BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

PRINCIPAL BENCH, NEW DELHI

ORIGINAL APPLICATION NO. 475 / 2024

IN THE MATTER OF:

News Item titled "Mountains of Plastic are choking the Himalayan State" appearing in the Hindu dated 04.03.2024

INDEX

Filed By:

Vikrant Pachnanda
Advocate for Central Pollution Control Board
C – 485, LGF, Defence Colony,
New Delhi – 110 024
M: +91 98711 38313
Email: vikrant.pachnanda@gmail.com

Date: 16.10.2024
Place: New Delhi

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI

Original Application No. 475 / 2024

News Item titled "Mountains of Plastic are choking the Himalayan State" appearing in the Hindu dated 04.03.2024

Reply on behalf of Central Pollution Control Board (CPCB) i.e, Respondent No. 1.

1. That the Hon'ble National Green Tribunal (hereinafter referred as NGT) *vide* Order dated 12.07.2024 and notice dated 26.07.2024 impleaded the Central Pollution Control Board (hereinafter referred as CPCB) as Respondent No. 1. Thereby, the submissions are made in the succeeding paragraphs.

2. That, CPCB is a statutory Board constituted under Section 3 of the Water (Prevention and Control of Pollution) Act, 1974. It performs the functions under The Water (Prevention and Control of Pollution) Act, 1974, The Air (Prevention and Control of Pollution) Act, 1981 and The Environment (Protection) Act, 1986.

3. That it is humbly submitted that the State Pollution Control Boards / Pollution Control Committees **(hereinafter referred as SPCBs/PCCs)** have been constituted in States / Union Territories under the Water Act and Air Act, to perform the functions and implement the provisions of these Acts in respect of their territorial Jurisdiction. Moreover, the SPCBs/PCCs, in respect of any given State/Union Territory, have been fully empowered to implement the provisions of these Acts.

BACKGROUND

4. That the issue has been raised in a Newspaper article published in 'The Hindu' dated 04.03.2024 with respect to plastic pollution in the Indian Himalayas, to which the response by the Answering Respondent as follows:

(a) Micro plastic Accumulation and Glacier contamination: Micro plastics are accumulating in the Himalayan Mountains, rivers, lakes, and streams. Micro plastics can become trapped in glaciers and are released into rivers during snowmelt.

It is submitted that in compliance of this Hon'ble Tribunal's order in O.A. No. 251 of 2022, CPCB had filed a report dated 10.02.2023. The report indicates that micro plastics enter water primarily through sewage, wastewater, and surface runoff persisting due to inadequate filtration in treatment systems and contributions from plastic infrastructure (pipes, machinery) used for collection, treatment & distribution of water/ waste water. Further industries, including pharmaceuticals and cosmetics, use primary micro plastics that often end up in domestic wastewater after use. Micro plastic is also prevalent in plastic bottled water. Airborne micro plastic poses inhalation risks in urban settings, while soil contamination occurs *via* plastic films and waste. Micro plastic had been found in human biological samples, suggesting potential health impacts from ingestion and inhalation routes. However, presently there are no studies on the impacts of ingested micro plastics on human health. Copy of the said report has been annexed herewith as **Annexure – I**.

(b) Impact of plastic pollution: Improper disposal of plastics is leading to soil and water pollution in the Indian Himalayan Region. The pollution is negatively affecting biodiversity in the region. The pollution is having an adverse impact on fresh water sources that downstream communities rely on.

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It is submitted that CPCB has prepared a study report during December, 2015 on *"Impact of Plastic Waste Disposal on Soil and Water Quality at Lucknow Dumpsites"*. As per the said report, dumping of plastic waste may deteriorate soil and underground water quality due to leaching of additives, colours, stabilizers and fillers present in the plastic waste. Copy of the said report is annexed herewith as **Annexure – II**.

(c) Urbanization and Consumption Patterns and tourist footfall: Rapid, unplanned urbanization and changing production and consumption patterns are contributing to the plastic waste crisis in the region. An increase in tourist footfall is exacerbating the plastic waste problem.

It is submitted that as per Rule 6 of the Plastic Waste Management Rules, 2016 (as amended), the concerned local body is responsible for development and setting up of infrastructure for segregation, collection, storage, transportation, processing and disposal of the plastic waste either on its own or by engaging agencies.

As per Rule 20 of the Solid Waste Management Rules 2016, "*Criteria and actions to be taken for solid waste management in hilly areas*" is herein as under:

In the hilly areas, the duties and responsibilities of the local authorities shall be the same as mentioned in rule 15 with additional clauses as under:

(a) Construction of landfill on the hill shall be avoided. A transfer station at a suitable enclosed location shall be setup to collect residual waste from the processing facility and inert waste. A suitable land shall be identified in the plain areas down the hill within 25 kilometers for setting up sanitary landfill. The residual waste from the transfer station shall be disposed of at this sanitary landfill.

(b) In case of non-availability of such land, efforts shall be made to set up regional sanitary landfill for the inert and residual waste.

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(c) Local body shall frame Bye-laws and prohibit citizen from littering wastes on the streets and give strict direction to the tourists not to dispose any waste such as paper, water bottles, liquor bottles, soft drink canes, tetra packs, any other plastic or paper waste on the streets or down the hills and instead direct to deposit such waste in the litter bins that shall be placed by the local body at all tourist destinations.

(d) Local body shall arrange to convey the provisions of solid waste management under the bye-laws to all tourists visiting the hilly areas at the entry point in the town as well as through the hotels, guest houses or like where they stay and by putting suitable hoardings at tourist destinations.

(e) Local body may levy solid waste management charge from the tourist at the entry point to make the solid waste management services sustainable.

(f) The department in- charge of the allocation of land assignment shall identify and allot suitable space on the hills for setting up decentralised waste processing facilities. Local body shall set up such facilities. Step garden system may be adopted for optimum utilisation of hill space.

Furthermore as per Schedule-I of Solid Waste Management, Rules 2016 "*Criteria for special provisions for hilly areas*" – Cities and towns located on hills shall have location specific methods evolved for final disposal of solid waste by the local body with the approval of the concerned State Pollution Control Board or the Pollution Control Committee. The local body shall set up processing facilities for utilisation of biodegradable organic waste. The non-biodegradable recyclable materials shall be stored and sent for recycling periodically. The inert and non-biodegradable waste shall be used for building roads or filling-up of appropriate areas on hills. In case of constraints in finding adequate land in hilly areas, waste not suitable for road-laying or filling up shall be disposed of in regional landfills in plain areas.

(d) Plastic Waste Statistics and mismanagement waste Index: According to the Himalayan Clean-up waste audit in 2022, 92.7% of trash in the region was plastic, with 72% being non-recyclable plastic. India has one of the highest mismanaged waste indexes (MWI) in the world at 98.55%, ranking 4th globally. MWI reflects the gap between waste management capacity and plastic consumption

As per the characterization study conducted by CPCB in Shillong (Hilly region) in year 2024, the percentage of plastic waste in mixed waste is given in the table below. A copy of the relevant document is attached as Annexure III. It may be noted that plastic content in mixed waste in four major cities is located in the plains (Vijaywada, Bhopal, Kolkata, Vadodara) as per study carried out by CPCB has also been included in the table.

City Name	Percentage of plastic waste in Mixed waste at Generation points	Percentage of plastic waste in Mixed waste at Disposal points
Vijayawada	9.7	4.4
Bhopal	13.57	5.3
Kolkata	11.77	10.7
Shillong	15.3	14.6
Vadodara	10.76	4.3

(e) India has one of the highest mismanaged waste indexes (MWI) in the world at 98.55%, ranking 4th globally. MWI reflects the gap between waste management capacity and plastic consumption. India recycles only 12% of its plastic waste through mechanical recycling

As per the Annual Report, plastic waste generation for last two Financial years is given below:

S.No.	Year	Plastic Waste Generation (TPA)
1.	2021-22	39.39 lakhs (information by all SPCBs/PCCs)
2.	2022-23	41.6 lakhs (As per information of 34 SPCBs/PCCs. Information is awaited from UPPCB) Direction for the submission of the Annual Report was issued to SPCBs/PCCs vide letter dated September 21, 2023, and subsequently an email was also sent on February 24, 2024 to concern SPCB/PCC. Copy of directions and email are attached as **Annexure- IV**

Furthermore as per information available on Centralized Extended Producers Responsibility (EPR) Portal for Plastic Packaging, total 2481 Plastic Waste Processors (PWPs) are registered having total production capacity of approximately 234 lakhs tons per Annum. These registered PWPs have generated approximately 80 lakh tons of certificates through the processing of plastic packaging waste. Plastic Category wise certificate generated and transferred to Producers, Importers and Brand Owners (PIBOs) for fulfillment of EPR target of FY 2022-23 is given below:

Category	EPR certificate Generated (Lac T)	EPR certificate transferred (Lac T)
CAT-I	27.4	22.7
CAT-II	37.2	31.9
CAT-III	15.47	8.7
CAT-IV	0.044	0.038
Total	80.114	63.338

5. CPCB has taken following actions for overall effective Plastic Waste Management:

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a. Registration of Brand Owners/Producers/Importer/Plastic Waste Processors

Government of India, in its fourth Amendment to the Plastic Waste Management Rules, dated February 16, 2022, notified 'Guidelines on Extended Producer Responsibility for Plastic Packaging' in the Schedule II of the Rules. As per these guidelines, PIBOs & PWPs shall have to register through the online centralized portal developed by the Central Pollution Control Board. Total 4473 Producers, 35188 Importers, 2791 Brand Owners & 2481 PWPs haven been registered on the portal till date.

b. Promote alternative to Petro based plastic carry bags / films i.e. the compostable carry bags:

As per Rules 4(h) & 4(ha) of the Plastic Waste Management Rules, 2016 (as amended):

"(h) *the provision of thickness under clause (c) shall not apply to carry bags or commodities made from compostable plastic or biodegradable plastics. Carry bags and commodities made from compostable plastics shall conform to the Indian Standard: IS/ISO 17088:2021 titled as Specifications for Compostable Plastics.;*

(ha) *the manufacture of carry bags and commodities covered under sub rule (3) shall be permitted to be made from compostable plastics or biodegradable plastics subject to mandatory marking and labelling laid down under these rules and the regulations of the Food Safety and Standards Authority of India for food contact applications. The manufacturers of compostable plastic or biodegradable plastic carry bags or commodities permitted under the rules, shall obtain a certificate from the Central Pollution Control Board before marketing or selling;*

CPCB has framed the Standard Operating Procedure and developed the online portal for certification of Compostable Manufacturers. As per Rule 4(h) of the above said Rules, certificates have been issued to 311

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Compostable Manufacturers till date by CPCB. The certified capacity has increased substantially, from nil in 2016 to 3.6 lakh TPA.

6. Major Directions Issued for strengthening Enforcement of PWM Rules taken by CPCB:

i. **Direction Under Section 5 of the Environment (Protection) Act, 1986**: Issued to all SPCBs/PCCs on **04-07-2024** to direct local bodies and district panchayats to assess and characterize plastic waste for annual reporting as per Standard Operating Procedure(SOP) and PWM Rules. (**Annexure-VA**)

ii. **Directions under Section 5 of the EPA, 1986**: Issued to all SPCBs/PCCs on **14-03-2024** to inform all PIBOs and PWPs to register on the centralized EPR portal by **31-03-24**. (**Annexure-VB**)

iii. **Direction Under Section 5 of the Environment (Protection) Act, 1986**: Issued to the Principal Secretary, all State Urban Development Departments(UDDs) and SPCB/PCCs on the following dates: 01-02-2022, 30-06-2022, 01-03-2023, 17-05-2023, 20-11-2023, and 16-02-2024. These directions were issued to conduct a joint enforcement drive for enforcement of the SUP ban for four days a month. The latest direction, issued on 16-02-2024, for joint inspections from February to June 2024. (**Annexure-VC**)

iv. **Directions under Section 5 of the EPA, 1986**: Issued to all SPCBs/PCCs on **20-11-2023** to take immediate necessary actions for improved registration systems for EPR guidelines compliance. (**Annexure-VD**)

v. **Direction Under Section 5 of the Environment (Protection) Act, 1986**: Issued to the SPCB/PCC on **21-09-2023** to submit complete information for the Annual Report on PWM Rules for FY 2022-23. (**Annexure-VE**)

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vi. **Direction to Airlines operators regarding SUP**: Issued to 11 airline companies on **17-02-2023** to phase out banned SUP items. (**Annexure-VF**)

vii. **Direction under Section 5 of the EPA, 1986**: Issued to 10 e-commerce companies and 21 e-commerce on **25-01-2023** and **13-12-2022** to stop usage of SUP items & ensure zero inventory. (**Annexure-VG**)

viii. **Directions under Section 5 of the EPA, 1986**: Issued to plastic raw material manufacturers on **13-12-2022** regarding supply restrictions to unregistered producers and manufacturers of banned SUP items. (**Annexure-VH**)

ix. Letter issued on 12.10.2022 to Chief Secretaries to issue necessary instructions to all concerned authorities in their jurisdiction to facilitate implementation of SUP Ban (Environment (Protection) Act,1986). (**Annexure-VI**)

x. Letter issued on 01.12.2021 to Custom Authorities to stop import of banned SUP items . (**Annexure-VJ**)

7. **Environmental Compensation Regime:** CPCB, in compliance of Hon'ble NGT order dated 10.09.2020 in OA No. 247/2017 has framed Guidelines for assessment of Environmental Compensation **(EC)** for violation of the Plastic Waste Management Rules, 2016. The said guidelines have provisions for penal Action including seizure of goods and levying environmental Compensation for violation of Section 4c & 4d of the above Rules and restricting thickness of carry bags/plastic sheet to 50 microns. The guidelines have been updated in March 2024 in accordance with amendments to the aforesaid rules.

8. **CPCB has also developed following Guidelines for:**

i. Management of Sanitary Waste

ii. Disposal of non-recyclable fraction (Multi-layered) plastic waste

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iii. Collection, Segregation and Disposal of Plastic Waste.

iv. Co-processing of plastic waste in Cement Kilns.

v. Disposal of Thermoset Plastic Waste including Sheet Moulding Compound (SMC) and Fiber Reinforced plastic.

vi. Standard Operating Procedure for Assessment & Characterization of Plastic Waste.

9. CPCB has issued following publications on Plastic Waste Management

a. Life Cycle Assessment (LCA) of Plastic Packaging Products

b. Assessment & Characteristics pf Plastic Waste generated in 60 cities

c. Plastic Waste Disposal through Plasma Pyrolysis Technique

d. Impact of Plastic Waste Disposal on Soil & Water Quality at Lucknow dumpsites.

10. Activities on Single Use Plastic:

a. Development of Web Portals

CPCB developed two web portals for the management of banned Single Use Plastic, which are as under:

- **CPCB Monitoring Module for Compliance of SUP:** This portal facilitates the uploading of information of entities such as Sellers, Users and Commercial Establishments by Local Bodies and their subsequent inspections. An app has also been developed as part of this portal, wherein field officers from Local Bodies can feed in information of inspections carried out by them directly to the portal. Details of registered entities and inspection are available to relevant Local Bodies, concerned State Pollution Control Boards (SPCBs)/ Pollution Control Committees (PCCs), and to CPCB. This portal also facilitates submission of daily reports for submission by SPCBs/ PCCs to CPCB (http://plastic.cpcb.gov.in/sup).

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- **SUP Public Grievance Portal**: This portal allows the public to register complaints regarding banned SUP items through an app. The portal has also mapped Local Bodies across India so that complaints submitted are directed to concerned Local Body who can then address the grievances within their jurisdiction. Furthermore, if no action is taken within the specified time limit, the portal allows for escalation of complaints to the relevant SPCB/PCC and UDD.(https://sup.cpcbccr.com/v2.0/#)

b. Workshops on Alternative to SUP

- 14 State-wise in-person Workshops for MSMEs on Alternatives to SUP were conducted in association with CIPET, concerned SPCBs/PCCs & MSME.
- 10 Workshop on "Alternatives to Single Use Plastic" for various stakeholders were conducted by CPCB.
- Compendium of presentations of workshops prepared and uploaded on CPCB's website.
- Compendium of manufacturers/sellers of alternatives to SUP prepared and uploaded on CPCB's website.

c. Awareness Activities on SUP

- **Webinar on "Phasing out Single use plastic"**

  CPCB organised "Awareness programmes to avoid the use of Single Use Plastics" during the week from 4th to 10th October, 2021 allocated by Ministry of Culture under the Azadi Ka Amrit Mahotsav' programme. Webinar was organized by CPCB for "Phasing out of Single Use Plastic". Presentations regarding current status of SUP across the country and

available alternatives of SUP were made during webinar. Members from State Boards, UDDs, Regional Directorate of CPCB and different plastic associations participated in the webinar.

- **Campaign in Social & Print Media**

  Material on phasing out SUP has been prepared and uploaded on CPCB's website. Further, advertising on campaigns to reduce/eliminate use of littered single use plastic been published in leading National & Local Dailies.

- **Awareness events organized under Mission LiFE**

  Under Mission LIFE, a public movement to mobilize individuals to become 'Pro-Planet People' , CPCB organized several events to raise awareness among youth, students, and other stakeholders . CPCB also organized a Webinar on "initiatives for a healthier environment" dated May 31, 2023 where a special session on "**Behavioral changes for better waste management**" was conducted.

d. **Enforcement Drive for implementation of SUP Ban:** CPCB issued directives for joint inspections to strengthen enforcement against SUP violations. Joint inspections were conducted from July 2022 to June 2024, resulting in 60,367 inspections, the seizure of 1,963.6 tons of SUP items, and imposing fines totalling ₹19.77 crore.

11. That the Answering Respondent craves the leave of this Hon'ble Tribunal to file additional reply, in future, if required.

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12. That, in the light of the above submissions, it is respectfully submitted that the Answering Respondent shall abide by any order(s) and / or direction(s) passed by the Hon'ble Tribunal in the instant case.

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N.C.T. of Delhi
Regd. No. 1513
OF INDIA

Divya

(Divya Sinha)
Scientist 'F'
Central Pollution Control Board

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI

Original Application No. 475 / 2024

News Item titled "Mountains of Plastic are choking the Himalayan State" appearing in the Hindu dated 04.03.2024

AFFIDAVIT

I, Divya Sinha, working as Scientist 'F' in Central Pollution Control Board, Parivesh Bhawan, East Arjun Nagar, Delhi, Respondent No. 1 in the above matter, do hereby solemnly affirm, declare on oath and state as under: -

1. That I, the deponent herein is authorized representative to represent the Respondent CPCB in the present case, and as such, I am well conversant with the facts and circumstances of the present case on the basis of the information derived from the official records, and hence, I am competent and authorized to verify, sign and swear this affidavit on behalf of the Respondent CPCB.

2. That the accompanying reply may be read part and parcel of the present affidavit.

3. That the accompanying reply has been drafted and filed under my instructions and authority the contents thereof are true and correct on the basis of the record maintained during ordinary course of business of CPCB and available records and documents and the contents of the same are read over and explained to me and are not repeated herein for the sake of brevity.

