300°C

Secondary desorption time 3 min

Flow path temp : 120°C

Desorb flow : 4ml/min

Inlet split : 52ml/min

Outlet split : 50ml/min

7.0 Processing & Calculations

The chromatograms have to be acquired using the computer based chem. Station software. The concentration of the unknown has to be calculated from the equation using regression anaaysis of the reciprocal of the pesticide residue concentration as weighing factor (1/x)

Y = mx+c
Where y = analyteareas
x = concentration of analyte
m = slope of the calibration curve
c = y-axix intercept value

Inject and analyze the verification Standard solution.

Calculate the concentrations as follows:

$$\text{Conc. (mg/100mL)} = \frac{\text{working Std. Soln. Conc. (in mg/100mL) x analyte peak area}}{\text{Verification std. soln. peak area}}$$

Analyze the working standard solution after every 15 samples, and at the end of the sample set.

8.0 Reference:

- **References :**
- 1. ASTM D- 3687-01 (Standard practice for Analysis of Organic Compound Vapours Collected by the Activated Charcoal Tube Adsorption Method)

- 2.US-EPA 502.2,524.2 ,8260B, (Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS))

- EURACHEM/CITAC Guide CG4

ANNEXURE - VII

METHOD OF ANALYSIS
Wastewater samples
Method – EPA 5035A

Table of contents

1.0 Purpose

To validate the GC-MS(P&T) method for the determination of VOC's. in Water and Effluent

2.0 Scope

This protocol provides guidance to validate the method of analysis to evaluate its reliability and suitability for its intended purpose.

3.0 Terms and abbreviations

The following table lists terms and abbreviations and their descriptions which are used in the protocol.

Terms	Abbreviations
GC-MS	Gas Chromatography with Mass Spectrometer
RSD	Relative Standard Deviation
LOQ	Limit of quantification

4.0 Validation Program and Acceptance Criteria

Validation parameters: Following performance parameters will be assessed during validation.

- Selectivity/Specificity
- Sensitivity (LOQ)
- Linearity
- Precision & Accuracy
- Recovery
- Measurement of Uncertainty

4.1 Selectivity/Specificity

The selectivity/specificity of the present method will be established by checking the reagent blank and matrix blank (without spiking VOC Standard)

and comparing the interference at the retention time or mass transition (m/z) of analytes against solvent LOQ.

Acceptance Criteria:

If the reagent blank and Matrix blank contains significant interference at the retention time or mass transition (m/z) of analytes in question, that will be rejected. (Criteria ≤ 30% of LOQ).

4.2 Sensitivity

Sensitivity of the method will be expressed as limit of quantification.

Acceptance Criteria:

Lowest level for which it has been demonstrated that criteria for accuracy and precision have been met .

4.3 Recovery

Recovery of an analyte in an assay is the instrument responses obtained from the amount of analyte added to and recovered from sample matrix, compared to detector response obtained from pure authentic reference standard. The percentage recoveries are determined by measuring the peak area of recovery samples at concentrations of LOQ. Comparing with the responses of the un-extracted solvent standards.

Acceptance criteria:

Accuracy should be 70 to 120% at LOQ level (As per the FDA Guidelines)

CV % of the recovery of analyte at each concentration level shall be ≤ 20.

If the above criteria are not met, repeat the recovery experiment.

4.4 Linearity

Determination of the relationship between the observed signal (response produced by the detection system) from the target analyte in the sample extract and known quantities of the analyte prepared as standard solutions is called as calibration curve. The no. of standards used in constructing a calibration curve will be a function of the anticipated range of analytical

values. Concentrations of standards should be chosen on the basis of the concentration range expected in the samples.

A calibration curve consists of reagent and matrix blank and 7 non-zero calibration standards covering the expected range (coded as CC1 (LLOQ) through to CC7 (~20xLOQ)). A linear equation will be determined to produce the best fit for the concentration /response relationship.

Acceptance criteria

Maximum allowed deviation of the CC1 from actual concentration shall be ±20% and standards other than CC1 from actual concentration shall be ± 15%

'r' shall be ≥0.99 (or) 'r2' shall be ≥ 0.98

At least 3 out of 7 non-zero standards shall meet the above criteria, including the CC1 and the calibration standards at the highest concentration (CC7). Any two consecutive points shall not be excluded. (As per FDA Guidelines)

4.5 Precision and Accuracy

Precision:

Under each calibration curve analyze 6 sets of each of LOQ,~3Xloq and ~5xLOQ samples.

The precision of the method is represented by % Coefficient of variation of analyzed samples under recovery experiment and calculated as follows.

CV % = (SD/Mean) x 100,

Where CV% = coefficient of variation and SD = standard deviation

Acceptance criteria:

The precision denoted by CV % at each concentration level should be $\leq$ 15% expect for LLOQ where it should not be $\leq$ 20%.

Accuracy:

The accuracy of method is represented by % recovery of the analytes and will be calculated as follows:

% Accuracy = (Mean of obtained concentrations /Actual concentration) x 100

Acceptance criteria:

The % accuracy obtained should be within 70-120%

4.6 Measurement of Uncertainty :

A range around the reported result within which the true value can be expected to lie with a specified probability (confidence level, usually 95%). Uncertainty data should encompass trueness (bias) and reproducibility

Measurand : Determination of Pesticide Residues in Grape Fruit

- Instrument used: …..
- Balance ID : ….
- Volumetric flask ID :…..
- Method of testing: In house method
- Standard used: All neat standards procured from known source
- Micropipettes used: …..
- Sources of Uncertainty:
    1. Uncertainty due to Standard Preparation

        f) Reference standard purity
        g) Balance uncertainty
        h) Glassware uncertainty
        i) Micropipette uncertainty (10-100µL)
        j) Micropipette uncertainty (100-1000µL)

    2. Repeatability uncertainty (Type-A): Sample preparation

Calculations:

As per EURACHEM/CITAC Guide CG4

5.0 Analytical Procedure GC-MS(P&T):

5.1 Instrument & equipment

- GC –MS
- Data system – Chem Station
- VRX, length 20m x ID 0.18mm, Film thickness 1.0µm
- Micropipette
- Analytical Balance

5.2 Reagents

- Methanol – AR grade

Reagent Water – Milli-Q water (with reference to the specification of Water for Laboratory ISO3696:1987 Electrical conductivity and TOC are within the specifications)

5.3 Standards

Reference standards procure from Sharalu Chem or Equivalent

5.4 Preparation of Standards for calibration curve:

Standards for calibration curve were prepared from stock of 2000µg/mL (AccuStandard)

Prepration of Stock Solutions

Conc. Of Stock Solution (mg/L)	Volume of Stock (mL)	Volume of Diluent* (mL)	Made up Volume (mL)	Final Conc. (mg/L)
2000	1	9	10	200
200	2.5	7.5	10	50
200	1.25	8.75	10	25
50	4	6	10	20
20	5	5	10	10
10	5	5	10	5
10	1	9	1	1

Preparation of pesticide residues for calibration curves: Prepare CC1 toCC7 daily ranging from 1 to 20 ng/mL with Water.