DEPONENT

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दिव्या सिन्हा / Divya Sinha
वैज्ञानिक 'एफ' / Scientist 'F'
केंद्रीय प्रदूषण नियंत्रण बोर्ड
Central Pollution Control Board
(पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार)
(M/o Environment, Forest & Climate Change, Govt. of India)
परिवेश भवन, पूर्वी अर्जुन नगर, दिल्ली-110032
Parivesh Bhawan, East Arjun Nagar, Delhi-110032

VERIFICATION

Verified at New Delhi on this day of 16 OCT 2024 2024 that the contents of the above reply are correct and true on the basis of the record of the cases as mentioned in the day to day affairs of the CPCB. Nothing has been concealed therefrom or mis-stated.

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N.C.T. of Delhi
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16 OCT 2024

DEPONENT

दिव्या सिन्हा / Divya Sinha
वैज्ञानिक 'एफ' / Scientist 'F'
केंद्रीय प्रदूषण नियंत्रण बोर्ड
Central Pollution Control Board
(पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार)
(M/o Environment, Forest & Climate Change, Govt. of India)
परिवेश भवन, पूर्वी अर्जुन नगर, दिल्ली-110032
Parivesh Bhawan, East Arjun Nagar, Delhi-110032

Annexure-I

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL,

Principal Bench, New Delhi

Original Application No. 251/2022

In re: News item published in The Hindu dated 29.03.2022 titled "Detecting microplastics in human blood"

Index

S. No.	Particulars	Page No.
1.	**Report** in compliance of order dated 05.04.2022 in OA No. 251/2022, In re: News item published in The Hindu dated 29.03.2022 titled "Detecting microplastics in human blood".	
2.	**Annexure-1:** A copy of Minutes of Meeting on "Committee Meeting in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022" with CIPET/ICMR /NCSCM held on April 19th, 2022.	
3.	**Annexure-2 :** A copy of Hon'ble NGT order dated 05.04.2022.	

(Divya Sinha)
Scientist E
Central Pollution Control Board
Delhi-110032

Date: 10.02.2023
Place: Delhi

CENTRAL POLLUTION CONTROL BOARD
DELHI

Date: 08.02.2023

Report in the matter of Tribunal on its own motion SuoMotu based on the news item published The Hindu titled "Detecting Microplastics in human blood" dated March 29, 2022 (O.A. No. 251/2022)

A. BACKGROUND

Vide order dated 05.04.2022 in aforesaid matter, Hon'ble NGT issued the following directions

Para4: *There is need for further studies, considering the studies already conducted, to be steered by the Committee comprising of CPCB, ICMR, Central Institute of Petrochemicals Engineering & Technology (CIPET), NCSCM, and any other expert institutions as required, under the Nodal coordination of CPCB. Such studies and recommendations/ suggestionsmay cover standards for safe environment, remedial steps to reduce menace of micro plastic and addressing other incidental issues. CPCB may incur expenditure on studies and other incidents out of Environmental Compensation funds*

B. ACTION TAKEN REPORT

Three meetings of the Committee members representingCPCB, *ICMR, CIPET&, NCSCM*were held on April 19, July 27 & August 5, 2022 respectively through Video Conferencing.Issues related to microplastics were discussed during the Meetings. The Minutes of the Meetings are enclosed at Annexure I. Detailed assessment of the work done by individual organization as well as available information on Microplastics has been completed and the outcome of the same is enumerated below:

1.0 About Microplastics

Microplastics is used extensively to describe plastic particles with an upper size limit of 5 mm (UNEP). Occurrence of microplastics has been reported from oceans, sediments, surface water, ground water, wastewater, tap water, bottled water, air, food products, aquatic organisms, and human (Microplstics in Drinking Water WHO 2019). Based on their origin; microplastics can be categorized into primary and secondary microplastics. Primary microplastics are intentionally manufactured in size < 5 mm to be used in various applications such as cosmetics, clothing and other textiles, fishing nets, etc. (Mai et al.

2018). Secondary microplastics originate from the breakdown of discarded plastic waste by solar radiation, mechanical degradation, microbial action etc. (Rodrigues et al. 2018; Wagner and Lambert 2018).

These microplastic particles may be of various shapes such as fragments, pellets, beads, and fibres. (Figure1.1). Further classification of microplastics on the type of plastic and its density is given in Table 1.1

Figure 1.1: Micrographs showing different types of microplastics: (a&b) fragments, (c&d) fibre/line, (e&f) film (g) foam and (h) pellet.

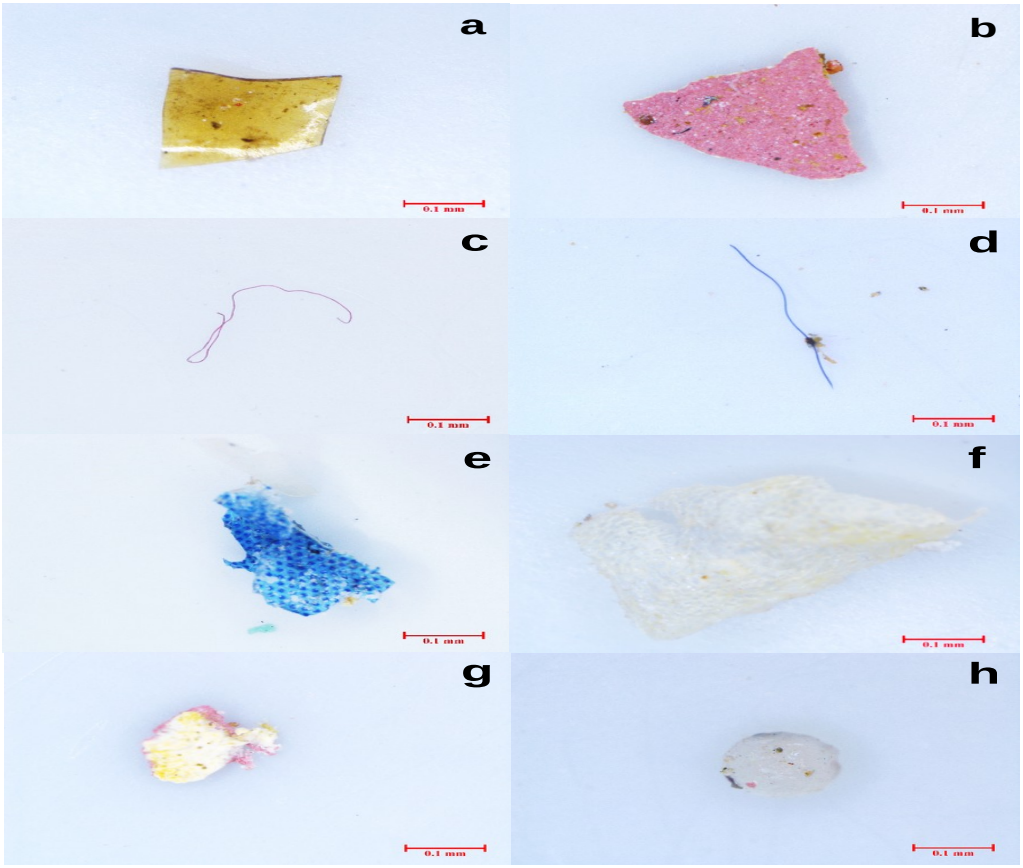

Table 1.1: Type & Density of Microplastics

Common Polymers of Microplastics	Common applications	Specific Gravity
Polyethylene (PE)	Plastic bags, six-pack rings,	0.91-0.94

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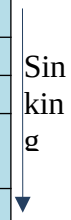
Polypropylene (PP)	Rope, bottle caps, gear, strapping	0.90-0.92
Polystyrene (expanded) (PS)	Bait boxes, floats, cups	0.01-1.05
Seawater		~1.02
Polystyrene (PS)	Utensils, containers	1.04-1.09
Polyvinyl Chloride (PVC)	Film, pipe, containers	1.16-1.30
Polyamide or nylon	Gear, rope	1.13-1.15
Polyethylene terephthalate (PET)	Bottles, strapping, gear	1.34-1.39
Polyester resin + glass fibres	Textiles	>1.35
Cellulose acetate	Cigarette filters	1.22-1.24



2.0 Sampling & Analysis of Microplastics

There is currently no standard method for sampling and analysis of microplastics in the environment. ISO is currently working on the subject (WHO Report :Microplastics in Drinking Water: 2019)

Sampling and analysis of microplastics, based on available literature, involves the following three steps:

a) Sampling;
b) Sample extraction and isolation &
c) Identification, characterization and quantification

2.1 Sampling

Microplastic samples can be acquired using trawl nets drawn across the surface of the water, or through collection of water samples from which the particles are extracted later.

2.2 Sample Extraction

Sample purification usually involves filtration, followed by some sort of extraction process such as density separation, in which samples are mixed with a liquid of defined density, allowing microplastic particles to float and heavier particles to sink. Further purification may require chemical or enzymatic methods to remove organic or inorganic contaminants (biofouling). The extent of the preparation is dependent on the nature of the samples: dirtier samples will require more preparation.

2.3 Analysis

2.3.1 Count of Microplastics

The simplest and the most common technique to quantify the microplasticsparticles is the optical microscopy where quantification is achieved through manual counting.Though this technique is simple, it poses limitations in terms of misidentification and reduced accuracy (underestimation (Loder et al. 2015) / overestimation (Lenz et al. 2015)). However,application of electron microscopic techniques, such as scanning electron microscopy can overcome this limitation up to some extent (Eriksen et al. 2013)

2.3.2 Chemical Composition

Two different approaches are available to determine the chemical composition: spectroscopic&thermoanalytical.

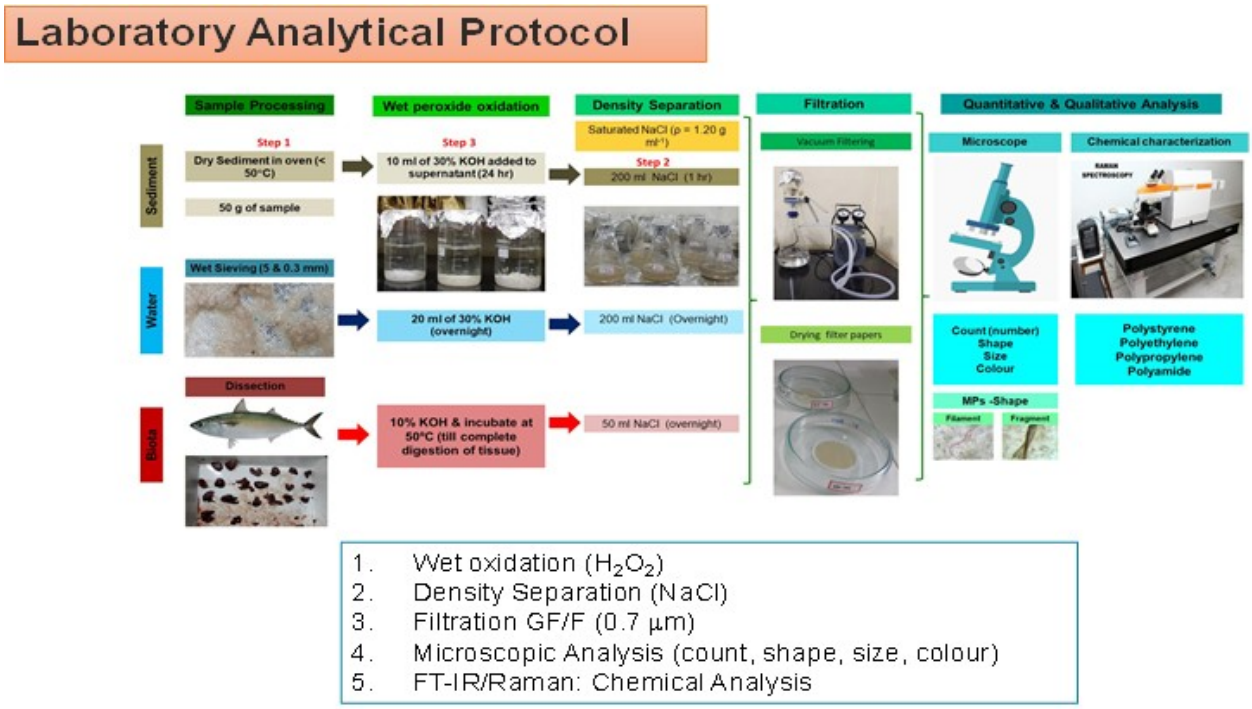
- **Spectroscopic methods**: Used to identify the specific chemical structure of polymers by comparing their absorption or emission spectra with reference spectra. Fourier transform infrared spectroscopy (micro FTIR) Fourier transform infrared spectroscopy and Raman spectroscopy are utilized for this purpose.
- **Thermo-analytical methods**, the sample ispyrolysed under inert conditions, so that specific decomposition products of the individual polymers can be analyzed. Pyrolysis-gas chromatography/mass spectrometry (GC/MS) can provide information on additives as well as the polymer

2.4. Sampling & Analysis Methods followed in India

2.4.1 Ministry of Earth Sciences (National Center for Coastal Research (NCCR))

(a) Sampling Methods

(b) Sample Extraction & analysis



1. Wet oxidation (H_2O_2)
2. Density Separation (NaCl)
3. Filtration GF/F (0.7 µm)
4. Microscopic Analysis (count, shape, size, colour)
5. FT-IR/Raman: Chemical Analysis

2.4.2 CIPET

(a) Sample extraction techniques:

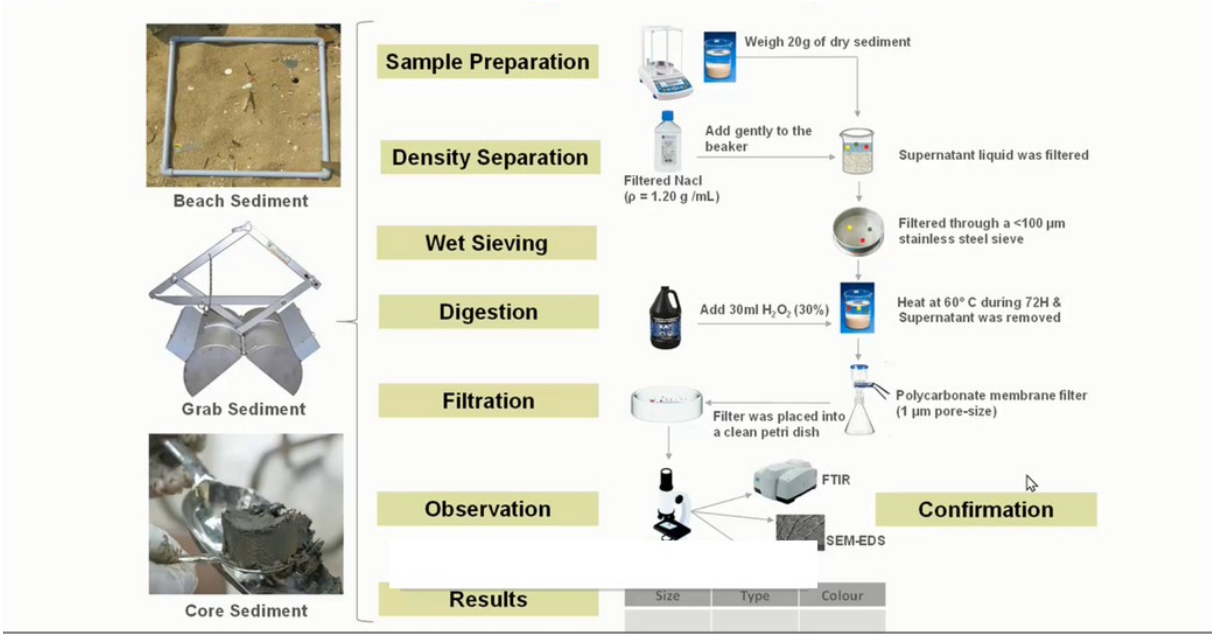
- Quality Control (Running blank samples)
- Preparation of salt solution:
- Density Separation
- Wet Peroxide Oxidation
- Sieving
- Vacuum Filtration

(b) Qualitative analysis:

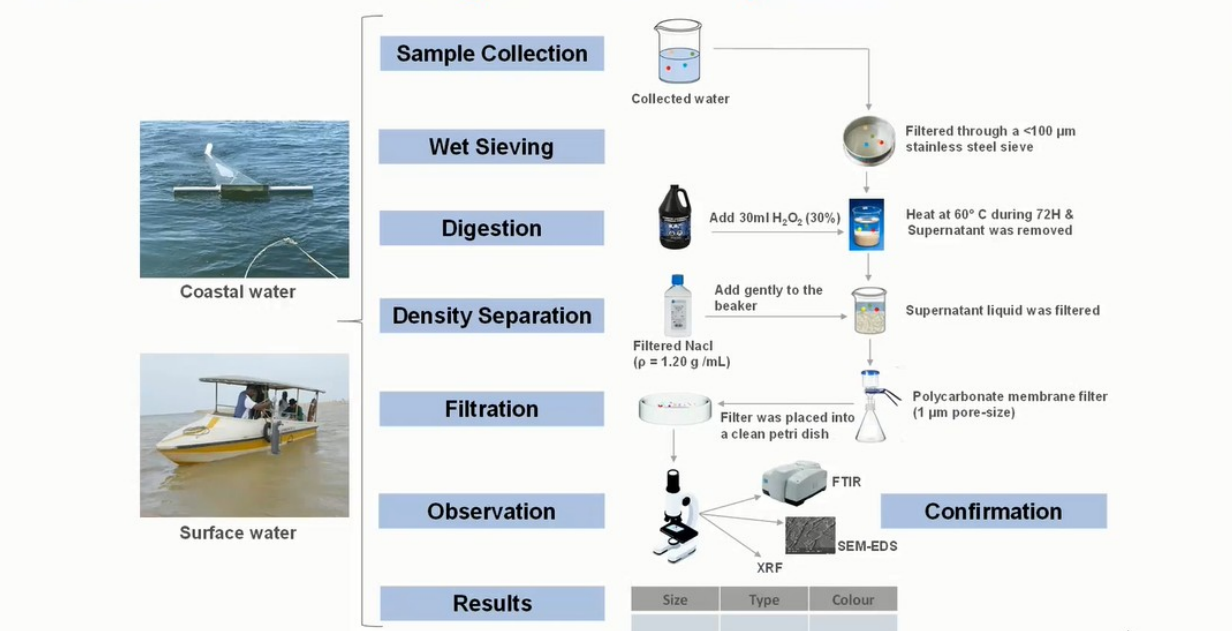
- Optical Microscope: The analysis is done through different magnification ranges i.e. 5x,10x and 20x to for various shape and sizes of microplastics.
- Micro-FTIR: In this technique, the spectra obtained by of targeted microplastics are analysed through the peaks obtained and analysing them through the functional group.
- Pyrolysis GC-MS: The thermal technique is used for the knowledge of degradation products of the microplastics found in the sample.
- Number of microplastic samples found in per litre of sample in each location was analysed along with various shapes and colours.

2.4.3 NCSCM

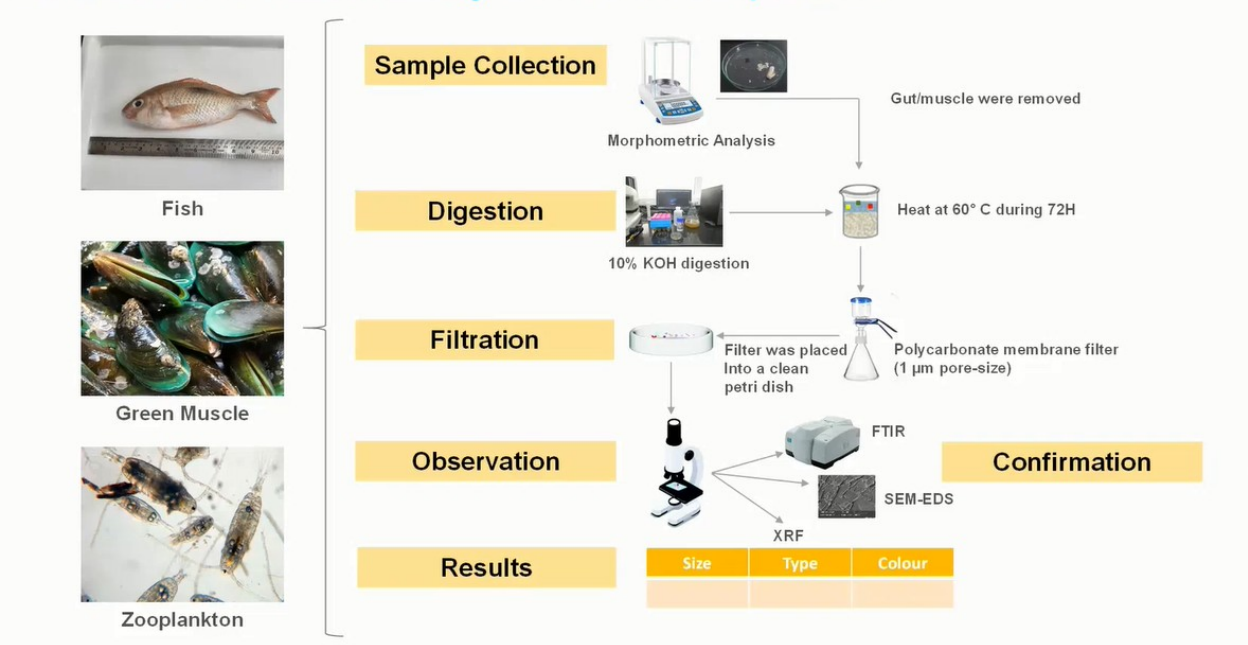
(a) Sample Extraction & analysis (Sediments)



(b) Microplastic Analysis in Water



a. Microplastics analysis in Biota



2.5 Observations

(a) Sampling and analytical methods adopted by different institutions in India are similar with minor variations

(b) Standard method for Sampling & Analysis developed by BIS/ISO is essential to formalize further action on monitoring reports.

3.0 Assessment of Microplastics

Microplastics (both primary and secondary) pollute drinking water sources primarily through discharge of sewage/wastewater treatment plant effluent and surface run-off. There are large numbers of industries that use (primary) microplastics for various applications, such as medicines, cosmetics etc. After their use, these primary microplastics get washed off and become a part of the domestic wastewater (Singh et al. 2021). As the sewage/wastewater treatment plants are not equipped for the complete removal of microplastics, the effluent released from these plants contains substantial quantity of microplastics (Amrutha and Warrier 2020). Upon mixing of this effluent with the freshwater sources, microplastics become part of the fresh/drinking water supply chain (Magnusson and Noren 2014; Novotna et al. 2019). It is also important to note that many components of water treatment plants and water distribution system are usually made up of plastic materials, such as high density polyethylene, polyvinyl chloride, polypropylene etc. (Mintenig et al. 2019) and hence, these further contribute towards microplastic generation in the water they carry.The treated bottled water is also reported to contain microplastics (Mason et al. 2018;Pivokonsky et al. 2018). Nevertheless, the smallest microplastic particle reported in case of drinking water is 1 µm (WHO 2019). Evidence suggests that it is the bottling process and/or packaging of the plastic bottles/caps that largely contributes to the generation of microplastics.

In the air, suspended microplastic particles have been isolated from various places, such as, urbanized city centres, indoor households, and remote outdoor regions. As there is wide range of microplastics' size, it is highly likely that these particles are inhaled by the humans (Jenner et al. 2022).

Soil can get affected from plastics through various means such as plastic mulch films, municipal so waste, sewage sludge, fertilizers coated with plastics etc. (McCormick et al.2014; Blasing and Amelung 2018; Liu et al. 2018). A significant positive correlation has been seen between the rate of sludge applied onto the soil and concentration of microplastic particles in the soil (Zhang et al. 2020).

Various organizations including CIPET, NCSCM, NCCR (MoES), NPC & CPCB have conducted microplsatic monitoring. Further international organization including UNEP, WHO and OECD have worked extensively on Microplastics and published comprehensive Reports. Based on aforementioned Sources of generation of microplastics, transfer media and end use areas have been identified. Further details of microplastics(concentration, type etc) for these areas have been compiled. Details are given in Table 3.1

Table 3.1 : Sources of Generation &Analysis& of Microplastics

S.N.	**Class**	**Category**	**Subcategory**	**Description**	**Analysis data**	**Reference**
1.	**Generation**					

S.N.	Class	Category	Subcategory	Description	Analysis data	Reference
	of Microplastics					
a	Industry	(i)During production	Toothpaste		NA	UNEP
			Cosmetics	Microbeads in skin care	NA	UNEP
			Printer , ink, spray, injection moulding		NA	UNEP
			Plastic production	Emissions/ spillages	NA	UNEP
			Ship breaking		NA	UNEP
			Cigarette filters		NA	UNEP
		(ii)During Usage	Synthetic textiles	Use & washing	100 microfibers/L	UNEP,OECD
			Horticulture	Plastic Sheeting / Tube	NA	UNEP
			Road Transport	Tyre & Road wear particles	NA	OECD, WHO
			Paint from Building & Ships		NA	OECD
			Bottled Water	Caps & bottle	Section 3.1	WHO
			Synthetic Soles of Shoes		NA	WHO
b	Improper waste management	(i) Land Litter		Degradation under specific temp & UV rays	NA	UNEP, WHO
		(ii)Dumpsites		Degradation under specific temp & UV rays	NA	UNEP, WHO

S.N.	**Class**	**Category**	**Subcategory**	**Description**	**Analysis data**	**Reference**
		(iii)Marine litter		Degradation under specific temp & UV rays	NA	UNEP
c	Ocean Activities			Fishing Nets, Boxes, Rope, galley waste;	NA	UNEP, MoES
				Aquacuture - nets, floating	NA	UNEP
				Coastal Tourism	NA	UNEP NCSCM
				Offshore Oil & Gas Platform	NA	UNEP
d	Outflow from sewage treatment plant			Waste water treatment plant can effectively remove microplastics , but in most area adequate sewage treatment systems not provided	NA	WHO
e	Agricultural Runoff			When waste water sludge is used as compost	NA	WHO
f	Stormwater drains			Carrying Road dust	NA	WHO
g	Leachate			Leachate	Section 3.2	CPCB
2	**Transfer of Microplastics**					
a	Surface Water				Section 3.3	CPCB, NPC
b	Soil / Beach Sediment				Section 3.4	MoES, NCSCM
c	Sludge				NA	
d	Fish				Section 3.5	MoES **NCSCM**
e	Ocean				Section	MoES,

S.N.	Class	Category	Subcategory	Description	Analysis data	Reference
	water				3.6	NCSCM
3	**End use**					
a	Ground Water				Section 3.7	CPCB. WHO
b	Drinking Water			Microplastics have been identified in drinking-water as small as 1 µm, based on the smallest particle size detected by current methods. Large particles occur less frequently than small particles. The predominant particle shapes are fragments and fibres. The predominant plastic types are PET and PP	Table 3.1	WHO
c	Ambient Air			Tyre & Road wear dust	Section 3.8	WHO, CPCB

3.1: Drinking Water & Bottled Water

(a) WHO

Table 3.2 : MP comncentration in Tap Water / Bottled Water

Author	Water type	Lower size bound (µm)	Particles/L in sample (average)	Particles/L in blanks (average)
Oßmann et al.	Bottles (mineral water)	1	3074-6292	384

	•Glass •Single use PET •Reusable PET		2649 4889	
Pivokonsky et al. (2018)	DWTP from surface water sources (3 sites	1	628 338 369	<5% of counts in samples
Schymanski et al. (2018)	Bottles •Single use •Returnable •Glass •Beverage carton	5-20	 14 118 50 11	14±13
Mason, Welch and Neratko (2018)	Bottled	6.5-100 Lower bound based on microscope and software	315	23.5
Strand et al. (2018)	Tap from ground-water sources	10-100	0.2, 0.8 and 0.0 (LoD = 0.3)[4]	Unknown
Mintenig et al. (2019)	Tap from ground-water sources.	20	0.0007	0.67 particles/ L 0.3 fibres/L
Uhl, Eftekhardadkhah, and Svendsen (2018)	Tap from 24 sources	60	Average not reported since only a single result above LoQ (that result was 5.5)	0.5 (LoQ = 4.1 LoD= 0.9)
Mason, Welch and Neratko (2018)	Bottled	>100	10.4	4.15
Strand et al. (2018)	Tap from ground-water sources	>100 (10 µm sieve size)	0.312 (LoD = 0.58)	0.26
Kosuth, Mason and Wattenberg (2018)	Tap from unspecified sources	100 lowest reported	5.45	0.33 (based on 5 particles in 30 blanks (ea. 500mL))

3.2 Leachate from Dumpsite

Table 3.3. : Leachate (CPCB)

Location	Type of water	Microplastics concentration (particles/ L)	Reference
South China	Leachate	3 to 25 particles/L	Wan et al. 2022
Suzhou, China	Leachate	235.4 ± 17.1 particles /L	Sun et al. 2021
China	Leachate	0.42 to 24.58 particles/L	He et al. 2019
Shanghai, China	Leachate	4 ± 13 particles/L	Su et al. 2019
Lahti, Finland	Leachate	1.97 particles/L	Praaghet al. 2018
Alfsnes, Iceland	Leachate	4.51 particles/L	Praaghet al. 2018
Kodungaiyur, India	Leachate	0.75 to 16.2 particles/L	CPCB
Perungudi, India	Leachate	0.8 to 32 particles/L	CPCB

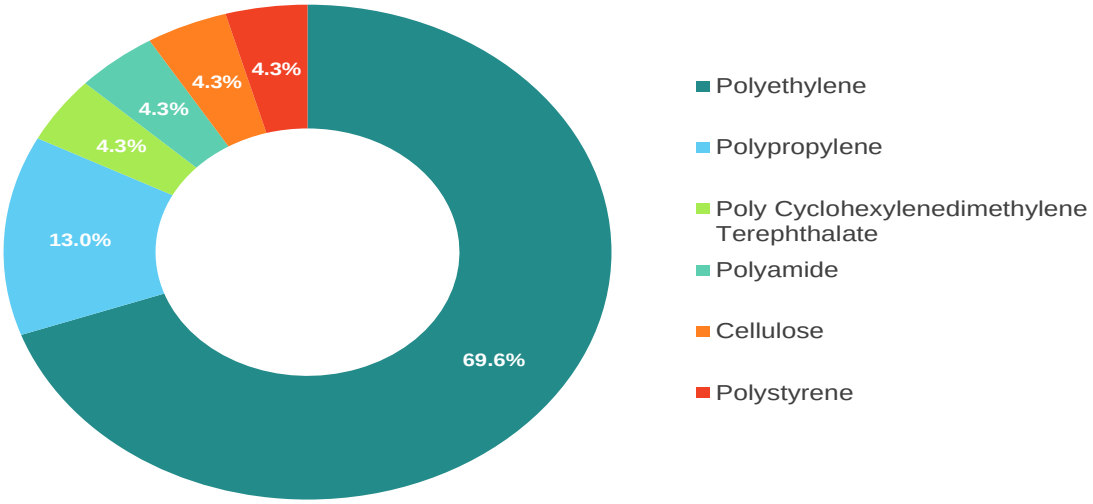


Figure 3.1 : Percentage composition of different types of plastics found in Leachate (CPCB)

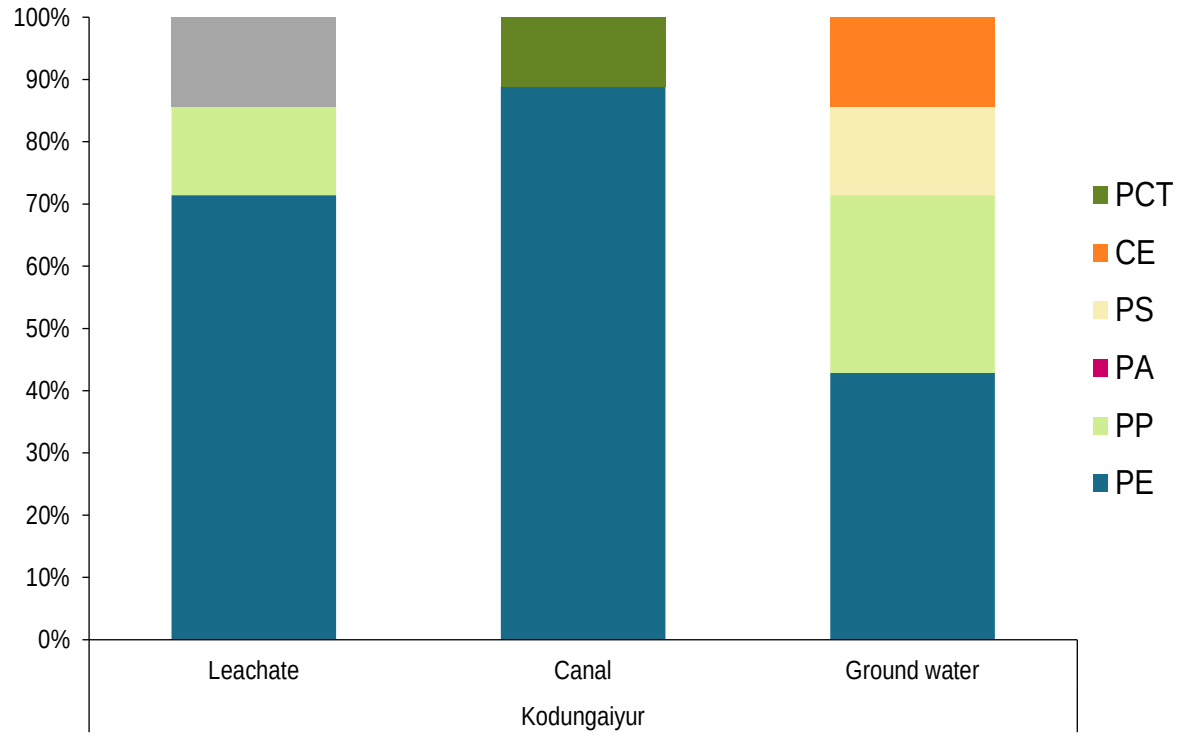


Figure 3.2: Percentage composition of microplastics in leachate, canal and groundwater samples around in dumpsite (CPCB)

3.3 Surface water

Table 3.4 Microplastics in Surface Water (WHO)

Location	Results reported (particles/L)	Sieve size (µm)	Study
Groundwater, Germany	Average:[b]0.7×10^{-3} Range:[b]$0\text{-}7\times10^{-3}$	3	Minteniget al. 2019
Three Gorges Reservoir, China	Average: 4.7 Range: 1.6 – 12.6	48	Di and Wang, 2018
Dongting Lake and Hong Lake, China	Averages: 1.2 and 2.3 Ranges: 0.9-2.8 and 1.3-4.7	50	Wang et al. 2018
Wuhan, China	Range: 1.6-8.9	50	Wang et al. 2017
Rhine river, Switzerland, France, Germany, Netherlands	Average: 0.0056	300	Mani et al. 2015
Western Lake Superior, USA	Average: 0.00026	333	Hendrickson, Minor, and Schreiner, 2018

Figure 3.3 Microplastics identified in the River
(Sizes of Plastic like Particles in Water Samples in percentage in four cities)(NPC)

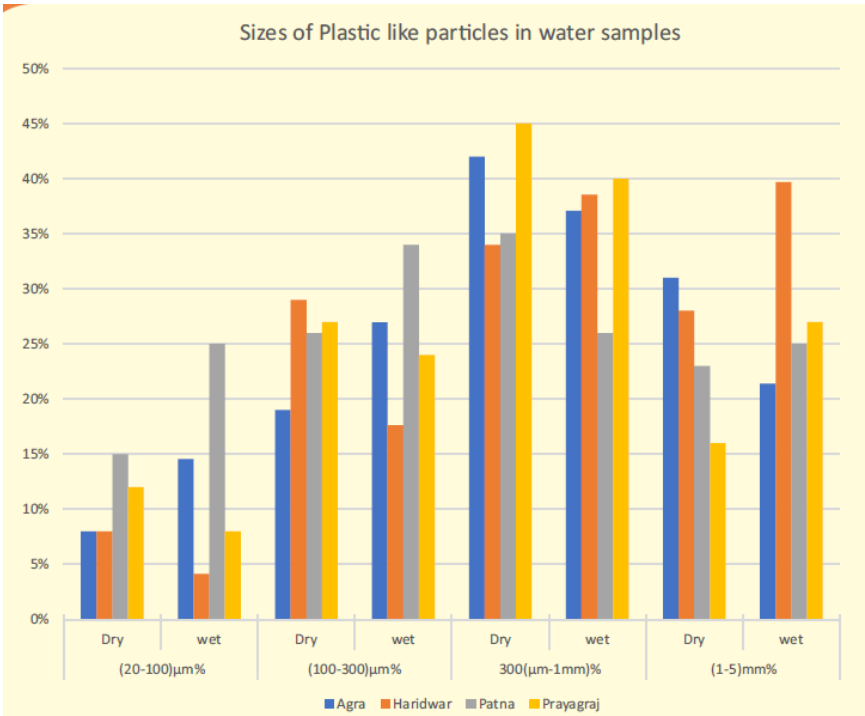
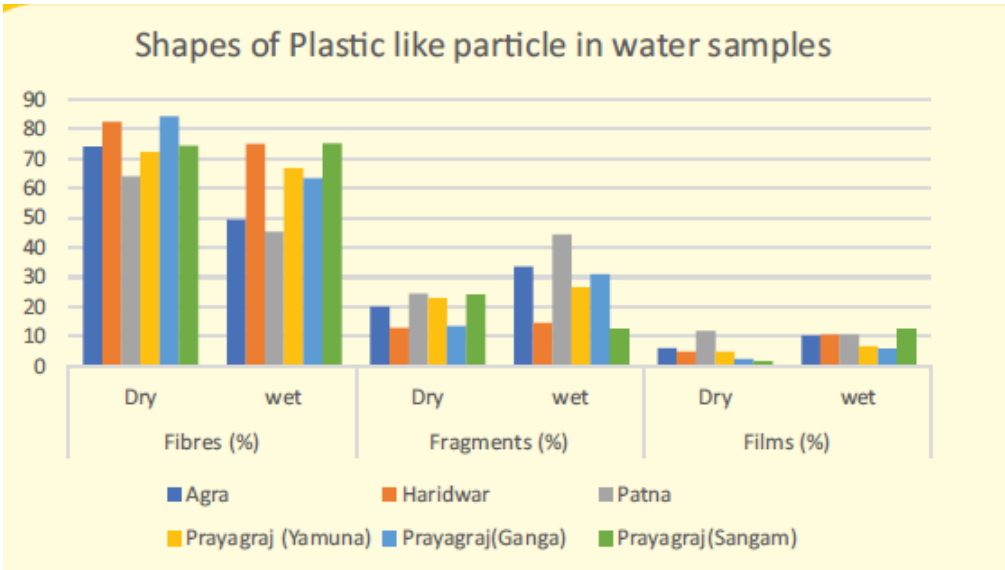
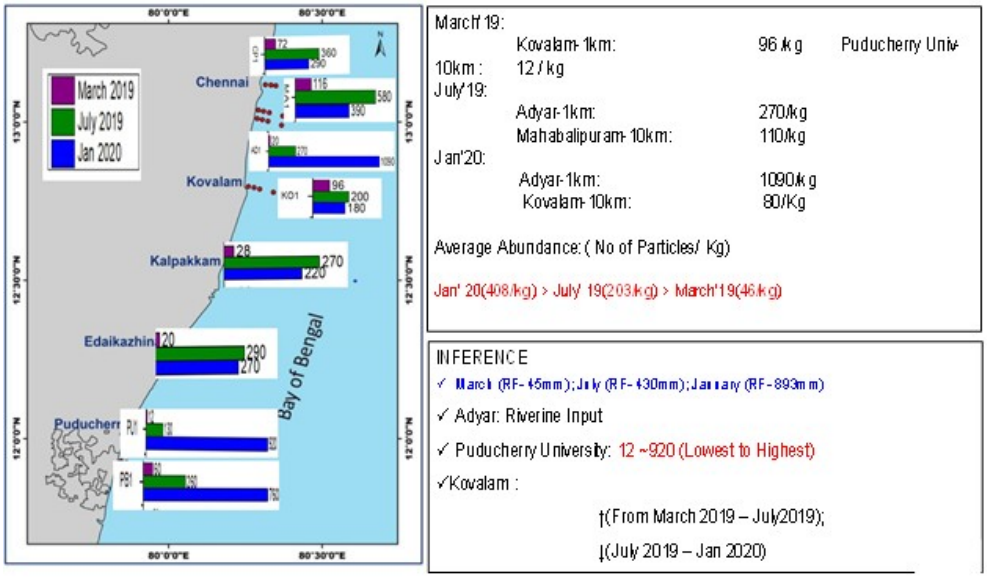