Conc. Of Stock Solution (µg/ml	Volume of Stock (µL)	Made up Volume (mL)	Final Conc(µg/L	Lable
20	43	43	20	C(
15	43	43	15	C(
20	43	43	10	C(
10	43	43	8	C(
5	43	43	5	C(
1	43	43	1	C(
0.1	43	43	0.1	C(

5.6 Sample Preservation

On receipt of samples, store them at about 4°C.

5.7 Sample preparation

Sampling:
Reservoir water samples for all analyses were collected using a 1.2-L, Teflon Kemmerer sampler samples collected by submerging the sample bottle, removing the cap, filling the bottle, and recapping the bottle while still submerged.

The finished (treated) drinking-water samples and imported raw-water samples were collected from spigots located at the distribution points. The water lines were flushed for 5 minutes before the sample bottles were filled

5.8 Effluent and water samples: load the effluent sample directly, in case it is turbid or oily dilute the sample with organic free water. Water samples can be loaded directly in to the purge and trap system.

5.8 Analytes :

Dichlorodifluoromethane, Chloromethane, Vinylchloride, Bromomethane, Ethylchloride, Trichloromonofluromethane, 1,1-Dichloroethane, Methylenechloride, trans-1,2-dichloroethane,, 1-1,dichloroethane, cis-1,2-

dichloroethene, Bromochloromethane, Chloroform, 2,2-dichloropropane, 1,2-dichloroethane, 1,1,1-trichloroethane, 1,1-dichloropropene, carbontetrachloride, Benzene, Dibrmomethane, 1,2-dichloropropane, Trichloroethylene, Bromodichloromethane, 1,3-dichloropropene, trans-1,3-dichloropropene, 1,1,2-trichloroethane, Toluene, dichlorpropane, Dibromochlormethane, 1,2-dibromoethane, Tetrachloroethylene, 1,1,1,2-tetrachloroethane, Chlorobenzene, ethylbenzene, Bromoform, m&p-xylene, Styrene, 1,1,2,2-tetrachloroethane, o-xylene, dichloropropane, isopropylbenzene, bromobenzene, n-propylbenzene, 2-chlorotoluene, chlorotoluene, 1,3,5trimethylbenzene, tert-butylbenzene, 1,2,4-trimethylbenzene, sec-butlbenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 4-isopropyltoluene, 1,2-dichlorobenzene, butylbenzene, 1,2-dibromo-3,-chloropropane, 1,2,4-trichlorobenzene, Naphthalene, Hexachlorobutadiene, 1,2,3-trichlorobenzene.

5.9 Details of GC/MS Method :

Instrument Details: Model Used:- 6890 GC-MSD (Make:- Agilent Technologies Ltd.)

GC conditions:-

Oven

Initial Temperature : 40 ºC (On)
Initial Time : 3.00 Min.
Maximum Temp : 260ºC
Equilibrium Time : 0.50 min.
Ramps:

#	Rate	Final Temp.	Final Time
1	10	100	0.00
2	25	225	3.00
3	0.0 (off)		

Post Temp : 0 ºC
Post Time : 0.00 min.
Run Time : 17.00 min.

Front Inlet (Split / Split less)

Mode : Split
Inlet Temp : 250 °C (On)
Pressure : 23.20 psi (On)

Split : 50:1
Split flow : 49.6 mL / min.
Total flow : 53.1 mL / min.
Gas saver : ON
Gas Type : Helium

Column 1

Capillary Column
Model Number: J&W US5270225H
DB-VRX,20m x 0.18mm x 1µm
Intial flow : 1.0mL/min
Inlet : Front Inlet
Outlet : MSD
Outlet pressure : vacuum

Thermal Aux 2 (Transfer line)

Use : MSD Transfer Line Heater
Initial temp : 260 °C
Initial time : 0.00 min.

MS Acquisition Parameters

General Information
Tune File : atune.u
Acquisition Mode : Scan

Name	Quantification ion
Dichlorodifluoromethane	85
Chloromethane	50
Vinyl chloride	62
Bromomethane	94
Ethylchloride	64
Trichloromonofluoromethane	101
1,1-dichloroethene	96
Methylene chloride	84
Trans-1,2-Dichloroethene	96
1,1-dichloroethane	63
Cis-1,2-Dichloroethene	96
Bromochloromethane	128
Chloroform	83
2,2-dichloropropane	77
1,2-dichloroethane	62
1,1,1-Trichloroethane	97
1,1-dichloropropene	75
Carbon Tetrachloride	117

Benzene	78
Dibromomethane	93
1,2-dichloropropane	63
Trichloroethylene	95
Bromodichloromethane	83
1,3-dichloropropene	75
Trans-1,3-dichloropropene	75
1,1,2-Trichloroethane	83
Toluene	91
1,3-Dichloropropane	76
Dibromochloromethane	129
1,2-Dibromoethane	107
Tetrachloroethylene	166
1,1,1,2-Tetrachloroethane	131
Chlorobenzene	112
Ethylbenzene	91
Bromoform	173
m & p - Xylene	106
Styrene	104
1,1,2,2-Tetrachloroethane	83
O-Xylene	106
1,2,3-Trichloropropane	75
Isopropyl benzene	105
Bromobenzene	156
n-Propylbenzene	91
2-Chlorotoluene	91
4-Chlorotoluene	91
1,3,5-trimethylbenzene	105
Tert-Butylbenzene	119
1,2,4-trimethylbenzene	105
Sec-Butylbenzene	105
1,3-dichlorobenzene	146
1,4-dichlorobenzene	146
4-isopropyltoluene	119
1,2-dichlorobenzene	146
Butylbenzene	91
1,2-dibromo-3,-chloropropane	75
1,2,4-trichlorobenzene	118
Naphthalene	128
Hexachlorobutadiene	225
1,2,3-trichlorobenzene	180

Purge & Trap Conditions:- Velocity XPT (with AQUATEK 70) method

Variable	Value	Variable	Value
Valve Oven Temp.	150°C	Dry Purge Temp.	40°C
Transfer Line Temp.	150°C	Dry Purge Flow	200 mL / min.
Sample Mount Temp.	90°C	GC Start	Start of Desorb
Purge Ready Temp.	45°C	Desorb Preheat Temp.	245°C
Dry Flow Standby Temp.	175°C	Desorb Drain	On
Standby Flow	10 mL / min.	Desorb Time	1.00 min.
Pressurize Time	0.25 min.	Desorb Temp.	250°C
Fill I.S. Time	0.00 min.	Desorb Flow	200 mL / min.
Sample Transfer Time	0.25 min.	Bake Rinse	On
Pre-purge Time	0.00 min.	Number of Bake Rinses	3
Pre-Purge Flow	40 mL / min.	Bake Drain Time	0.50 min.
Sample Heater	Off	Bake Drain Flow	400 mL / min.
Sample Preheat Time	1.00 min.	Bake Time	3.00 min.
Preheat Temp.	40°C	Bake Temp.	270°C
Purge Time.	11.00 min.	Dry Flow Bake Temp.	175°C
Purge Temp.	0°C	Bake Flow	400 mL / min.
Purge Flow	40 mL/min.	Focus Temp.	-150°C
Purge Rinse Time	0.25 min.	Inject Time	1 min.
Purge Line Time	0.25 min.	Inject Temp.	180°C
Dry Purge Time	0.00 min.	Standby Temp.	100°C

6.0 Processing & Calculations

The chromatograms have to be acquired using the computer based chem. Station software. The concentration of the unknown has to be calculated from the equation using regression anaaysis of the reciprocal of the pesticide residue concentration as weighing factor (1/x)

Y = mx+c
Where y = analyteareas
x = concentration of analyte
m = slope of the calibration curve
c = y-axix intercept value

Inject and analyze the verification Standard solution.

Calculate the concentrations as follows:

$$\text{Conc. (mg/100mL)} = \frac{\text{working Std. Soln. Conc. (in mg/100mL) x analyte peak area}}{\text{Verification std. soln. peak area}}$$

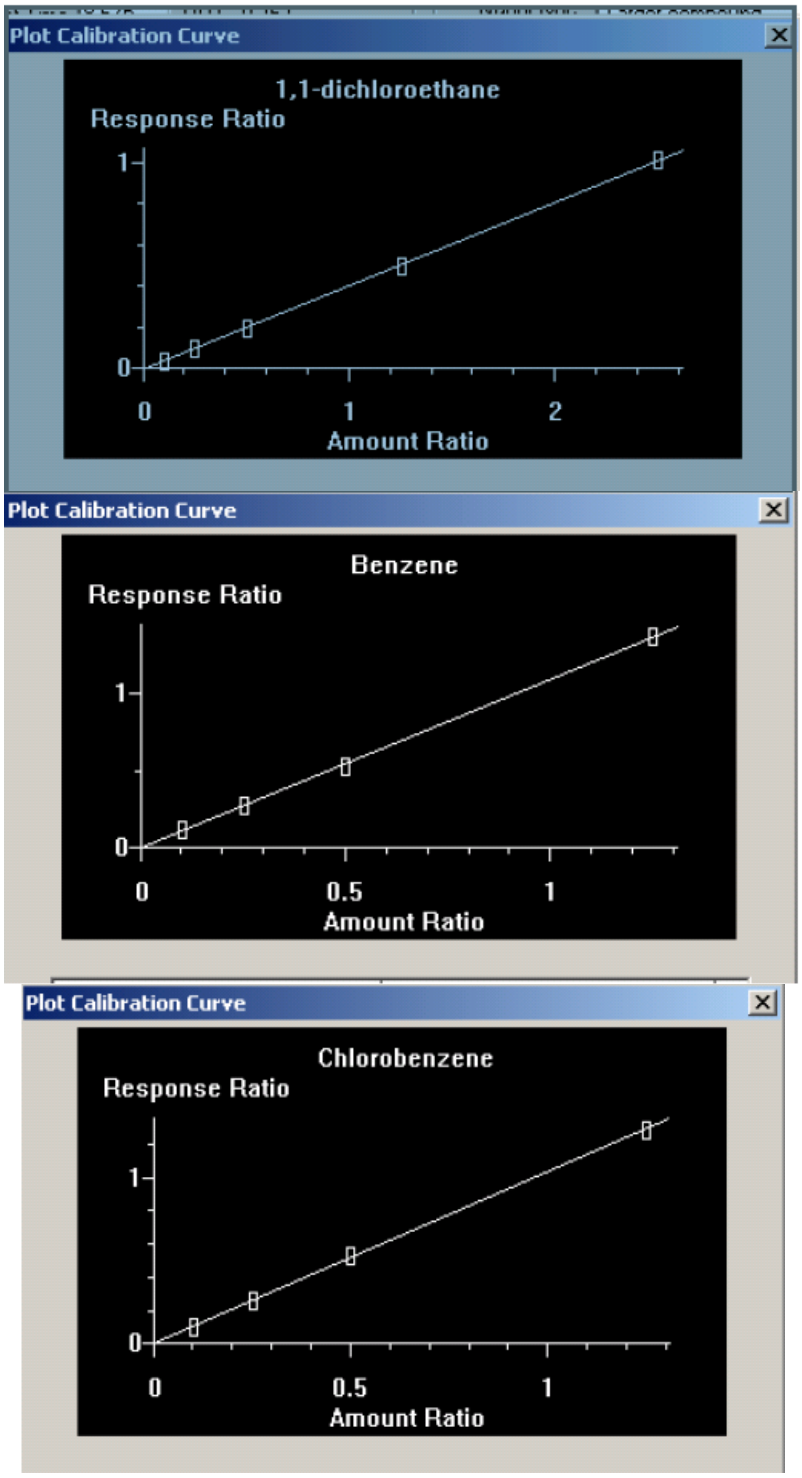
Analyze the working standard solution after every 15 samples, and at the end of the sample set.

7.0 Reference:

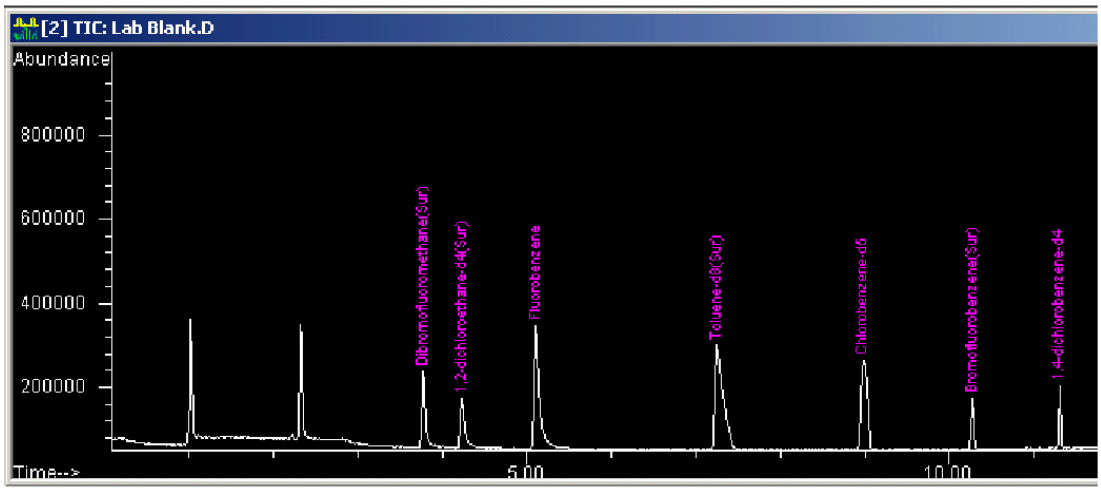
- **References :**
- 1.US-EPA 502.2,524.2 ,8260B, (Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS))
- 2. US-EPA 5035,5035A 5035C (Closed –System Purge and Trap and Extraction for Volatile Organics in soil and waste water)
- EURACHEM/CITAC Guide CG4