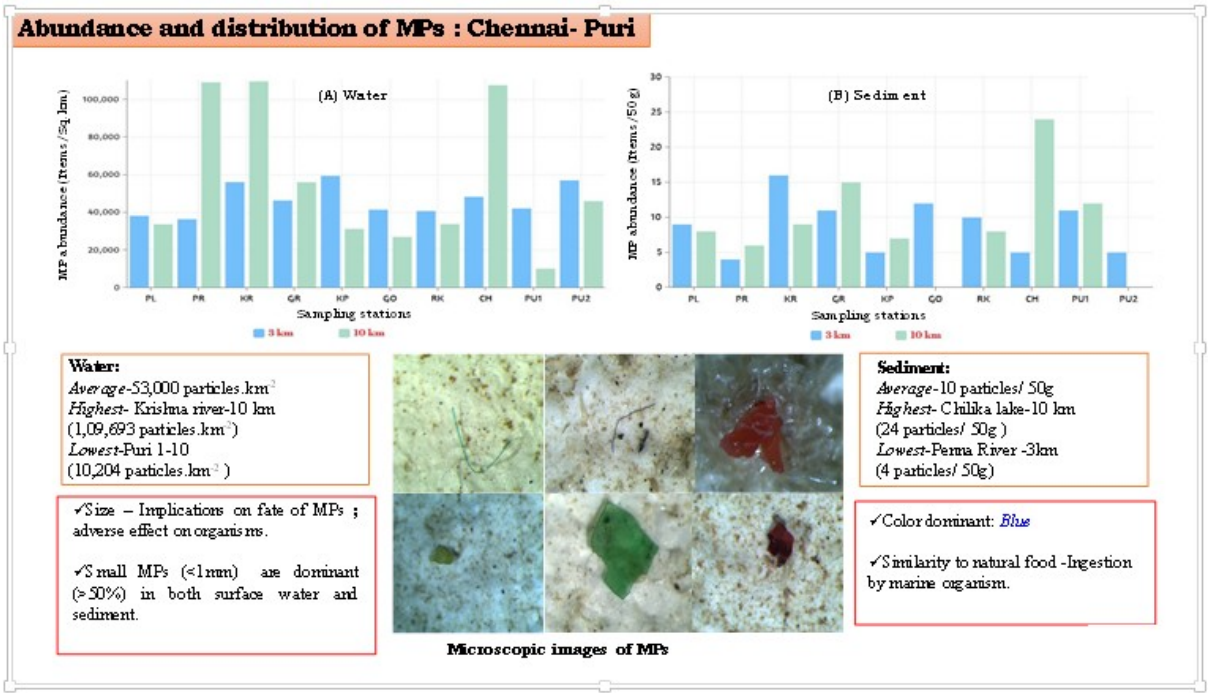
Figure 3.4 Microplastics identified in the River
(Shapes of Plastic like Particles in Water Samples amongst Fibres/Fragments/Films in percentage in four cities) (NPC)



Section 3.4 :Beach Sediment/ Deep Sea Sediments
(a) Figure3.5 Microplastics (MoES- NCCR)
(Microplastic sediments –Chennai-Puducherry)



(b) Figure3.6Microplastics (MoES- NCCR)
(Microplastic sediments –Chennai-Puri)



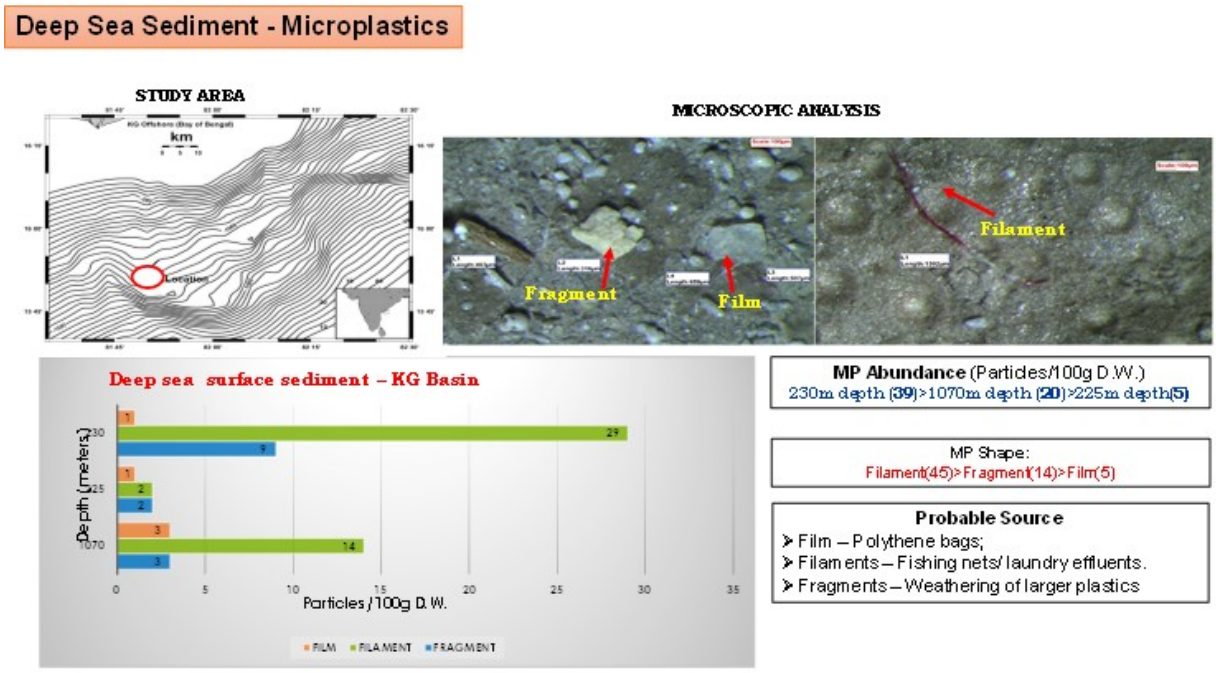
(c) Beach sediments (NCSCM)

Abundance of microplastics in terms of numbers of particles and their range, in the beach sample reported from different parts of the world and long the Tamil Nadu coast () Table 3.5

S.No.	Location	Range	Mean ±	Reference

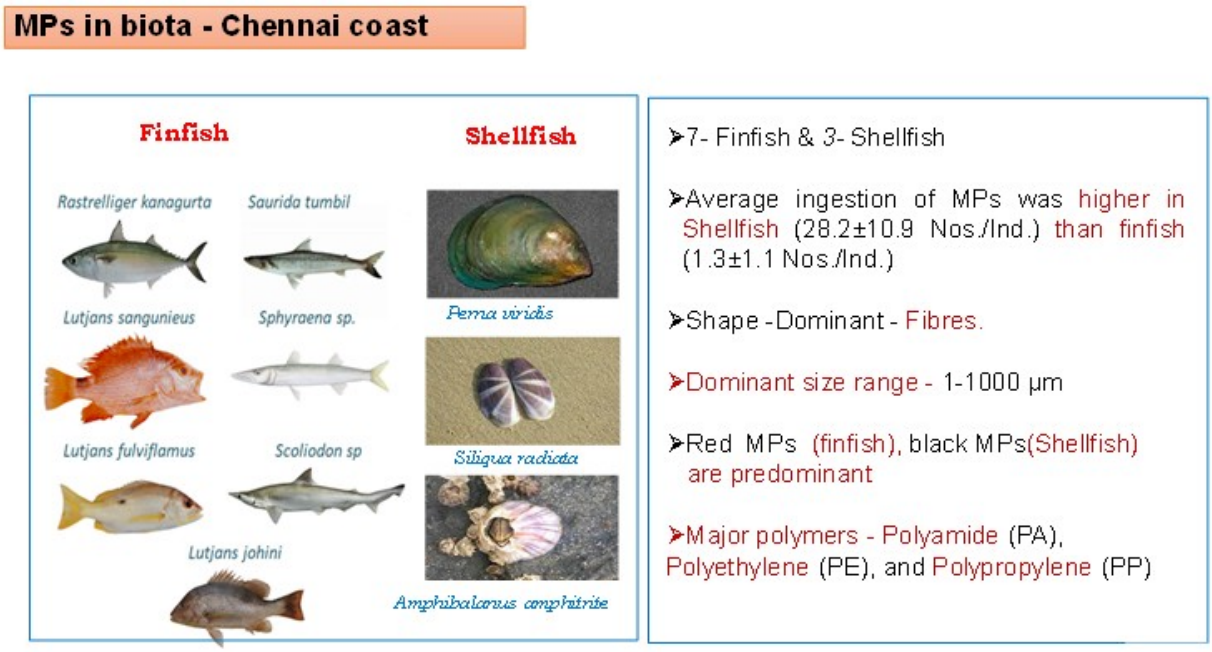
1.	Charleston, Harbor, USA	42 to 1196/m^2	413.8 ± 76.7/ m^2	Grayet al. 2018
2.	Winyah Bay, USA	51 to 441/m^2	221.0 ± 25.6/ m^2	Grayet al. 2018
3.	Guanbara Bay, Brazil	12 to 1300/m^2	-	Carvalho and BaptistaNeto , 2016
4.	Bostanu, Persian Gulf	-	1258 ± 291/kg	Najiet al. 2016
5.	Gorsozan, Persian Gulf	-	122 ± 23/kg	Najiet al. 2016
6.	Norther Gulf on Mexico	-	50.6 ± 9.96/ m^2	Wessel et al.2016
7.	South Korea	2 to 92,217/m^2	8205/m^2	Lee et al. 2013
8.	Chile	1 to 169/m^2	30 ± 2.6/m^2	Hidalgo-Ruz and Thiel, 2013
9.	Easter Island	-	800 ± 320/m^2	Hidalgo-Ruz and Thiel, 2013
10.	South Korea	-	976 ± 405/m^2	Heoet al. 2013
11.	Mumbai, India	12 to 960/m^2	68.8/m^2	Jayasiriet al. 2013
12.	Otzias beach, Eastern Mediterranean	20 to 1218/m^2	575/m^2	Kaberiet al. 2013
13.	Portugal coast	1 to 137/m^2	26.6 ± 32.5/m^2	Martins and Sobral, 2011
14.	Malta, Central Mediterranean	0 to 1462/m^2	33.3/m^2	Martins and Sobral, 2011
15.	Belgium	-	91.9/kg	Claessenset al. 2011
16.	Hawaiian Archipelago	4 to 17,645/m^2	-	McDermid and McMullen, 2004
17.	Tamil Nadu Coast, India	2 to 178/m^2	46.6 ± 37.2/m^2	R. Karthik et al.

Figure 3.7 Deep Sea MicroplasticConcentration (MoES)



Section 3.5 Microplastics in Fish

Figure 3.8Microplastics in Biota (MoES)



Section 3.6 Coastal Water

Abundance ranged between 0.22 and 3.58 particles/m3 with an average of 1.25 ± 0.88 particles/m3 (n = 14) (NCSCM).

Figure 3.9Microplastics in Coastal Water (Global distribution of mean microplastic particles (particles/m') in the coastal waters and comparison)

1. Western Portion Guanabara Bay, Brazil (Olivatto et al., 2019)
2. Kingston Harbour, Jamaica (Rose and Webber, 2019)
3. South China Sea (Cai et al., 2018)
4. Southern Sri Lanka (Koongolla et al., 2018)
5. Balearic Islands, Spain (Ruiz-Orejon et al., 2018)
6. Small Island of Bintan, Indonesia (Syakti et al., 2018)
7. Sea of Marmara (Tunçer et al., 2018)
8. Guanabara Bay-Brazil (Figueiredo and Vianna, 2018)
9. Italian minor Islands - Lucia et al., 2018
10. Tuscany coastal waters, Italy (Baini et al., 2018)
11. Aegean-Levantine Sea (Van der Hal et al., 2017)
12. Bay of Brest, France (Frere et al., 2017)
13. Southern Ocean (Isobe et al., 2017)
14. Bohai Sea, China (Zhang et al., 2017)
15. Rose Sea, Antarctica (Cincinelli et al., 2017)
16. North-eastern section of Qatar (Castillo et al., 2016)
17. Adriatic Sea (Suaria et al., 2016)
18. East Asia Sea, Japan (Isobe et al., 2015)
19. Arctic Polar water (Lusher et al., 2015)
20. Kyeonggi coast, South Korea (Chae et al., 2015)
21. Southeast Korea, coast (Kang et al., 2015)
22. Costa Vicentina, Portuguese coast (Frias et al., 2014)
23. Northeast Atlantic, Ireland (Lusher et al., 2014)
24. East China Sea (Zhao et al., 2014)
25. Northeast Pacific, California (Doyle et al., 2011)
26. Southwest coast, India (**Present study**)

Section 3.7 Microplastics in Groundwater

Table 3.6:Microplastics in Groundwater (CPCB)

Location	**Type of water**	**Microplastics concentration (particles/ L)**	**Reference**
South China	Leachate	3 to 25 particles/L	Wan et al. 2022
Suzhou, China	Leachate	235.4 ± 17.1 particles /L	Sun et al. 2021
China	Leachate	0.42 to 24.58 particles/L	He et al. 2019
Shanghai, China	Leachate	4 ± 13 particles/L	Su et al. 2019
Lahti, Finland	Leachate	1.97 particles/L	Praaghet al. 2018
Alfsnes, Iceland	Leachate	4.51 particles/L	Praaghet al. 2018
Kodungaiyur, India	Leachate	0.75 to 16.2 particles/L	CPCB study 2022
Perungudi, India	Leachate	0.8 to 32 particles/L	CPCB study 2022
South China	Groundwater	11 to 17 particles/L	Wan et al. 2022
Australia	Groundwater	16 to 97 particles/L	Samandraet al. 2022
Karst, US	Groundwater	15.2 particles/L	Pannoet al. 2019
Kodungaiyur, India	Groundwater	0.87 particles/L	CPCB study 2022
Perungudi, India	Groundwater	2.1 particles/L	CPCB study 2022

Section 3.8 Microplastics in Ambient Air

Table 3.7: Microplastics concentrations detected in the air at Dumpsites in India vsMicroplastics measured at different locations across the globe(CPCB)

Location	Samples Type	Method	Microplastics conc. (particles/m^3)	Reference
Shanghai, China	Urban megacity	KB-120F type intelligent middle flow total suspended particulate sampler	0–4.18	Liu et al. 2019a
Paris, France	Indoor and outdoor of Residential area of Paris city	Simple vacuum filtration array	0.3–1.5	Driset al. 2017
Asaluyeh County, Iran	Industrial area	ECHO PM ambient filter sampler	0.3–1.1	Abbasiet al. 2019
West Pacific Ocean	Coastal area	KB-120F type intelligent middle flow total suspended particulate sampler	0.13 ± 0.24	Liu et al. 2019a
Cal State University, USA	Across 100 km of coastal Southern California, Semi-urbanized landscape	Simple vacuum filtration array	0.7–19.6	Gaston et al. 2020
Kodungaiyur, Chennai, India	Urban area,landfill site	High Volume Air Sampler	0.37–0.92 (PM10) 0.50–0.97 (PM2.5)	CPCB study 2022
Perungudi, Chennai, India	Urban area, landfill site	High Volume Air Sampler	0.22–0.72 (PM10) 0.50–3.88 (PM2.5)	CPCB study 2022

3.9 Observations

- Quantification of Microplastic generation at source has not been done for most of the Sources
- Variation in Microplastic concentrations units reported by different organizations observed
- Most of the monitoring has been done in Coastal Areas

4.0 Risk Assessment

Microplastics can present several unique challenges for traditional human health risk assessment approaches. Findings of World Health Organization and ICMR are highlighted in this section

4.1 WHO

WHO in its report on Microplastics in Drinking water: WHO Report 2019" has highlighted the following issues

- Microplastics can present several unique challenges for traditional human health risk assessment approaches. Plastic polymers are generally considered to be of low toxicity. Being insoluble, they are unlikely to be absorbed from the gastrointestinal (GI) tract and generally do not interact with biological matrices, although particle size may influence absorption and toxicity (i.e. smaller particles may represent a greater hazard). However, plastics can contain additives and unbound monomers, which may leach out either into the surrounding water environment prior to human consumption or potentially, into the GI tract to become bioavailable under some circumstances. Further, plastic particles can sorb chemicals from the environment, some of which are of toxicological concern.
- Investigation of potential risks related to particles indicate that it is possible that some smaller plastic particles may be able to pass through the gut wall and translocate to tissues remote from the mucosa, although this may not necessarily translate to a health risk. Humans have always ingested particles and have ingested plastic particles for decades with no related indication of adverse health effects. In addition, a good deal of evidence suggests that microplastics pass through the GI tract into the faeces.
- There is currently a paucity of information to quantitatively assess any potential risk associated with exposure to microplastic particles Most toxicological tests of microplastics have focused on aquatic organisms or ecotoxicology. No epidemiological or human studies on ingested microplastics

have been identified. Data from studies on laboratory animals are scant and inadequate to confirm human health risk assessment of microplastics ingestion. **There are no studies on the impacts of ingested microplastics on human health and there are only a limited number of animal studies of questionable reliability and relevance**