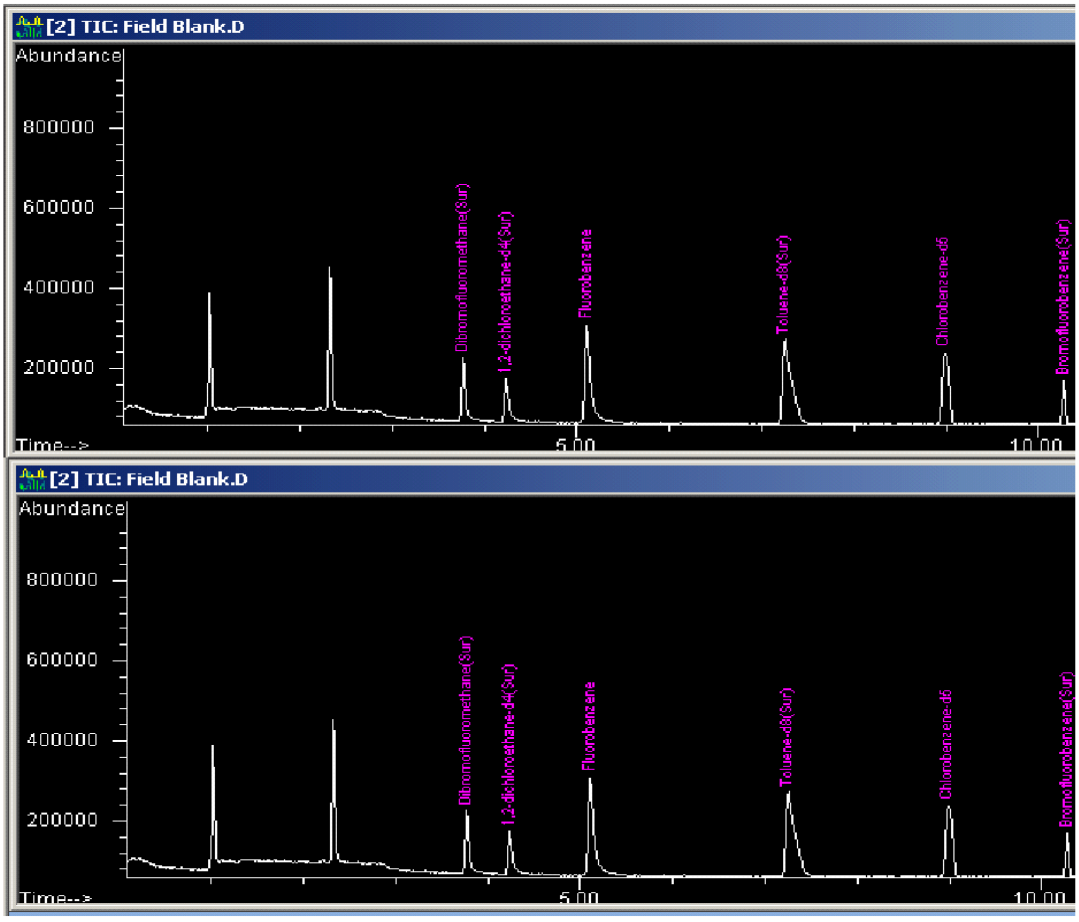
ANNEXURE - VIII

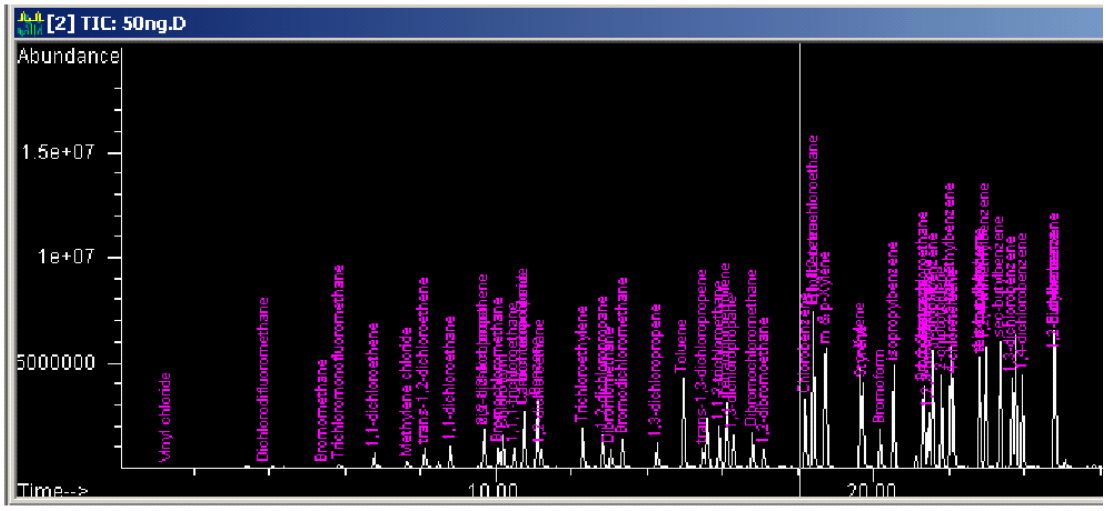
CHROMATORGRAMS



CHROMATORGRAMS



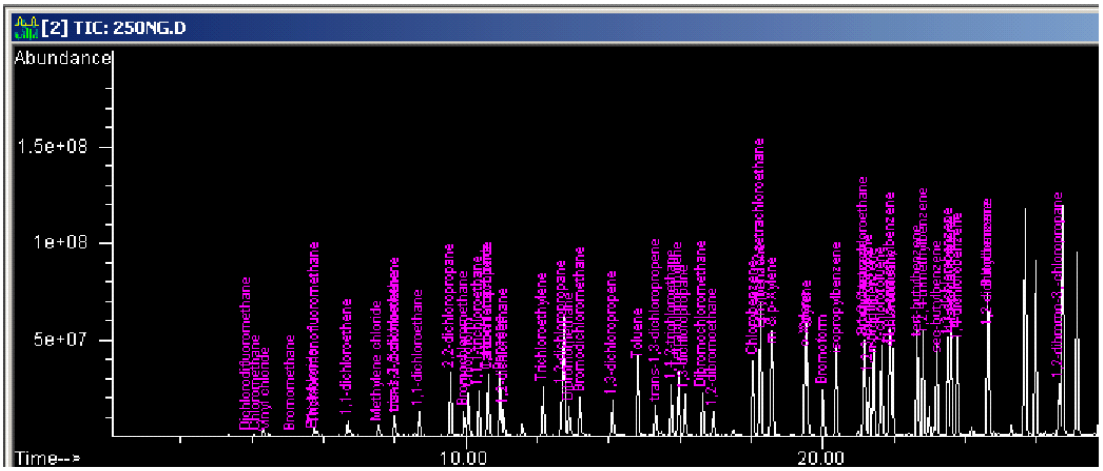




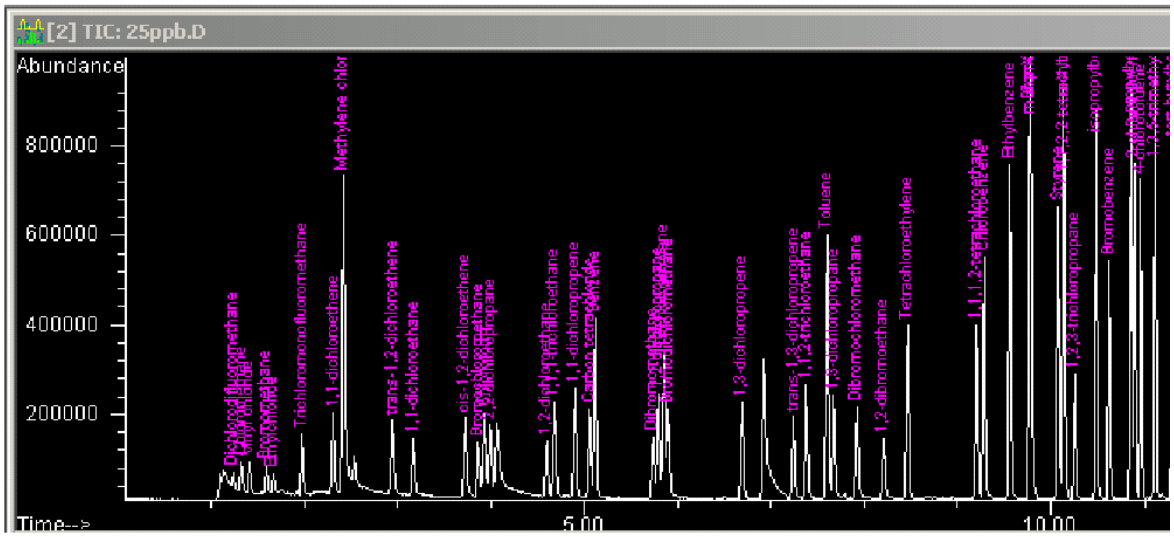
Data File : 50ng.D
Operator :
Sample : Spike_50ng
Misc :
ALS Vial : 1 Sample Multiplier: 1
Quant Method : C:\MSDCHEM\1\METHODS\VOC 60_VF.M
Quant Title : VOCs using
Response via : Initial Calibration

Internal Standards	R.T.	QIon	Response	Conc Units		Dev(Min)
Target Compounds						Qvalue
7) 1,1-dichloroethene	6.79	61	5949860	31.74 ng		98
8) Methylene chloride	7.66	84	1712456	26.56 ng	#	62
9) trans-1,2-dichloroethene	8.11	61	5833606	38.39 ng		92
10) 1,1-dichloroethane	8.80	63	12850550	36.65 ng		98
11) cis-1,2-dichloroethene	9.69	61	8795658	42.39 ng		95
12) Bromochloromethane	10.08	130	4321137	46.90 ng	#	78
13) Chloroform	10.20	83	14391961	43.35 ng		98
14) 2,2-dichloropropane	9.69	77	4045900	1.79 ng		95
15) 1,2-dichloroethane	11.19	62	8268715	48.71 ng	#	95
16) 1,1,1-trichloroethane	10.48	97	8631478	8.45 ng		98
17) 1,1-dichloropropene	10.74	75	10945893	43.30 ng		97
18) Carbon tetrachloride	10.75	117	8943613	13.47 ng		99
19) Benzene	11.09	78	37581724	38.15 ng		99
20) Dibromomethane	13.05	174	3543532	55.67 ng	#	82
21) 1,2-dichloropropane	12.84	63	8697441	43.53 ng	#	90
22) Trichloroethylene	12.31	130	9844597	47.96 ng		100
23) Bromodichloromethane	13.35	83	12503210	48.36 ng		98
24) 1,3-dichloropropene	14.26	75	9327502	48.03 ng		92

25) trans-1,3-dichloropropene	15.48	75	7349537	55.41 ng	#	93
26) 1,1,2-trichloroethane	15.92	97	9717275	48.26 ng		97
27) Toluene	14.98	91	48639048	37.65 ng		99
28) 1,3-dichloropropane	16.29	76	12533676	46.87 ng	#	85