- There is currently no evidence to suggest a human health risk from microplastic associated biofilms in drinking-water**.** The risks from pathogens in microplastic-associated biofilms is considered far lower than the well-established risk posed by the high concentrations and diversity of pathogens present in human and livestock waste, which often make their way into drinking-water sources with inadequate treatment
- **Routine monitoring of microplastics in drinking-water is not recommended at this time, as there is no evidence to indicate a human health concern**

4.2 **ICMR**

ICMR has informed that they have not carried out any study on impact of microplastics on human health so far. However, as per the study carried out so far, Microplastics have been reported in human saliva, blood, placenta , colon, stool and lungs. Overview of the findings of the study carried out on impact of Microplastics on human health , as reported by ICMR, is given below:

	No. of Studies	No. of Human Samples	MP Reported	Impact on Human Health
Blood	1	22	1.6 microgm/mL	Not reported
Placenta	1	6	12 particles in 4 out of 6 samples tested	Not reported
Lungs	2	13 (First Study)	0.69±0.85 gm/L of Lung tissue; 39 particles in 11/13 samples tested	Not reported
		20 (Second study)	37 particles in 13 out of 20 samples tested	Not reported
Stool	2	8 (First Study)	2 particles per gm of Stool	Not reported
		24 (Second study)	1-36 particles per gm of stool	Not reported
Saliva	1	2000	No. of sample in which MP reported: 650;	Not reported

			Avg. concentration: -0.33 MP/individual	
Genotoxic& cytotoxic effects of MP in Human blood	In-vitro	2	Size studied: 10-45 microm; Concentration – 25,50, 100, 250, 500 microg/L; Type:PE	Genomic instabilities were reported
Cytotoxic effect of MP with metal nano particles in human celebral& epithelial cells	In-vitro		Size studied: 3-16 microm; Concentration – 50 microg/L-10 mg/L; Type:PE&PS	Oxidative stress was reported

It was further informed by ICMR that studies are only about the presence of microplastics in human body and not about their physiological or psychological impact. Studies showing genotoxic& cytotoxic impacts are invitro studies conducted on only two individuals. Health impact of emerging contaminants are chronic and long term studies are required to establish Cause effect relationship. It would not be appropriate to set standards for drinking water for microplastics without establishing the cause-effect relationship

4.3 Observations

- Further studies are required understand the uptake and impact of microplastics on human health
- Influence of particle size, shape and chemical composition of microplastics to be studied in detail
  Studies are also required to assess the impact of associated chemicals & biofilm on human health

5. Remediation techniques:

5.1 Available technology for Microplastic removal

Microplastic treatment technologies are in the nascent stage. Removal methods in case of air and soil matrices have not been reported yet. Treatment technology options for microplastics in water include the

- Conventional Water treatment system: In the conventional water treatment technology, primary and secondary treatment processes help in the removal of microplastics 50 – 98% of microplastics could be removed during primary treatment and 0.2 – 14% during secondary treatment (Sun et al. 2019). Microplastic concentration can be significantly reduced by ultrafiltration and reverse osmosis (Ziajahromi et al. 2017). Combination of secondary and tertiary treatment processes has also been useful in the removal of microplastics.

- Microbial Degradation (Biodegradation): Environmental friendliness, cheap cost and low energy input, as well as a reduced carbon footprint, are all advantages of biodegradation. Plastics can be used by microorganisms as carbon and nitrogen sources, allowing them to survive and reproduce.

- Photodegradation/ Photocatalytic degradation: Photocatalytic degradation of typical microplastics can be carried out by UV light radiation and degradation for various sizes of microplastics will be studied.

5.2 Observations

- Available technologies for removal of microplastics need to be studied in detail to assess their efficacy
- Research studies to be conducted for removal of microplastics from air & soil

6.0 Initiatives taken to reduce Microplastics

- The Microbead-Free Waters Act has been notified inUS which prohibits the manufacture and distribution of nonprescription drugs that are also cosmetics and that contain plastic microbeads for the purposes of exfoliating or cleansing any part of the human body. Common examples of rinse-off nonprescription drugs that are also cosmetics include, but are not limited to, anti-cavity (fluoride) toothpastes, acne scrubs, anti-bacterial soaps, and anti-dandruff shampoos
- **BIS 2017 :** Plastic microbeads of diameter 5 mm or less, that are insoluble in water, and solid plastic particles used to exfoliate or cleanse in personal care products have been listed in the banned list
- **Plastic Waste Management (Second Amendment) Rules, 2022:**
  a. Banned all single-use plastics from 1st July 2022.
  b. mandate to increase the thickness of plastic carry bags to over 120 microns from December 31.
  c. Banned imports of solid plastic waste from March 2019

C. Conclusions

1. Independent studies regarding microplastics have been conducted by various organizations in the country including CPCB, MoES-NCCR, NCSCM, NPC and CIPET . Further international studies have been conducted by WHO, UNEP , OECD and others.
2. The studies have primarily focussed on monitoring microplastics (concentration, polymer type, colour, shape) in various environmental matrices.
3. Occurrence of microplastics has been reported in oceans, sediments, surface water, ground water, wastewater, tap water, bottled water, air, food products, aquatic organisms, and human beings
4. There is currently no standard method for sampling and analysis of microplastics in the environment. ISO is currently working on the subject
5. Sampling and analytical methods adopted by different institutions in India are similar with minor variations.Variation in Microplastic concentrations units reported by different organizations has been observed
6. Uniform procedure for sampling & analysis may be developed by organizations involved in microplastic analysis (CIPET, NCSCM, MoES-NCCR) which can be adopted uniformily across the country till the time ISO standard is finalized.
7. Source of generation of microplastics including industries, waste management , waste water treatment, ocean activities etc. have been identified. However, exact quantum of microplastics generated from the identified source has not been determined.
8. Microplastic concentration in transfer media is available for soil/beach sediment, surface water bodies, biota and ocean water. Microplastic concentration for sludge , specifically when it is converted to compost for land application is not available
9. Microplastic concentration in end use areas including ambient air, drinking water and ground water is available.
10. Source monitoring, transfer end use of all possible sources listed in Table 3.1 to be covered. Emphasis to be laid on such areas for which no information is available.
11. Regular monitoring of various water quality parameters to be conducted to provide insight into the presence and concentration of microplastics in environmental matrices(water, sediments, biota)
12. Microplastic leakages and pathways may be monitored in order to identify further sources and hotspots of microplastics.
13. Uniform procedure for sampling & analysis as finalized by this Committee may be adopted for such studies till the time ISO Standards are finalized

14. Studies conducted on the matter have reported about the presence of microplastics in human body. Physiological or psychological impact has not been reported in these studies.
15. Health impact of emerging contaminants and long term studies are required to establish Cause effect relationship of microplastics on human health
16. The aforementioned studies should cover different type, concentration and shapes of microplastics. Impact of chemicals /biofilms associated with Microplastics on human health to be covered. The studies may include the following:
    - Estimation of the duration and frequency of human exposure to microplastics. Microplastic monitoring as required may be conducted for the same
    - Once the exposure assessment is done precisely, dose-response assessment may be carried out, where the minimum concentration (of microplastics) responsible for any observable effect (on human) shall be assessed..

17. **Bioassays** may be conducetd to assess the Eco-toxicological impact of microplastics on animal life.
18. Standards development (Source & ambient) for microplastics may be taken up following establishment of the cause-effect relationship of microplastics on human health
19. Available technologies to be assessed for their efficacy for removal of microplastics.
20. Technologies to be developed for removal of microplastics from Air & Soil
21. **Source-directed interventions,**
    - Sustainable design and manufacturing of textiles, tyres, and complementary products (, laundry detergents, road surfaces, and vehicles), to minimise the tendency of products to contribute to microplastics generation;
    - Restrictions on microplastics in the manufacture and sale of certain personal care and cosmetic products containing microplastics.
    - Product requirements for household, commercial, or industrial washing machines. For instance, Australia and France have introduced measures to phase in microfibre filters on new washing machines

9. **End-of-life interventions,** effective solid & plastic waste management practices, to prevent waste leaking into the environment and potentially contributing to microplastics generation including the following;

    (a) Reducing the amount of plastic waste that enters landfills and dumpsites through the implementation of waste reduction policies and

initiatives, such as waste-to-energy programs and increased recycling.Microplastics can also be reduced by supporting the development and use of biodegradable plastic alternatives

10. **End-of-pipe interventions,** wastewater, stormwater, and road runoff management and treatment, to retain the emitted microplastics before these reach water bodies.
11. Maximizing clean drinking water supply to all citizens in the country
12. Other Best practices as listed below for minimizing microplastics in environment may be followed:
    - **(a)** Install physical barriers such as screens and filters on STP/WWTP systems to help reduce the amount of microplastics that enter rivers, lakes, and oceans.
    - **(b)** Support sustainable fishing practices to reduce the amount of microplastic entering rivers from fishing equipment.
    - (c) Implementation of Clean-up efforts for beaches and rivers

13. Training and capacity building including microplastic monitoring, analysis , health impact studies may be taken up for effective implementation of aforementioned points

Figure 6.1 : Best practices for litter management in marine

Annexure-1

Minutes of Meeting on "Committee Meeting in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022" with CIPET/ICMR /NCSCM held on April 19th , 2022

A Committee meeting was held virtually via video conferencing on April 19, 2022 in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022 for study of microplastics impact on environment and human health. The meeting was coordinated by UPC-II division, CPCB, Delhi. Various stakeholders including representative of CIPET, ICMR, and NCSCM participated in the meeting (List of participants is placed as **Annexure-I**).

DH UPC-II briefly explained directions of NGT for the study to be conducted which covers standards for safe environment, remedial steps to reduce menace of micro plastic and addressing other incidental issues.

She also explained the steps taken by CPCB with regards to microplastics which mainly include assessment of microplastic with NCSCM in Ground Water & Ambient Air in compliance of NGT's order O.A. no. 99 of 2021. She also informed about the study undertaken by National Productivity Council on assessment of microplastics in river Ganga. It was further informed that Ministry of Science and Technology has constituted a committee and working on methods for removal of micro-plastics from water. It was proposed that the as the objective of the two Committees are interlinked, this committee may include representation from NEERI and DST.

The report submitted in O.A. No. 99 of 2021 was shared by CPCB with committee members and it was emphasized that study to should focus on identification of source of micro-plastic in water bodies, standardisation of monitoring techniques, risk assessment or health impact of micro plastics, methods of remediation and mitigation measures.

Dr. Mohanty from CIPET informed about the various studies being conducted regarding micro plastics are given below:

- Estimation of micro plastics in Tapi and Damanganga under Indo-Norway joint project(INOPOL) in Gujarat region in which it was observed t that land based resources are main contributor for the micro plastics.

- Standards for micro plastics determination being developed by ISO are at draft stage.
- Study for estimation of Micro plastic due to Compostable plastic is under way.

She also said that the CIPET can undertake study related to analysis of microplastic in water, soil, oceans etc part can be taken care by CIPET. Effect of microplastics on water content can be correlated with the releavant ISO Standards.

Dr Raj Narayan Tiwari from ICMR, Bhopal informed that they have taken up the studies for identification of micro plastic in different matrices in Bhopal. He further informed that articles published in Journals which highlight genotoxicity and cytotoxicity due to Microplastica. However health related studies due to microplastics in India have not been carried out so far.

Mr. Mrinal K. Biswas, RD Kolkata, CPCB discussed that the study shall be conclusive and it should include source, quality, quantity, impact on environment & human health and finally development of the standards for micro plastics. He also pointed out that the current available studies as well as journals are required to be considered for framing of action plan for the study to be carried out. Apart from that, study is required to be done in short term and long term manner to propose standards for microplastics.

Mr Robin form NCSCM, informed that they are working in coastline riverine system of India for characterisation, quantification and ecotoxical aspects of microplastics. He said leakage study i.e. quantity of micro plastic from leachate, landfills and sewage entering into nearby water body and ground water are required to be conducted in this field.

Further Ms. Divya Sinha -DH, UPC-II concluded the discussions and informed that the study shall cover inventorization, method of analysis, risk assessment or health impact of micro plastics, standards for treated sewage, drinking & ground water and methods of remediation and mitigation measures. She also informed that the standard for micro plastics in air is being developed by Air Quality Division CPCB.It was also important to identify which type plastics contribute maximum to the

generation of micro plastics

All the group members were requested to share the information and studies carried out in field of micro plastics with the Committee as well as provide any further inputs on the subject . Mr Mrinal K Biswas RD Kolkata was requested to to prepare draft Action Plan covering the Action Points discussed during the meeting as identifying the roles to be assigned to different organization. The same shall be circulated to the Committee members for finalization

The meeting ended with vote of thanks to the chair.

Annexure-I

List of Participants

S.N.	Name and Designation
1.	Dr. Raj Narayan Tiwari, Director, ICMR-NIREH, Bhopal
2.	Dr.R.S.Dhaliwal, Scientist G & Head, NCD, ICMR Hqrs
3.	Dr. Smita Mohanty, Director & Head (Principal Scientist) CIPET Bhuwneshwar
4.	Dr Robin , NCSCM Chennai
5.	Ms. Divya sinha Additional Director & I/c UPC-II, CPCB
6.	Mr. Mrinal Kanti Biswas Scientist "E" & Regional Director, CPCB
7.	Ms. Yogesh Chandra Scientist- B, CPCB

Sl.No	Action Point Description			Responsible Organization	Timeline (tentative)
1	Compilation of existing information on Microplastics	a	Committee members shall share information available with them	CPCB CIPET ICMR NCSCM	30.4.22
		b	Compilation of information	CPCB- RD Kolkata	7.5.22
		c	Identification of Gap Areas	CPCB – RD Kolkata	7.5.22
2	Standardization of methodology for monitoring, characterization & analysis of microplastics. Parameters for characterization to include size, type of plastic etc. Instruments required for monitoring / analysis and testing protocols to be delineated			CIPET/ NCSCM	15.5.22
3	Assessment of microplastics covering source, transfer media & end use. Available information as per Section 1 above shall be compiled and emphasis shall be on areas not covered as well as at the end use points. Number of samples to be collected shall be limited by the available infrastructure for monitoring as well as time			Assessment to be carried out by CIPET/ NCSCM – depending upon the available infrastructure. CPCB/Concerned SPCB/PCC to provide requisite support for the monitoring. Assessment to be coordinated & Report to be prepared by CPCB – RD Kolkata	15.6.22
	Source Monitoring	a	Source emissions from industries /activities - Identification of specific industrial sectors contributing to microplastics through literature survey and monitoring microplastics at source		
		b	Leachate from		

			dumpsite/ landfill site		
		c	Sewage treatment plant inlet / outlet		
	Transfer media	c	Surface Water bodies		
		e	Soil		
		f	Marine water		
		g	Fish		
	End- use	f	Water Supply plants (Inlet & Outlet)		
		g	Ground water		
		h	Ambient Air		
4	Source identification of microplastics based on Assessment report			CPCB	
5	Risk Assessment : To be carried out based on the Assessment report specifically w.r.t microplastic concentration at end use point .Parallelly reports in media on adverse impact of microplastics may be reviewed and study taken up as per requirement. Recommendation of safe level of microplastics in drinking water based on literature survey/ experimental studies			ICMR / BIS	15.6.22
6	Development of treatment methods for remediation of microplastics from water / wastewater.			NEERI/ DST/ CPCB	15.6.22
7	Recommendation of measures for reduction of microplastics in environment based on Assessment report including the following: • Measures for Control of coastal zone/ deep sea pollution due to marine litter • Developing regulatory & market based instruments for preserving riverine and marine ecosystems			CPCB	15.7.22
8	Identification of areas were standards have to be notified (drinking water standards, effluent discharge standards & ambient air quality standards)			CPCB	31.7.22
9	Training of SPCBs/PCC/CPCB staff on monitoring and analysis of microplastics &			CIPET / NCSMS	31.7.22

	including identification of measures/ for strengthening of laboratory infrastructure (Parallel activity)		
10	Submission of report to MoEF&CC	CPCB	15.8.22

Minutes of Meeting on "Second Committee Meeting in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022" with CIPET/ICMR /NCSCM held on July 27th , 2022

Second Committee meeting was held virtually via video conferencing on July 27, 2022 for study of micro plastics impact on environment and human health. Various stakeholders including representative of CIPET, ICMR, and NCSCM participated in the meeting (List of participants is placed as **Annexure-I**).

RD Kolkata, CPCB made brief presentation on research gap in Indian scenario based on the research document shared by CIPET, ICMR, and NCSCM. Gaps in Standardization of Qualitative and Quantitative techniques, gaps in Matrices covered under the published literature from various Geographical regions, were highlighted during the presentation. Presentation made is enclosed as **Annexure-II.**

Further discussions regarding need for future research was held by the members and DH UPC-II requested to all the group members to make brief presentation in next meeting as per details given below:

- RD Kolkata, CPCB
  - Methodology for development of standards covering sample requirement
  - Source of micro plastic
  - Areas of monitoring
  - Requirement for sampling methods and analysis
  - Capacity building
  - Availability and Gaps
- CIPET and NCSM
  - Available resources of monitoring sampling and analysis
  - Possible coverage for monitoring with existing resources
  - Institutional mechanism to fulfill additional sampling/analysis requirements, if any.
- ICMR
  - Existing studies on impact of micro plastic on human health
  - Identification of areas for further intervention to assess impact of micro plastic on human health.

The meeting ended with vote of thanks to the chair.

Annexure-I

List of Participants

S.N.	Name and Designation
1.	Dr. Raj Narayan Tiwari, Director, ICMR-NIREH, Bhopal
2.	Dr. Surya Singh ICMR-NIREH, Bhopal
3.	Dr.R.S.Dhaliwal, Scientist G & Head, NCD, ICMR Hqrs
4.	Dr. Smita Mohanty, Director & Head (Principal Scientist) CIPET Bhuwneshwar
5.	Dr Robin , NCSCM Chennai
6.	Ms. Divya sinha Additional Director & I/c UPC-II, CPCB
7.	Mr. Mrinal Kanti Biswas Scientist "E" & Regional Director, CPCB
8.	Ms. Yogesh Chandra Scientist- B, CPCB

Minutes of Meeting on "Third Committee Meeting in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022" with CIPET/ICMR /NCSCM held on August 5th, 2022.

Third Committee meeting was held virtually via video conferencing on August 5th, 2022 in compliance of Hon'ble NGT order in the matter of O.A. No. 251 of 2022 for study of micro plastics impact on environment and human health. Various stakeholders including representative of RD Kolkata, CIPET, ICMR, and NCSCM participated in the meeting (List of participants is attached as ***Annexure-I***).