29) Dibromochloromethane	16.79	129	14142249	49.24 ng		100
30) 1,2-dibromoethane	17.09	107	8959810	48.96 ng		100
31) Tetrachloroethylene	16.11	166	16040440	48.38 ng		100
32) 1,1,1,2-tetrachloroethane	18.40	131	6810835	80.28 ng	#	79
33) Chlorobenzene	18.20	112	30334684	45.41 ng		99
34) Ethylbenzene	18.41	91	56118963	32.87 ng		99
35) Bromoform	20.17	173	14319746	48.93 ng		98
36) m & p-Xylene	18.73	91	85998810	30.18 ng		96
37) Styrene	19.71	104	31202414	41.68 ng		99
38) 1,1,2,2-tetrachloroethane	21.31	83	19890105	43.02 ng	#	60
39) o-Xylene	19.65	91	46602297	38.58 ng	#	96
40) 1,2,3-trichloropropane	21.46	75	17579510	46.66 ng		90
41) isopropylbenzene	20.54	105	57248541	32.99 ng		99
42) Bromobenzene	21.34	77	18642781	43.40 ng		96
43) n-propylbenzene	21.57	91	72723735	27.42 ng		99
44) 2-chlorotoluene	21.80	91	41880739	40.24 ng		99
45) 4-chlorotoluene	22.11	91	33859513	43.88 ng	#	87
46) 1,3,5-trimethylbenzene	22.03	105	53666335	33.76 ng		95
47) tert-butylbenzene	22.80	119	47134924	37.51 ng		99
48) 1,2,4-trimethylbenzene	22.96	105	55217963	33.94 ng		96
49) sec-butylbenzene	23.36	105	73015274	29.04 ng		98
50) 1,3-dichlorobenzene	23.67	146	33146961	42.65 ng		99
51) 1,4-dichlorobenzene	23.94	146	34266172	41.99 ng		99
52) 4-isopropyltoluene	22.80	119	47062010	37.95 ng	#	59
53) 1,2-dichlorobenzene	24.82	146	34009240	41.65 ng		100
54) Butylbenzene	24.78	91	56126349	32.93 ng		98
55) 1,2-dibromo-3,-chloropropa	26.80	157	13181730	46.59 ng		97
56) 1,2,4-trichlorobenzene	28.85	180	32371735	43.92 ng		100
57) Naphthalene	29.51	128	85189117	17.99 ng		99
58) Hexachlorobutadiene	29.20	225	22559567	47.36 ng		99
59) 1,2,3-trichlorobenzene	30.05	180	32758876	44.02 ng		99