Mr Mrinal K Biswas, RD Kolkata, CPCB, described the action plan for development of standards for microplastics. He provided examples from other countries which already have their own practices for managing microplastics. RD Kolkata ended their presentation with the proposed execution plan and the roles to be assigned to different organizations, for developing environmental standards. (The presentation is here attached as ***Annexure-II***)

The meeting progressed with the second presentation by NCSCM, where the information about protocol for analysis of microplastic in sediment, water & biota was briefly explained by them. They also explained the importance of surrounding environment from which sample has been taken, for analysis of microplastic.

Last presentation of the meeting was given by ICMR-NIREH Bhopal, where the results from the studies which have already been done on the presence of microplastic and their possible effects on human body, were discussed. Instruments which may be used for estimating the concentration of microplastics were also discussed during the presentation. (The presentation is here attached as ***Annexure-III***)

Ms. Divya Sinha -DH, UPC-II concluded the discussions with request to provide detailed information as annexed below, latest by **22/08/2022**, regarding the efficient methodologies adopted by CIPET & NCSCM for analysis of samples for microplastics in the environment.

The meeting ended with vote of thanks to the chair.

CIPET and **NCSCM** are required to provide the following information, latest by 22/08/2022, on testing and analysis of microplastics for drinking water, groundwater, compost/leachate samples:

Heads	Drinking water Sample	Groundwater Sample	Compost/leachate Sample
Methodology for testing and analysis			
Instruments Required			
Time period required for analysis			
Cost incurred per sample			
Presence/Coverage area of Organization			
Studies available			

Annexure I

List of Participants	
S. No.	**Name and Designation**
1.	Mr. Mrinal Kanti Biswas Scientist "E"; Regional Director, CPCB
2.	Dr. Raj Narayan Tiwari, Director, ICMR-NIREH, Bhopal
3.	Dr. Surya Singh, ICMR-NIREH, Bhopal
4.	Dr. Smita Mohanty, Director & Head (Principal Scientist), CIPET Bhuwaneshwar
5.	Mr. Himalaya Vardikar, CIPET LARPM, Bhuwaneshwar
6.	Ms. Divya sinha, Additional Director & I/c UPC-II, CPCB
7.	Ms. Yogesh Chandra, Scientist- B, CPCB
8.	Mr. Madnesh Kumar Dubey, Scientist- B, CPCB
9.	Mr. Mayank Raj Purbey, Scientist- B, CPCB

ANNEXURE-II

3rd Meeting of the expert committee on "Development of standards for Microplastics"

-By-

Central Pollution Control Board
Regional Directorate, Kolkata

NGT order

- As per the Hon'ble NGT order dated 05.04.2022 pertaining to OA no. 251/2022 of 2022, where it has been directed that:

  *"There is need for **further studies**, considering the studies already conducted, to be steered by the Committee comprising of CPCB, ICMR, Central Institute of Petrochemicals Engineering & Technology (CIPET), NCSCM, and any other expert institutions as required, under the Nodal coordination of CPCB. Such studies and recommendations/ suggestions **may cover standards for safe environment**, **remedial steps** to **reduce menace of micro plastic** and **addressing other incidental issues**. CPCB may incur expenditure on studies and other incidents out of Environmental Compensation funds."*

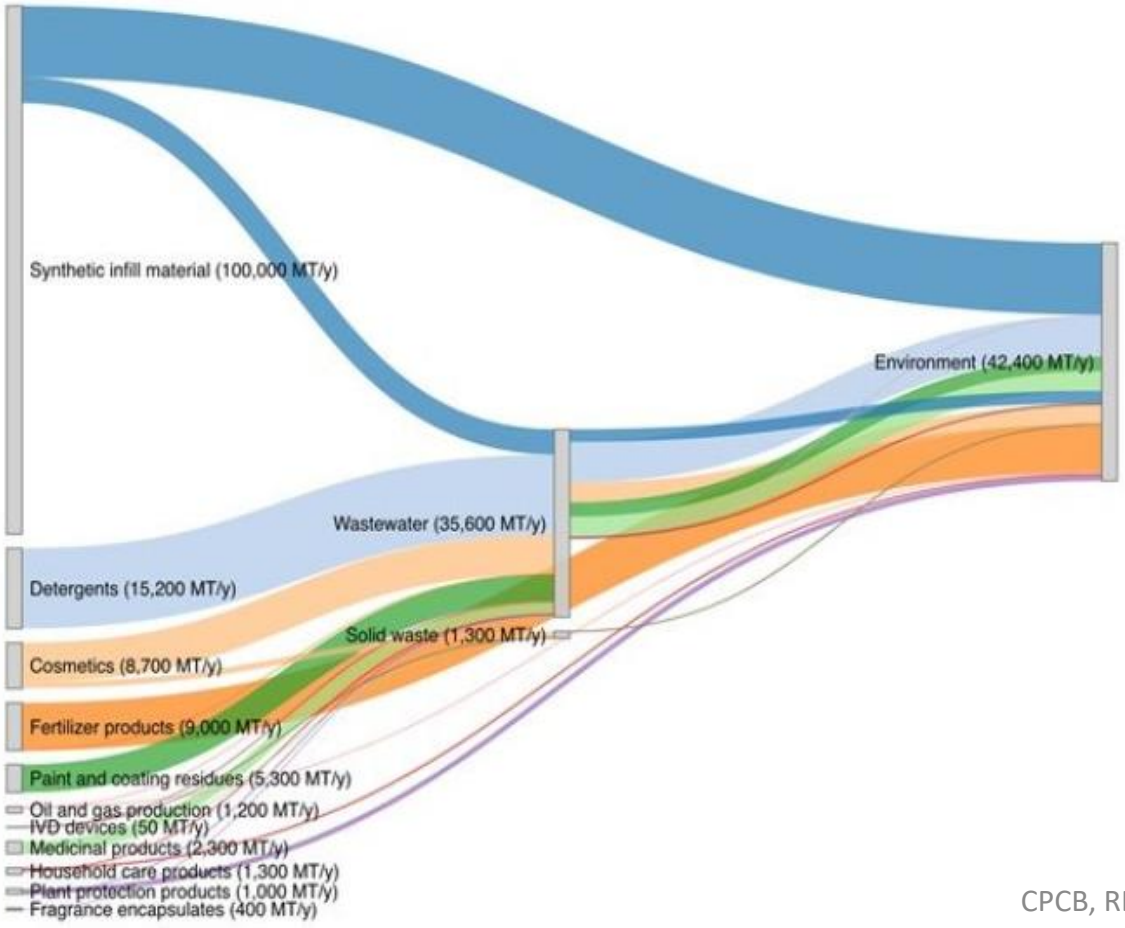
  &

- " *Having regard to the media report that violation of environmental norms in handling of plastics is resulting in serious adverse health effect on human beings, it appears to be necessary to **ensure strict compliance of environmental norms** and to undertake **further study** to consider **whether the existing policies of enforcement of environmental norms need to be revisited in any manner in the interest of human health**."*

International initiatives - EU

Regulations to control the pollution:

- Registration, Evaluation, Authorization and Restriction of Chemicals (REACH)
- Committee for Socio-Economic Analysis (SEAC)



- Sankey plot showing major sources and sinks of primary microplastic emissions in the EU. Emissions to the environment include those to both the aquatic and terrestrial compartment. (Rheinberger et al., 2021)

.....International initiatives till date – Europe

- In 2018, Commission adopted European Strategy for Plastics – a Circular Economy, about €100 million (for 2 yrs) has been allocated for implementation of plastics strategy and R&D projects.
- In January 2019, ECHA(European Chemical Agency) proposed a wide-ranging restriction on microplastics expecting to **prevent** the release of **5,00,000 tonnes of microplastics over 20 years.**
- **Development in 2022…..**

Specific laws with partial objectives	Directives for unintentional formation of microplastics	Production & release into the environment, both directly and indirectly
1. Marine Strategy Framework 2. Fertilising Products Regulation 3. REACH restriction proposal	1. Plastics Waste Framework strategy 2. Waste Framework Directive 3. Marine Strategy Framework Directive	1. Eco-design Directive 2. Waste Framework 3. Urban Waste Water Treatment Sewage Sludge 4. Directive on air quality 5. Industrial Emissions 6. Regulation on tyre labelling 7. Regulation on motor vehicle type approval

……..International initiatives till date – USA

- December 18, 2015, Congress amended the Federal Food, Drug and Cosmetic Act (FD&C Act) by passing the **Microbead-Free Waters Act of 2015**.
  - ❖Prohibits manufacturing, packaging, and distribution of rinse-off cosmetics containing plastic microbeads.
  - ❖This new law also applies to products that are both cosmetics and non-prescription (also called “over-the-counter" or "OTC") drugs, such as toothpastes.

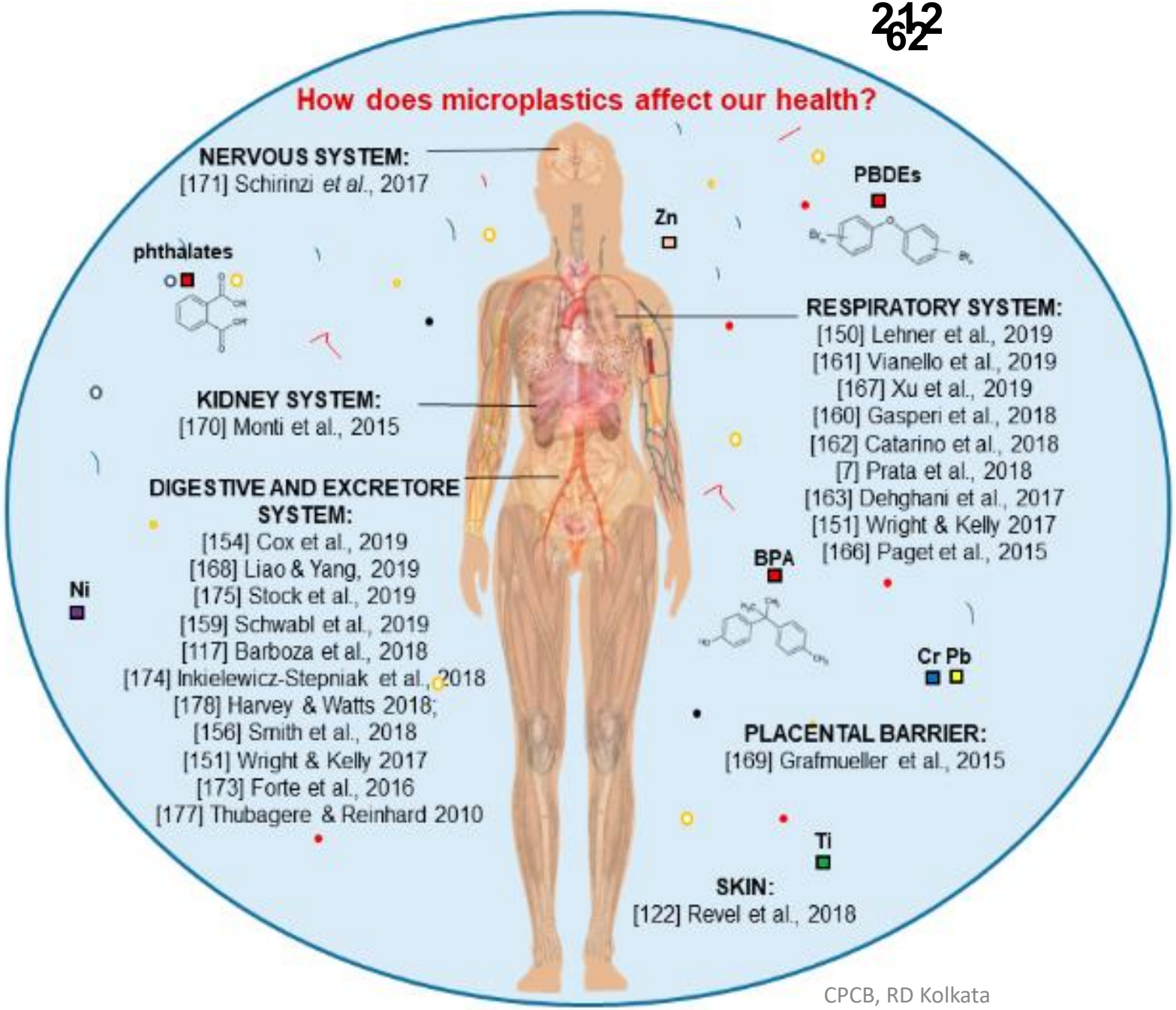
Indian scenario

BIS 2017 : Plastic microbeads of diameter 5 mm or less, that are insoluble in water, and solid plastic particles used to exfoliate or cleanse in personal care products are banned

Plastic Waste Management (Second Amendment) Rules, 2022:

a. Banned all single-use plastics from 1st July 2022.
b. mandate to increase the thickness of plastic carry bags to over 120 microns from December 31.
c. Banned imports of solid plastic waste from March 2019

Why do we need a standard?



Overview of scientific studies focused on the effects of micro and nanoplastics on human health.

Colored squares represent pollutants (organic and inorganic) that could be present in environmental matrices (free or associated with micro and nanoplastics) and that could enter into the human body through different entry routes.

Campanale et al., 2021

Pollutants being carried by MP

Organism exposed to MP

How to develop a standard?

1. Scientific stages

(a) Knowledge of the hazard: involves identification and characterization of microplastic.

(b) Evaluation of the risk: establishes the probability and severity of potential adverse effects of microplastic on health and safety.

(c) Assessment of hazard: determination routes of microplastic exposure and estimation of the number of people exposed.

2. Political and administrative stage

(a) Acceptance to the tolerable risk

(b) Determination to safeguard the public

(c) Consideration of human ecology

(d) Choice of control technology requires both formulations of strategy and selection

(e) Legislation standards consider the existing national legal framework and identify necessary legal strategies.

(f) Economics

Segments for Developing Environmental standard

Segment	Execution plan
1. Identification of priority pollution issue	❑ **Standard methodology for Sampling, processing and analysis** ❑ **Finalization of the matrix: Assessment of Quality & Quantity** A. Water (River, Lakes, Dams, Marine, Leachates & Ground Water B. Solid (Sediments, Sludge, Soil) C. Air (Rural, Urban & fugitive industrial emission) D. Biota (Fishes, Micro invertebrates) E. Packaged foods/drinks F. Existing water and waste water treatment facilities
2. Information on health effects	**ICMR-NIREH**
3. Assessment of exposure	Through Outcome of 1 & 2: A. Major Sources & budgeting B. Quality & Quantity C. Impact (includes risk) on Environment & Human D. Removal efficiencies of existing facilities
4. Strategies for prevention and control	A. Identification & Banning of selective additives usage and processes B. Technological intervention for removal MP and reuse of Plastic C. Issuance of directives restricting production and release D. Source control by legislation and awareness programs E. Promoting alternatives

……Segments for Developing Environmental standard

Segment	Execution plan
5. Legal framework	1. Nature of the decision 2. Scope and development of environmental legislation 3. Content and structure of regulation 4. Institutional consideration 5. Geographical dimension of environmental problems 6. Supporting measures for regulatory strategy
6. Consequences of different approaches to environmental health protection	1. Optimisation of Preventive methods and socio-economic impacts
7. Decision-making process	1. Interaction between science and policy 2. Constraints affecting development of the country 3. Finalization of the standards for **a) Discharge into** i. Inland surface water, ii. Public Sewers, iii. Land for irrigation and iv. Marine coastal areas b) **Acceptable limits** for drinking water supply

Work Distribution for identification & exposure study

- Distribution to cover the Matrices, Locations to address the gap

Sl no	Segment	Institutional Distribution
1	Spatial Analysis of Water, Soil & biota STPs/WTP, Solid waste Dump sites	Eastern Zone: CPCB – RD Kolkata Western Zone: CPCB – RD Vadodara Central Zone: ICMR – NIREH, Bhopal Northern Zone: CPCB Delhi Southern Zone: NCSCM, Chennai
2.	Air pollution	CPCB Delhi
3.	Coastal & Marine pollution	NCSCM, Chennai
4.	Health effect study	ICMR – NIREH, Bhopal
5.	Cosmetics, Packaged food & drinks	CIPET

CIPET having adequate infrastructure and network, may initiate sampling and analysis in all the 4 zones (except south), till capacity building is done in other participatory institutes

Matrix and location wise work plan: River

Sl. no.	Matrix	Segment	Existing study (Approx.) by independent researcher		Proposed representative study area (Water, Sediment & Biota)			
					Control group		Polluted stretch	
			Number	Name	Number	Name	Number	Name
1.	Water, Sediment & Biota, Water intake points	River	9	1. Ganga* 2. Brahmaputra* 3. Meghna 4. Adyar 5. Kosasthalaiyar 6. Multhirappuzhayar 7. Netravati 8. Alakananda 9. Indus * Few locations covered only	1	Umngot /Dawki	17	1.Ganga 2. Damodar 3. Bidyadhari 4. Yamuna 5. Cauvery 6. Mahanadi 7. Godavari 8.Krishna 9. Narmada 10. Tapi 11. Mandovi & Zuari 12. Netravati & Sharavathi 13. Kochi Backwaters 14. Neendakara 15. Perumadhura

Lake

Sl no	Matrix	Segment	Existing study (Approx) by independent researcher		Proposed representative study area (Water, Sediment & Biota)			
					Control group		Polluted stretch	
			Number	Name	Number	Name	Number	Name
2.	Water, Sediment, Biota Water intake points	Lakes	5	1. Veeranam lake, TN 2. Red hills Lake, TN 3.Vembanad lake, Kerala 4. Renuka lake, HP 5. Anchar lake, Northwest Himalaya	2	Kankaria lake, Gujrat Gurudongmer, Sikkim	15	1. Mirik lake, WB 2. Santragachi, WB 3. Ambazari Lake, Maharashtra 4. Puskar Lake, Rajasthan 5. Naraina Lake, Gujarat 6. Dal lake, J&K 7. Bellandur Lake, Bangalore 8. Naini lake, UK 9. Hussain Sagar, Telangana 10. Chilika Lake, Odisha 11. Vembanad lake, Kerala 12. Pulicat Lake, AP 13. Kolleru Lake, AP 14. Upper lake, MP 15. Lower lake, MP

Dam

Sl no	Matrix	Segment	Proposed representative study area (Water, Sediment & Biota)	
			Polluted stretch	
			Number	Name
3.	Water, Sediment & Biota, Water intake points	Dams	10	1. Panchet, WB 2. Mythan, Jharkhand 3. Hirakund, Odisha 4. Nizam Sagar Dam, Telangana 5. Sardar sarovar, Gujarat 6. Tehri, UK 7. Tungavadra, Karnataka 8. Uri Hydroelectric Dam, J& K 9. Gandhi Sagar Dam, MP 10. Kolar Dam, MP 11. Idukki Dam, Kerala 12. Govind Ballabh Pant Sagar Dam , UP 13. Jayakwadi Dam, Maharashtra