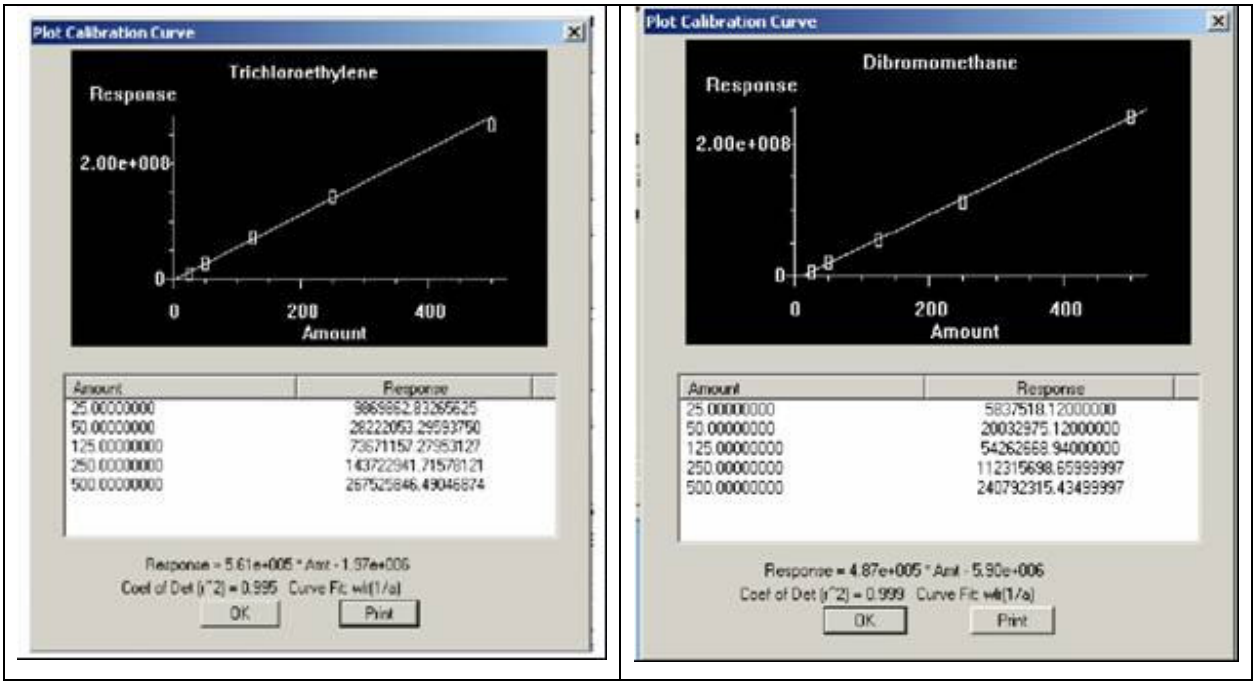


Purge & Trap
Standards Chromatorgram



Target Compounds						Qvalue
1) Dichlorodifluoromethane	1.24	85	232437	25.00 ppb	#	90
2) Chloromethane	1.33	50	623604	25.00 ppb		98
3) Vinyl chloride	1.41	62	648982	25.00 ppb		98
4) Bromomethane	1.60	94	335606	25.00 ppb		98
5) Ethylchloride	1.67	64	380961	25.00 ppb		96
6) Trichloromonofluoromethane	1.98	101	1020462	25.00 ppb		99
7) 1,1-dichloroethene	2.31	61	933441	25.00 ppb		93
8) Methylene chloride	2.42	84	3590396	25.00 ppb		87
9) trans-1,2-dichloroethene	2.95	61	920569	25.00 ppb		96
10) 1,1-dichloroethane	3.17	63	1213830	25.00 ppb		99
11) cis-1,2-dichloroethene	3.72	61	943271	25.00 ppb		98
12) Bromochloromethane	3.87	130	572656	25.00 ppb		95
13) Chloroform	3.94	83	1454437	25.00 ppb		99
14) 2,2-dichloropropane	4.00	77	1137315	25.00 ppb		100
15) 1,2-dichloroethane	4.60	62	978747	25.00 ppb	#	97
16) 1,1,1-trichloroethane	4.68	97	1488332	25.00 ppb		99
17) 1,1-dichloropropene	4.90	75	1157281	25.00 ppb		98
18) Carbon tetrachloride	5.06	117	1312235	25.00 ppb		100
19) Benzene	5.12	78	3634300	25.00 ppb		98
20) Dibromomethane	5.74	174	694924	25.00 ppb		98
21) 1,2-dichloropropane	5.80	63	882160	25.00 ppb	#	83
22) Trichloroethylene	5.85	130	1228441	25.00 ppb		96
23) Bromodichloromethane	5.90	83	1285890	25.00 ppb		97
24) 1,3-dichloropropene	6.70	75	1321419	25.00 ppb		100
25) trans-1,3-dichloropropene	7.24	75	1060345	25.00 ppb		99
26) 1,1,2-trichloroethane	7.38	97	942313	25.00 ppb		98
27) Toluene	7.61	91	4711599	25.00 ppb		98
28) 1,3-dichloropropane	7.68	76	1439678	25.00 ppb		98
29) Dibromochloromethane	7.93	129	1149877	25.00 ppb		95
30) 1,2-dibromoethane	8.21	107	971232	25.00 ppb		98
31) Tetrachloroethylene	8.47	166	1416086	25.00 ppb		98
32) 1,1,1,2-tetrachloroethane	9.21	131	1244471	25.00 ppb		97

32)	1,1,1,2-tetrachloroethane	9.21	131	1244471	25.00 ppb	97
33)	Chlorobenzene	9.28	112	3234335	25.00 ppb	96
34)	Ethylbenzene	9.56	91	4999416	25.00 ppb	96
35)	Bromoform	9.77	173	985282	25.00 ppb	99
36)	m & p-Xylene	9.78	91	7798300	25.00 ppb	96
37)	Styrene	10.08	104	3107516	25.00 ppb	92
38)	1,1,2,2-tetrachloroethane	10.13	83	1204739	25.00 ppb #	1
39)	o-Xylene	10.14	91	4011127	25.00 ppb	96
40)	1,2,3-trichloropropane	10.26	75	978833	25.00 ppb	93
41)	isopropylbenzene	10.48	105	4780510	25.00 ppb	97
42)	Bromobenzene	10.62	77	1682413	25.00 ppb	95
43)	n-propylbenzene	10.86	91	5348606	25.00 ppb	97
44)	2-chlorotoluene	10.89	91	3345521	25.00 ppb	99
45)	4-chlorotoluene	10.96	91	4159907	25.00 ppb	88
46)	1,3,5-trimethylbenzene	11.12	105	4081684	25.00 ppb	91
47)	tert-butylbenzene	11.30	119	4045879	25.00 ppb	95
48)	1,2,4-trimethylbenzene	11.40	105	4125834	25.00 ppb	93
49)	sec-butylbenzene	11.47	105	5247423	25.00 ppb	99
50)	1,3-dichlorobenzene	11.48	146	2519084	25.00 ppb	98
51)	1,4-dichlorobenzene	11.53	146	2533620	25.00 ppb	98
52)	4-isopropyltoluene	11.62	119	4440105	25.00 ppb	97
53)	1,2-dichlorobenzene	11.78	146	2562461	25.00 ppb	99
54)	Butylbenzene	11.91	91	3268215	25.00 ppb	99
55)	1,2-dibromo-3,-chloropropa	12.10	157	319144	25.00 ppb	92
56)	1,2,4-trichlorobenzene	13.00	180	1660739	25.00 ppb	98
57)	Naphthalene	13.15	128	3632620	25.00 ppb	98
58)	Hexachlorobutadiene	13.21	225	910080	25.00 ppb	99
59)	1,2,3-trichlorobenzene	13.27	180	1603228	25.00 ppb	99



Annexure-IX

PROFILE OF THE CHEMICALS

Source: National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, February 2004

Sr. No.	Name of Chemical	Odour	Symptoms	Target organs	Carcinogen
01	Hydrogen sulphide	Rotten eggs	Irritation of eyes, respiratory system, coma, convulsion, conjunctivitis, eye pain, tears to eyes, dizziness, headache, weakness and exhaustion, insomnia, gastrointestinal disturbance	Eyes, respiratory system, Central Nervous System	No
02	Disagreeable odour like garlic or rotten cabbage	Irritation eyes, skin respiratory system	Irritation eyes, skin, respiratory system; convulsion	Eyes, skin, respiratory system, central Nervous System, blood	No
03	Dimethyl Sulphide	NA	Irritation, eyes, skin, respiratory system	Eyes, skin, respiratory system, central nervous system	No
04	Ethanol	Characteristic suffocating odour	Irritation eyes, skin, nose, headache, drowsiness, weakness, exhaustion, cough, liver damage, anemia, reproductive effects.	Eyes, skin, respiratory system, central nervous system, liver, blood, reproductive system	No
05	Methylene Chloride	Faint sweet odour	Irritation eyes, skin, weakness, exhaustion, drowsiness, dizziness, numbness, tingle limbs, nausea [potential occupational carcinogen]	Eyes, respiratory system, cancer site: [in animals: lung, liver, salivary& mammary gland tumours]	Yes
06	Trichloroethane	Chloroform like odour	Irritation eyes, skin, nose, headache, drowsiness, weakness, exhaustion, cough, liver damage, anemia, reproductive effects.	Eyes, skin respiratory system, heart, liver, kidneys cancer site: [in animals: liver and kidney cancer]	Yes
07	Toluene	Sweet pungent benzene like odour	Irritation eyes, nose, weakness, and exhaustion, confusion, dizziness, headache, dilated pupils, tears to eyes, anxiety, muscle fatigue, insomnia dermatitis, liver injury, kidney damage	Eyes, skin, respiratory system, central nervous system liver and kidney	No
08	Dimethyl Disulphide	NA	Irritation eyes, skin, respiratory system	Eyes, skin, respiratory system, central nervous system blood	No
09	Acetone	Fragrant mint like odour	Irritation eyes, nose, throat, headache, dizziness, central nervous system depression, dermatitis	Eyes, skin, respiratory system, central nervous system	No
10	Isopropyl Alchohol	Odour of rubbing	Irritation eyes, nose, throat, drowsiness, dizziness, headache, dry cracking skin, alcohol	Eyes, skin, respiratory system	No
11	n-Hexane	Gasoline like odour	Irritation of eyes, nose, nausea, headache, peripheral neuropathy, numbness, extremities muscle weakness, dermatitis, dizziness, chemical pneumonia	Eyes, skin, respiratory system, central nervous system	No