Ground water & Marine water

Sl no	Matrix	Segment	Existing study (Approx) by independent researcher		Proposed representative study area (Water, Sediment & Biota)
			Number	Name	Polluted stretch
4.	Water, Sediment & Biota	Ground Water (water extraction point)	2	Chennai, TN Punakayal, TN	State wise, representative data collection considering both urban and rural areas.
	Water, Sediment & Biota	Marine water & Coastal Pollution	41	Karnataka Kerala Tamilnadu Andaman Nicober Lakshyadweep	Sampling point: 1. Transect at every 200km interval along the coastal line of West Bengal, Odisha, AP, Goa, Maharashtra, Gujarat 2. Upto 200m depth contour (continental shelf)

Others

Sl no	Matrix	Segment	Existing study (Approx) by independent researcher		Proposed study area	
					Polluted location	
			Number	Name	Number	Name
5.	Soil, Leachate & affected GW	Solid waste Dumpsite	0	none		State wise 1 or 2 major dumpsite
6.	Air	Urban	4	Chennai, TN Patna , Bihar Nagpur, Maharashtra Varanasi, UP	**As per the ongoing study by CPCB**	
7.	Health effect	Animal study Clinical study Human study	11	Arthropod and fishes	**Plan to be developed by ICMR NIREH**	

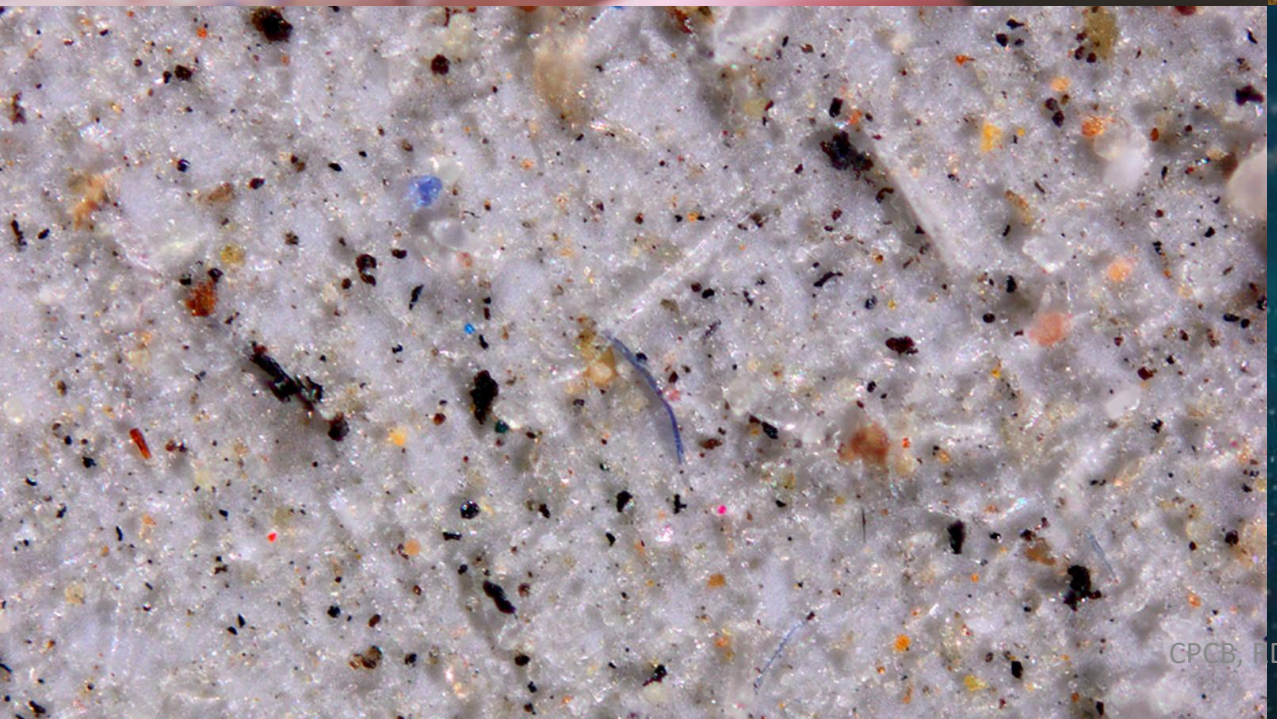
Evaluation of existing treatment technologies

Sl. No.	Treatment	Matrix	Technology wise evaluation (State wise evaluation)	
			Conventional	Advanced
1	Sewage treatment plants	Water & sludge	AL OP ASP TF	SBR MBBR FBAS MBR & others
2	Water treatment plants		State-wise evaluation	State-wise evaluation

Immediate action

Preparation and submission of interim report to Hon'ble NGT:

1. Distribution of microplastics in the environment – based on LIMITED studies in Indian context.
2. Impact on Environment – based on international studies
3. Impact on Human Health – based on international studies
4. Gap analysis & proposed methodology for the study indicating requirement for establishing a strong database, budgeting, impact, prevention and control.



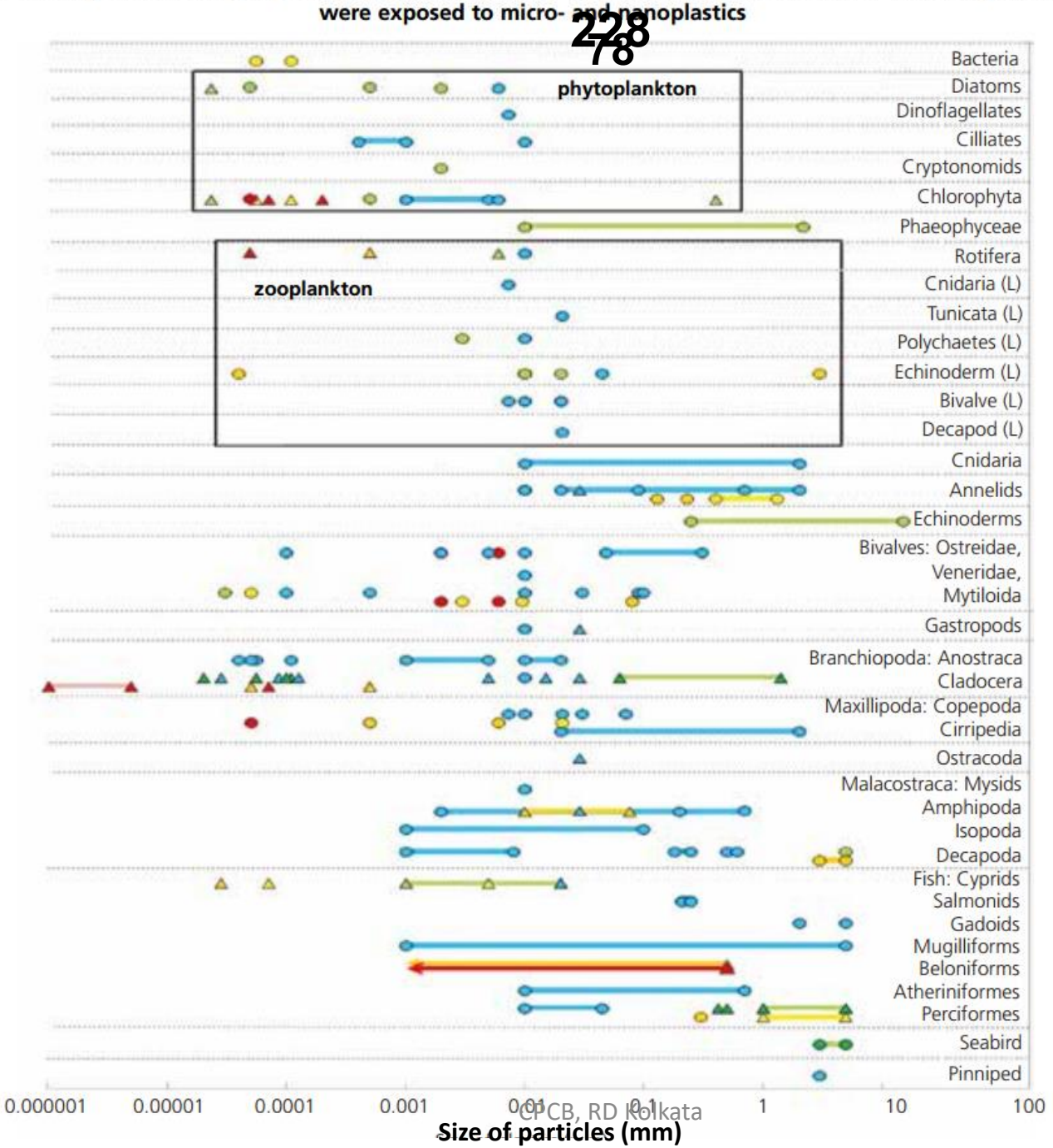

Thank You

Table 2 Types of pollutants carried by different types of microplastics

Microplastic	Pollutant	Reference
PA	Benzene derivative	Rehse et al. (2018)
PBAT	Heavy metals	Kedzierski et al. (2018)
PE	Lubrication oil	Haghi and Banaee (2017)
	PAH	Oliveira et al. (2013)
	Paraquat	Rochman et al. (2013b)
	PBDE	Llorca et al. (2018)
	PCB	Wang et al. (2015)
	Per- and polyfluoroalkyl substances	Fisner et al. (2017)
	PFOSA	Zhan et al. (2016)
	PPCP	Hu et al. (2017)
	Triclosan	Frydkjær et al. (2017)
PET	Heavy metals	Rochman et al. (2013a)
PP	Heavy metals	Rochman et al. (2013b)
	PAH	Fisner et al. (2017)
PS	Antibiotic	Wen et al. (2018)
	Cadmium	Zhang et al. (2019b)
	Lubrication oil	Llorca et al. (2018)
	PCB	Wang et al. (2015)
	Per- and polyfluoroalkyl substances	Guo et al. (2018)
	PFOSA	Zhan et al. (2016)
	Roxithromycin	Hu et al. (2017)
PVC	17α-Ethinylestradiol	Qu et al. (2018)
	Antibiotic	Sleight et al. (2017)
	Benzene derivatives	Kedzierski et al. (2018)
	Heavy metals	Rochman et al. (2013a)
	Odesmethylvelafaxine	Pascall et al. (2005)
	PCB	Wu et al. (2016)
	PFOSA	Guo et al. (2018)
	Phenanthrene	
	Venlafaxine	
LDPE	Heavy metals	Rochman et al. (2013a)
HDPE	Heavy metals	Holmes et al. (2014)

PBAT polybutylene adipate terephthalate, *HDPE* high-density polyethylene, *PFOSA* perfluorooctanesulfonamide, *PPCP* pharmaceuticals personal care product

Summary of laboratory experiments (published up to the end of December 2016), in which organisms were exposed to micro- and nanoplastics



3RD MEETING OF THE EXPERT COMMITTEE ON MICROPLASTICS

(*w.r.t.* Hon'ble NGT OA No. 251/2022 of 2022)

Convened by

Central Pollution Control Board, Delhi

Presented by

ICMR – National Institute for Research in Environmental Health (NIREH), Bhopal

Human Health Research Scenario

Microplastics have been reported and estimated in:

- Human saliva
- Human blood
- Human placenta
- Human colon
- Human stool
- Human lungs

Human Saliva 231

Total number of studies till date: 1

No. of human samples: 2000

Instrument: µRaman Spectroscopy

Total number of particles reported: 650

Concentration of MP reported: 0.33 particles / individual

Impact on health: Not reported

Ref. Abbasi et al. 2021, Human exposure to microplastics: A study in Iran

Human Blood 232 82

Total number of studies till date: 1

No. of human samples: 22

Instrument: Pyr GC – MS (limitation 700 nm)

Concentration of MP reported: 1.6 µg / mL

Impact on health: Not reported

Ref. Leslie et al. 2022, Discovery and quantification of plastic particle pollution in human blood

Human Placenta

Total number of studies till date: 1

No. of human samples: 6

Instrument: µRaman Spectroscopy (limitation 5 µm)

No. of MP particles reported: 12 particles in 4 samples out of 6 tested

Impact on health: Not reported

Ref. Rasuga et al. 2021, Plasticenta: First evidence of microplastics in human placenta

Human Colon 234

No. of human samples: 11

Instrument: FTIR Microscope

Concentration of MP reported: 28 ± 15.4 particles / g colon tissue

No. of MP particles reported: 331 particles / individual specimen

Impact on health: Not reported

Ref. Ibrahim et al. 2020, Detection of microplastics in human colectomy specimens

Human Stool 235 85

First Study

No. of human samples: 8

Instrument: FTIR microspectroscopy (limitation 50 µm)

Concentration of MP reported: 2 particles / g of stool

Impact on health: Not reported

Second Study

No. of human samples: 24

Instrument: FTIR microspectroscopy

No. of MP particles reported: 1 particle / g - 36 particles / g of stool

Impact on health: Not reported

Ref. Schwabl et al. 2019, Detection of various microplastics in human stool
Zhang et al. 2021, You are what you eat: Microplastics in feces of young men living in Beijing

Human Lungs 236

First Study

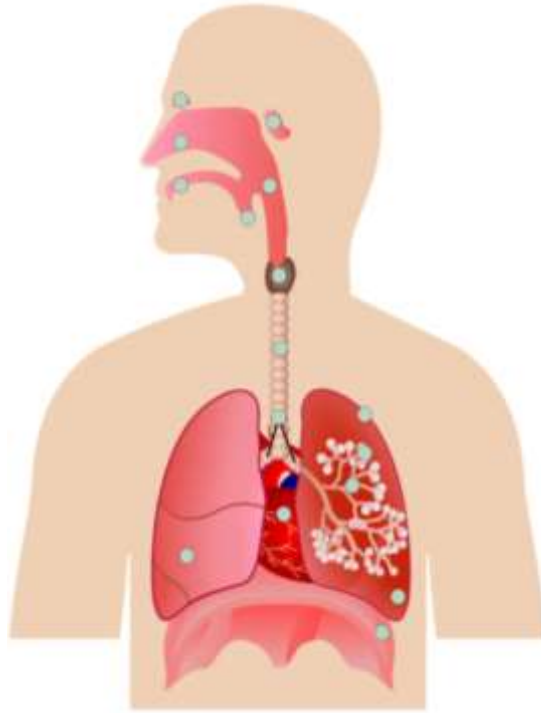
No. of human samples: 13

Instrument: µFTIR Spectroscopy (limitation 3 µm)

Concentration of MP reported: 0.69 ± 0.84 particles / g lung tissue

No. of MP particles reported: 39 particles in 11 samples out of 13 tested

Impact on health: Not reported



Second Study

No. of human samples: 20

Instrument: Raman Spectroscopy (limitation 20 µm)

No. of MP particles reported: 37 particles in 13 samples out of 20 tested

Impact on health: Not reported

Ref. Jenner et al. 2022, Detection of microplastics in human lung tissue using µFTIR spectroscopy
Amato-Lourenco et al. 2021, Presence of airborne microplastics in human lung tissue

Human Health Research Scenario in the Area of Microplastics

Genotoxic and cytotoxic effects of microplastics in human blood lymphocytes

No. of human samples: 2

Size of microplastic particle studied: 10 – 45 µm

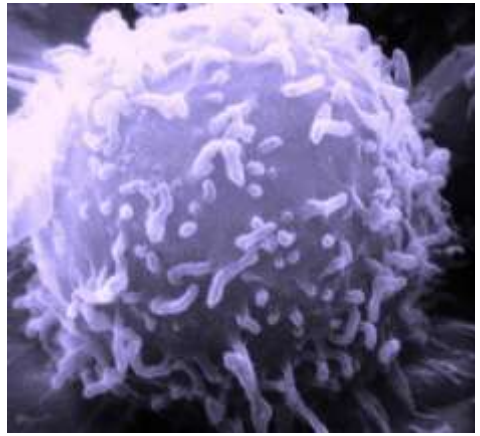
Type of microplastic particle studied: Polyethylene

Concentrations of MP studied: 25, 50, 100, 250, 500 µg/mL of blood

Type of study: *in-vitro*

Result: Genomic instabilities were reported

Mechanism: Unknown



Ref. Cobanoglu et al. 2021, Genotoxic and cytotoxic effects of polyethylene microplastics on human peripheral blood lymphocytes

Human Health Research Scenario in the Area of Microplastics

Cytotoxic effects of microplastics *accompanied by* metal nanoparticles in human cerebral and epithelial cells

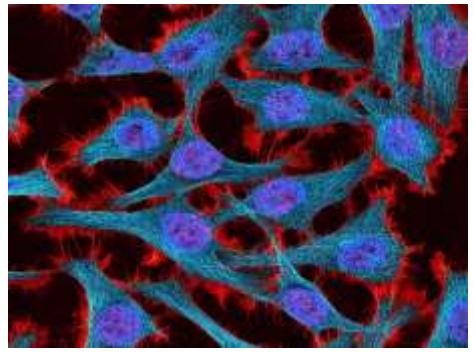
Size of microplastic particle studied: 3 – 16 µm

Type of microplastic particle studied: Polyethylene & polystyrene

Concentrations of MP studied: 50 µg/L to 10 mg/L

Type of study: *in-vitro*

Result: Oxidative stress was reported



Ref. Schirinzi et al. 2017, Cytotoxic effects of commonly used nanomaterials and microplastics in cerebral and epithelial human cells

Key Takeaways.

- *Studies are only about the presence of microplastics in human body, NOT about their physiological / psychological impact*
- *Studies showing the genotoxic and cytotoxic impacts of the microplastics are in-vitro studies, conducted over ONLY two individuals*
- *Health impacts of emerging contaminants (e.g. MPs) are chronic. So, long-term studies are required to establish CAUSE-EFFECT RELATIONSHIP*
- *Without establishing cause-effect relationship, it would not be appropriate to set STANDARDS for drinking water having microplastics*

Annexure-2

Item No. 06 (Court No. 1)

BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI

(By Video Conferencing)

Original Application No. 251/2022

In re: News item published in The Hindu dated 29.03.2022 titled **"Detecting microplastics in human blood"**

Date of hearing: 05.04.2022

CORAM: HON'BLE MR. JUSTICE ADARSH KUMAR GOEL, CHAIRPERSON
HON'BLE MR. JUSTICE SUDHIR AGARWAL, JUDICIAL MEMBER
HON'BLE MS. JUSTICE PUSHPA SATHYANARAYANA, JUDICIAL MEMBER
HON'BLE PROF. A. SENTHIL VEL, EXPERT MEMBER

ORDER

1. Proceedings have been initiated in light of captioned media report to the effect that in absence of enforcement of environmental norms on the subject, small particles of plastics enter the blood cells of human being through food, having adverse health impact.

2. Having regard to the media report that violation of environmental norms in handling of plastics is resulting in serious adverse health effect on human beings, it appears to be necessary to ensure strict compliance of environmental norms and to undertake further study to consider whether the existing policies of enforcement of environmental norms need to be revisited in any manner in the interest of human health.