Sr. No.	Name of Chemical	Odour	Symptoms	Target organs	Carcinogen
12	Chloroform	Pleasant odour	Irritation of eyes, skin, dizziness, mental dullness, nausea, confusion; headache, weakness, exhaustion, enlarged liver [potential carcinogen]	Liver, kidneys, heart, eyes, skin, central nervous system cancer site: [in animals; liver and kidney cancer]	Yes
13	Carbon Tetrachloride	Characteristic either like odour	Irritation of eyes, skin, CNS depression, nausea, vomiting, liver, kidney injury, drowsiness, dizziness	Eyes. Respiratory system, lungs, liver kinder, skin cancer site: [in animals: liver cancer]	Yes
14	Benzene	An aromatic odour	Irritation eyes, skin, skin, nose, dizziness, headache, nauseam exhaustion, bone marrow depression [potential occupational carcinogen]	Eyes, skin, respiratory system, blood, central nervous system bone marrow Cancer Site [leukaemia]	Yes
15	2-Butanone (Methyk Ethyl Ketone)	A moderately sharp, fragrant, mint- or acetone like odour	Irritation eyes, skin, nose, headache, dizziness, vomiting, dermatitis	Eyes, skin respiratory system blood, central nervous system	No
16	Carbon Disulphide	A sweet ether like odour	Dizziness, headache, poor sleep, weakness, exhaustion, anxiety, weight loss, gastritis, kidneys, liver injury, eyes burns, dermatitis, reproductive effects	Central nervous system, peripheral nervous system, cardiovascular system, eyes kidneys, liver, skin, reproductive system	No
17	Ethylbenzene	An aromatic odour	Irritation eyes, skin, mucous membrane, headache, coma.	Eyes, skin respiratory system, central nervous system	No
18	m,p Xylenes	An aromatic odour	Irritation eyes, skin, nose, throat, dizziness, excitement, drowsiness, incoordination, staggering, gait, nausea, vomiting, abdominal pain, dermatitis	Eyes, skin, respiratory system, central nervous system gastrointestinal tract, blood, liver, kidneys	No
19	Acetonitrile	An aromatic odour	Irritation nose, throat, nausea, vomiting, chest pain, weakness, exhaustion, convulsion, in animal: liver, kidneys damage	Respiratory system, cardiovascular system, central nervous system, liver, kindneys	No
20	Acrylomitrile	An unpleasant odour	Irritation eyes, skin, headache, sneezing, nausea, vomiting, weakness, exhaustion, dizziness, skin [potential occupational carcinogen]	Eyes, skin, cardiovascular system, liver, kidneys, central nervous system Cancer Site [brain tumours lung & bowel cancer]	Yes
21	1,2-Dichloroethane	Chloroform-like odour	Irritation eyes, central nervous system depression; nausea, vomiting, dermatitis; liver, kidneys, cardiovascular system damage [potential occupational carcinogen]	Eyes, skin, kidneys, liver, central nervous system, cardiovascular system Cancer Site [in animals: forestomach, mammary gland and circulatory system cancer]	Yes
22	Vinyl chloride	Pleasant odour at high	Weakness, exhaustion, abdominal pain, gastrointestinal bleeding, enlarged liver [potential	Liver, Central Nervous System, blood, respiratory system, lymphatic system	Yes

		concentration	occupational carcinogen]		
23	I,I Dichlorochane	Chloroform like odour	Irritation skin, central nervous system depression, liver, kidneys, lung damage	Skin, liver, kidneys, lungs, central nervous system	No
24	1,1,2-Trichlorothane	Sweet, chloroform like odour	Irritation eyes, nose, central nervous system depression, liver, kidney damage [potential occupational carcinogen]	Eyes, respiratory system, central nervous system liver, kidneys Cancer Site: [in animal liver cancer]	Yes
25	Clorobenzene	Almond like odour	Irritation eyes, skin, nose, drowsiness, incordination, central nervous system depression; in animals: liver, lung, kidney injury	Eyes, skin, respiratory system, central nervous system, blood.	No
26	o-Xylene	Aromatic odour	Irritation eyes, skin, nose, throat, dizziness, excitement, drowsiness, incordination, anorexia, nausea, vomiting, abdominal pain, dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys	No
27	1,2,4-Trimethylbenzene		Irritation eyes, skin, nose, throat, respiratory system, bronchitis, headache, drowsiness, fatigue, dizziness, nausea, incordination, vomiting, confusion, chemical pneumonitis	Eyes, skin respiratory system, central nervous system, blood	No
28	Alpha-pinene	A characteristic odour	Irritation eyes, skin, nose, throat, headache, dizziness, convulsion, blood in the urine, kidney damage, abdominal pain, nausea	Eyes, skin respiratory system, central nervous system, kidneys	No
29	d-Limonene	Characteristic citrus odour	Irritation of eyes, nose, lungs, lightness of head, difficulty in breathing, skin irritation, liver injury, kidney damage	Eyes, skin, respiratory system, liver and kidney	No
30	1,3 Butadiene	Mild aromatic and gasoline like odour	Irritation eyes, nose, throat, drosiness, dizziness, reproductive damages, [potential occupational carcinogen]	Eyes, respiratory system, central nervous system, reproductive system Cancer Site [blood cancer]	Yes
31	Acrolin	A piercing disagreeable odour	Irritation eyes, skin, mucous membrane, chronic respiratory disease	Eyes, skin, respiratory system, heart	No
32	Methyl tert-Butyl Ether	NA	NA	NA	NA
33	Styrene	A sweet, floral odour	Irritation eyes, nose, respiratory system, headache, weakness, exhaustion, dissiness, confusion, drowsiness, unsteady gait, possible liver injury, reproductive effects	Eyes, skin, respiratory system, central nervous system, liver, reproductive system	No
34	Nonane	A gasoline like odour	Irritation eyes, skin, nose, throat, headache, drowsiness, dizziness, confusion, nausea, tremor	Eyes. Skin, respiratory system, central nervous	No system
35	Chloromethane	A faint sweet odour	Dizziness, nausea, vomiting, visual, disturbance, stagger, slurred speech, convulsion, coma, liver, kidney damage reproductive [potential occupational carcinogen]	Central nervous system, liver, kidneys, reproductive system Cancer Site [in animals; lungs, kidney & forestomach tumours]	No

36	N-Butyl Acetate	A mild turpentine like odour	Irritation eyes, skin, upper respiratory system, headache, drowsiness	Eyes, skin, respiratory system, central nervous system	No
37	Hexachlorobutadiene	A mild, turpentine like odour	In animals, irritation eyes, skin, respiratory system; kidney damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, kidneys Cancer Site [in animals: kidney tumours]	Yes
38	Carbony Sulphide	NA	NA	NA	NA
39	Chloroethane	A pungent ether-like odour	Incordination abdominal cramps, cardiac arrest; liver, kidney damage	Liver, kidneys, respiratory system, cardiovascular system, central nervous system	No
40	Triclorofluoromethane	Odourless liquid	Incordination, tremor, dermatitis, cardiac arrest	Skin, respiratory system, cardiovascular system	No
41	4-Methyl-2-Pentanone	A mild odour	Irritation eyes, skin, headache, drowsiness, dermatitis	Eyes, skin central nervous system	No
42	Cumene	A sharp, penentrating aromatic odour	Irritation eyes, skin, mucous membrane; dermatitis, headache, coma	Eyes, skin, respiratory system, central nervous system	No
43	1,3,5-Trimethyl benzene	A distinctive aromatic odour	Irritation eyes, skin, nose, throat, respiratory system, bronchitis, headache, drosiness, fatigue, dizziness, nausea, incordination, vomiting, confusion, chemical pneumonits	Eyes, skin, respiratory system, central nervous system, blood	No
44	Bromomethane	A chloroform like odour at high temperature	Irritation eyes, skin, respiratory system, central Nervous System depression; liver, kidney disease cardiac arrest [potential occupational carcinogen]	Eyes, skin, respiratory system, central nervous system, blood	No
45	Vinyl Acetate	A pleasant fruit odour	Irritation eyes, skin, nose, throat, hoarseness cough, loss of smell; eye burns, skin blisters	Eyes, skin respiratory system	No

ANNEXURE - X

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