3. It appears from the record that the Southern Bench of NGT has taken up Suo Moto based on similar media reports in OA No. 99/2021(SZ), *Tribunal on its own motion Suo Motu based on the news*

item in The Times of India Newspaper, Chennai Edition dt. 05.04.2021, "Chennai, you are breathing micro plastic" vs. The Chief Secretary to Government of Tamil Nadu Chennai and Ors. and OA No. 174/2021(SZ), *Tribunal on its own motion Suo Motu based on the news item in The Times of India Newspaper, Chennai Edition dt. 27.07.2021, "High level of metals PM 2.5 found in city's air you're breathing" vs. The Chief Secretary to Government of Tamil Nadu Chennai and Ors.,* wherein CPCB carried out study on analysing micro plastic in ground water in context of landfills leachate and analysis through National Centre for Sustainable Coastal Management (NCSCM), Chennai. To avoid conflicting orders, the said matters stand transferred to the Principal Bench of this Tribunal for being dealt alongwith the present matter. Counsel appearing in the said matters be informed by e-mail. If they have any objection, they are at liberty to move this Tribunal. Record of the said matters be called for in the form of scanned documents. It is not necessary for the time being to call for the original record which may be retained at Chennai Bench. The date fixed in the said matters will stand deferred to 19.10.2022 on which the present matter will now be listed. The titles of the said matters be now modified as *In re: News Item published in The Times of India, Chennai dated 05.04.2021 titled* ***"Chennai, you are breathing micro plastic"*** in OA No. 99/2021(SZ) and *In re: News Item published in The Times of India, Chennai dated 27.07.2021 titled* ***"High level of metals PM $_{2.5}$ found in city's air you're breathing"*** *in* OA No. 174/2021(SZ).

4. There is need for further studies, considering the studies already conducted, to be steered by the Committee comprising of CPCB, ICMR, Central Institute of Petrochemicals Engineering & Technology (CIPET), NCSCM, and any other expert institutions as required, under the Nodal coordination of CPCB. Such studies and recommendations/ suggestions

may cover standards for safe environment, remedial steps to reduce menace of micro plastic and addressing other incidental issues. CPCB may incur expenditure on studies and other incidents out of Environmental Compensation funds.

5. The report of the study with suggestions for remedial action may be filed before this Tribunal by e-mail by August 31, 2022 with a copy to the Secretary, MoEF&CC as input for consideration of policy on the subject. MoEF&CC may file its action taken report in the matter before the next date by e-mail at judicial-ngt@gov.in preferably in the form of searchable PDF/ OCR Support PDF and not in the form of Image PDF.

List for further consideration on 19.10.2022.

A copy of this order along with the media report be forwarded to CPCB, ICMR, CIPET, NCSCM, Chennai and MoEF&CC by e-mail for compliance.

Adarsh Kumar Goel, CP

Sudhir Agarwal, JM

Pushpa Sathyanarayana, JM

Prof. A. Senthil Vel, EM

April 05, 2022
Original Application No. 251/2022
SN

Annexure-II

Impact of Plastic Waste Disposal on Soil and Water Quality at Lucknow Dumpsites

CENTRAL POLLUTION CONTROL BOARD
(Ministry of Environment & Forests)
Parivesh Bhawan, East Arjun Nagar,
Delhi-110032

December, 2015

अरूण कुमार मेहता, भा.प्र.से.
संयुक्त सचिव
(पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय)
ARUN KUMAR MEHTA, I.A.S.
Joint Secretary
(Ministry of Environment, Forest & Climate Change)
&
अध्यक्ष
केन्द्रीय प्रदूषण नियंत्रण बोर्ड
Chairman
CENTRAL POLLUTION CONTROL BOARD

सत्यमेव जयते

भारत सरकार
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय
नई दिल्ली - 110003
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST &
CLIMATE CHANGE
NEW DELHI-110003

FOREWORD

The soil and groundwater has been contaminated due to indiscriminate littering and dumping of various wastes including plastic waste. The existing MSW landfill sites are mostly filled with different categories of plastic waste which persist in nature for several years specially due to its non-biodegradability. Plastic waste dumping on land causes several environmental issues like imparting infertility in soil, releasing toxic gases on burning, causing death on eating by cattle and most importantly, the additives and colours used during manufacturing processes have potential of leaching out heavy metals and other chemical compounds that may contaminate soil & ground-water quality. To study the effect of municipal and plastic waste dumping on soil and underground water, CPCB sponsored a project to Indian Institute of Toxicological Research (IITR), Lucknow to study "Impact of Plastic Waste Disposal on Soil and Water Quality at Lucknow Dumpsites". The soil and water quality data revealed that the heavy metals, chloride, phthalates etc. migrate from plastic waste into the surrounding medium because these are not chemically bound and remain present as mobile and leachable phase. The leachate can cause considerable pollution problems by contaminating the surrounding soil, ground or surface water.

I hope this report would be useful to the urban local bodies, State Pollution Control Boards and other agencies to understand the environmental issue due to improper dumping of MSW including Plastic waste. I would like to thank officials of IITR, Lucknow for completing the study. I would also like to appreciate sincere efforts made by Dr. S.K. Nigam, Additional Director, CPCB, Delhi for overall co-ordination of the study and Scientists of Zonal Office, Lucknow in assisting the field studies.

(A.K. MEHTA)
Chairman

'परिवेश भवन', सी.बी.डी. कम-ऑफिस कॉम्प्लैक्स, पूर्वी अर्जुन नगर, दिल्ली-110032
'PARIVESH BHAWAN', C.B.D.-CUM-OFFICE COMPLEX, EAST ARJUN NAGAR, DELHI-110 032
PHONE : 22307233, TEL. FAX : 22304948, E-mail : ccb.cpcb@nic.in, akmehta@nic.in

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Contents

Executive Summary

Solid waste management (SWM) is an integral part of the urban environment and planning of the urban infrastructure to ensure safe and healthy environment. While considering the promotion of sustainable economic growth, the rapid and unplanned industrialization, urbanization and population growth have resulted in proliferation of consumer articles vis a vis generation of waste.

Lucknow city is situated at the banks of river Gomti. Geographically, Lucknow city is situated at coordinates 26.85°N and 80.92°E having 2,528 km^2 area. As per 2001 census its population was approximately 27.50 lakhs generating more than 1200 tonnes per day of municipal solid waste. The purpose of the study was to assess the impact of plastic waste disposal on soil and ground water quality of Lucknow dumpsite. The following two dumpsite locations of Lucknow city: a) Ghaila, Hardoi Road and b) Dudauli, Sitapur Road have been under taken for the sampling and study.

Samples of soil and water were collected and analyzed in both pre monsoon and post monsoon seasons. It was found through the determination of Toxicity Characteristic Leaching Procedure (TCLP) that chemical moieties like heavy metals, chloride, phthalates etc. migrate from plastic waste to the surrounding medium. Since these plastic additives are not chemically bound with the polymeric chain and remain present as free and leachable phase, hence, they can migrate from plastic to the recipient medium during landfilled conditions due to physico-chemical exertion and microbial degradation. These leachates can cause considerable pollution problems by contaminating the surrounding soil, ground or surface waters.

1. Introduction

Plastics are petro-based polymer made-up of long chain of hydrocarbons and non-biodegradable. Plastics are widely used for storage and packaging of food stuffs and transportation. The usage includes disposable and reusable containers, plastic wraps, cutlery, water bottles and baby bottles. Plastic products can be easily found in human residential and occupational environments in high concentrations. After their service life, the plastic products may be landfilled where due to biotic and abiotic degradation, leaching of plastic additives i.e. heavy metals, plasticizers, stabilizers, unreacted monomers and harmful moieties of colorants occur which ultimately percolate in different segments of environment contaminates soil and water bodies.)

The toxicological effects of several plastic additives have been sporadically studied and there is a need for holistic study on impact of plastics waste disposal on soil and ground water. The aim of this study is to monitor and assess the impact of polymeric and plastic additives with special reference to heavy metals and phthalate esters on soil and water medium as they are landfilled along with municipal solid waste. An effect has been made to understand the toxicological implications due to leaching of plastic waste and to generate baseline data to draw recommendations for identifying the health risk due to the presence of heavy metals and phthalate esters migrating food chain through various polymeric and plastic additives used by plastic products manufacturing industries.

2. AIMS & OBJECTIVES

- To collect the soil and water samples from two identified dumpsite locations of Lucknow city (i.e. Dudauli and Ghaila sites) and compile the information regarding the commonly used practice for plastic waste disposal by municipal authorities and Consumers.
- To estimate the migration or leaching of heavy metals (Cd, Co, Cr, Cu, Pb, Mo, Ti and Zn) and phthalate esters in ground water and soil samples collected from landfill sites.

3. SCOPE OF THE STUDY

- To collect and identify different types of plastic products and waste from market and dumpsites such as colored plastic bags and containers and gift items, plastic crockery and multilayered plastic and find out leachability of plastic products and waste in laboratory through appropriate testing methods.
- To collect water and soil samples near the dumpsites at Lucknow.
- To **study the migrations of phthalate esters from dump sites.**
- To suggest remedial measures on use of additives in production of plastic products.

4. PLAN OF WORK

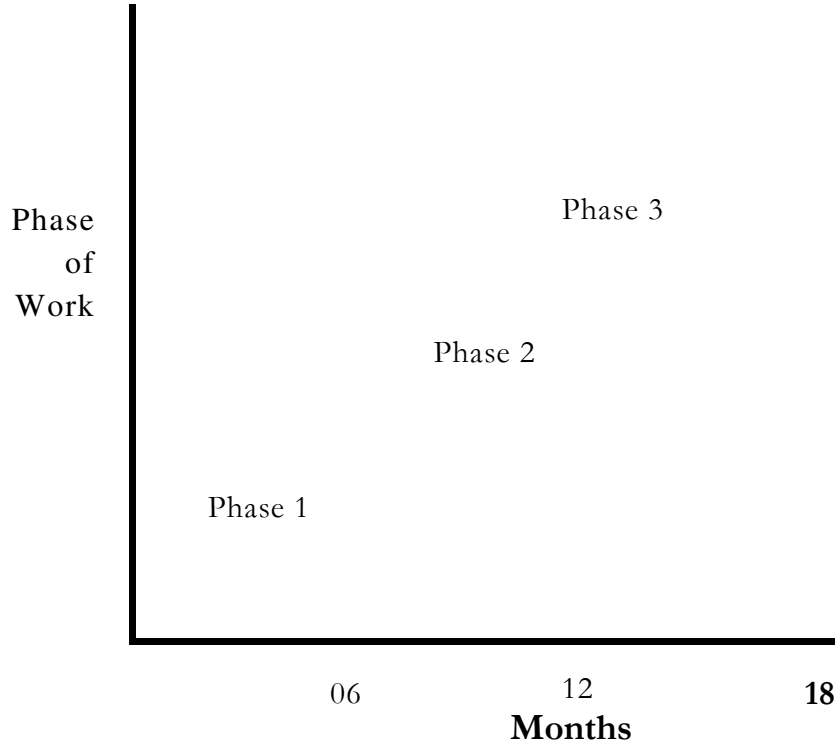


Table-1: Work Plan

Phases	Proposed Plan	Status
Phase 1:	Initiation of sample collection, procurement of chemicals and glassware, processing, preparation of reagents, standardization of method and appointment of staff.	• Control samples of and water had been analyzed during November, 08-January, 09. • Procurement of chemicals and glass wares, processing, preparation of reagents, standardization of method had been completed. • Project staff as envisaged in the project had been appointed. • Pre-monsoon sampling from Dudauli dumpsite was completed.
Phase 2:	Estimation of plastic additives viz. heavy metals and phthalates using standard procedure.	Analysis of pre-monsoon samples was done
Phase 3:	Continued the analysis of phthalates, metals etc, and interpretation of available data and compilation of report.	Post-monsoon sampling from Dudauli dumpsite was completed on September 28-30, 2009 and sampling on Ghaila dumpsite was completed on December 9-10, 2009.

5. METHODOLOGY

5.1 Sampling

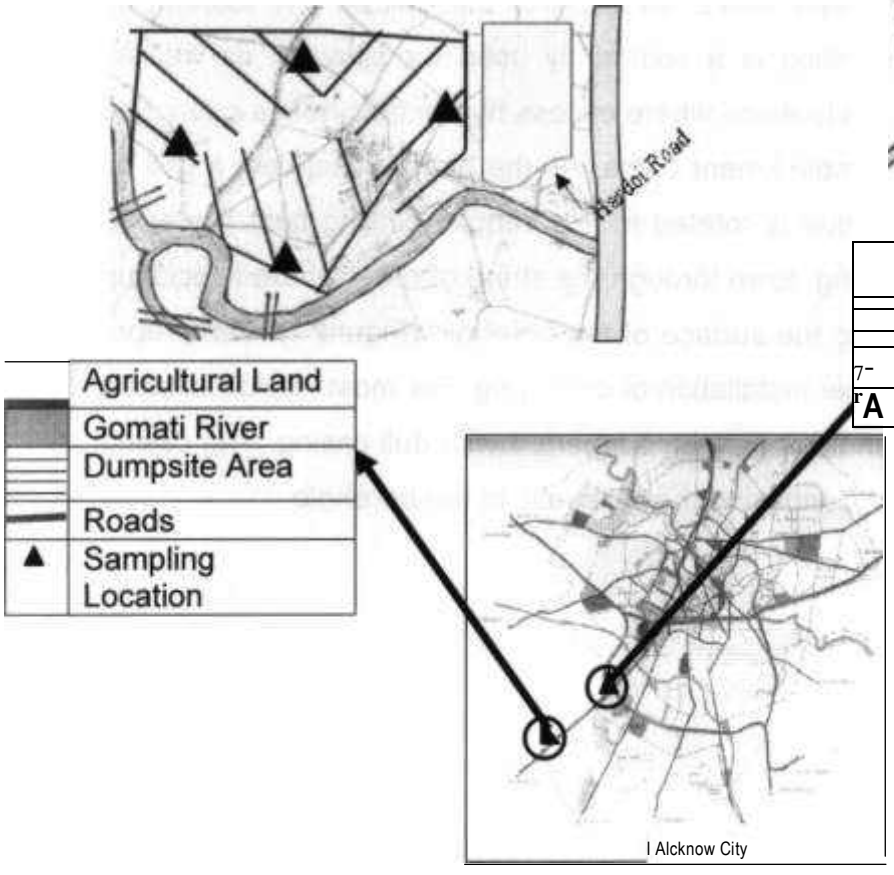
5.1.1 Identification of Sampling Location:

On the basis of field survey and data concerning to municipal and plastic waste dumping provided by Lucknow Nagar Nigem, relating to two dumpsite location i.e. (a) Ghaila, Hardoi Road and (b) Dudauli, Sitapur Road have been under taken for digging borewell of 30 meter deep at each locations. The samples were taken for soil and water quality testing using Standard Methods. Samples were taken at two locations on Ghaila dumpsite and four locations on Dudauli dumpsite in pre and post monsoon period. From each location respective siol samples were collected at the surface and further at regular intervals of 3 metes upto the depth of the constructed well. After construction of well first static water samples were drawn in triplicate at each location. Summary of the sample collection is presented in **Table 2.**

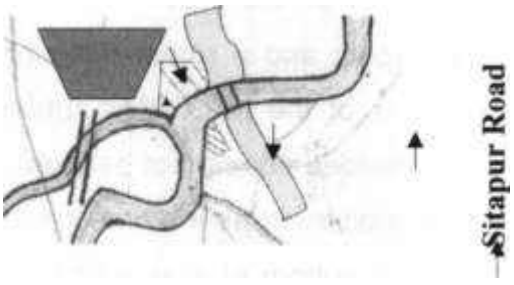
Table - 2

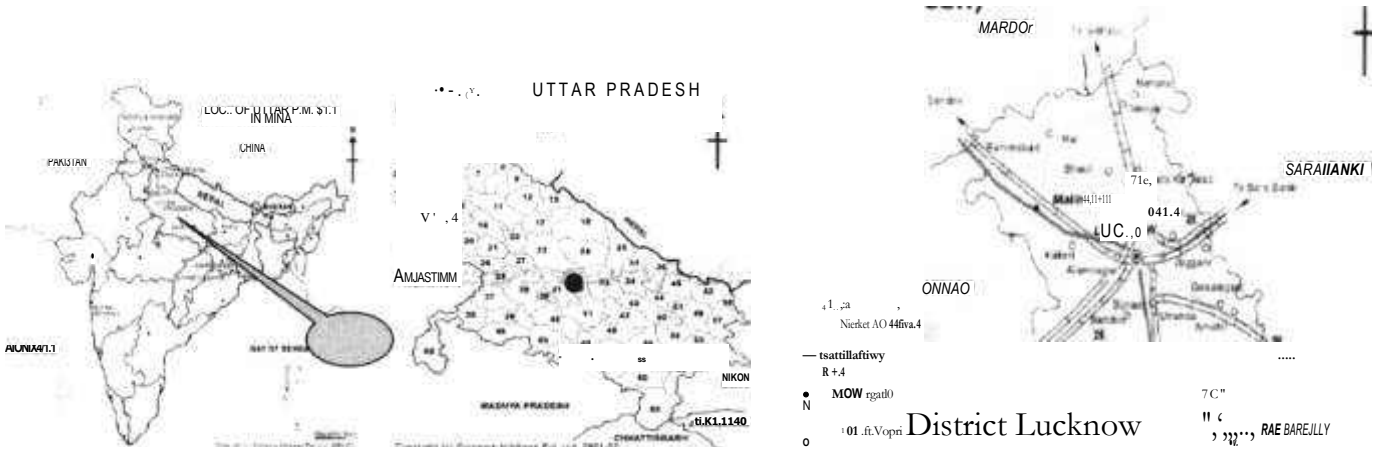
S. No.	Sample Site	No. of Samples			
		Pre-Monsoon Plan for Sampling		Post-Monsoon Plan for Sampling	
		Water	Soil	Water	Soil
1.	Municipal Solid Waste Dumpsite, **Ghaila,** Hardoi Road, Lucknow (2 **locations, 3 each)**	06	06	06	06
2.	Municipal Solid Waste Dumpsite, **Dudauli,** Sitapur Road, Lucknow (4 locations, 3 each)	12	12	12	12
	Total (72 Samples)	18	18	18	18
Total No. of construction of 30 meter deep test wells: 06 **Total No. of samples involving lysimetric method:** Water (36 samples) and Soil (36 samples)					

Ghaila Municipal Solid Waste Dumpsite, Hardoi Road, Lucknow



Dudauli Municipal Solid Waste Dumpsite, Sitapur Road, Lucknow





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5.1.2. Sampling Procedure:

Sampling was carried out through direct circulation system rotary (Mud Rotary Drilling) method using DC mini rig (suitable capacity 300 mm diameter and 120 meter depth in alluvial soil). This method and system includes a drill bit, a drill string having drill rods, and a rotary table or power swivel for bringing the drill bit into rotation by means of the rods. Mud rotary drilling is a commonly used for alluvium as well as overburden but cannot be used in situations where excess hydrostatic heads cannot be tolerated such as in some earth embankment dams. As the name describes, a drill bit on the bottom of a string of drill rods is rotated in a borehole. Drilling fluid (water) is circulated in the borehole by pumping down through the string of rods, where it picks up the drill cuttings and carries them to the surface of the borehole (Figure 1). The proper drilling fluid is essential for the proper installation of drilling rig. For most instrumentation installations the sides of the borehole should be supported with drill casing. The casing also prevents the drilling fluid from contacting the sidewalls of the borehole.

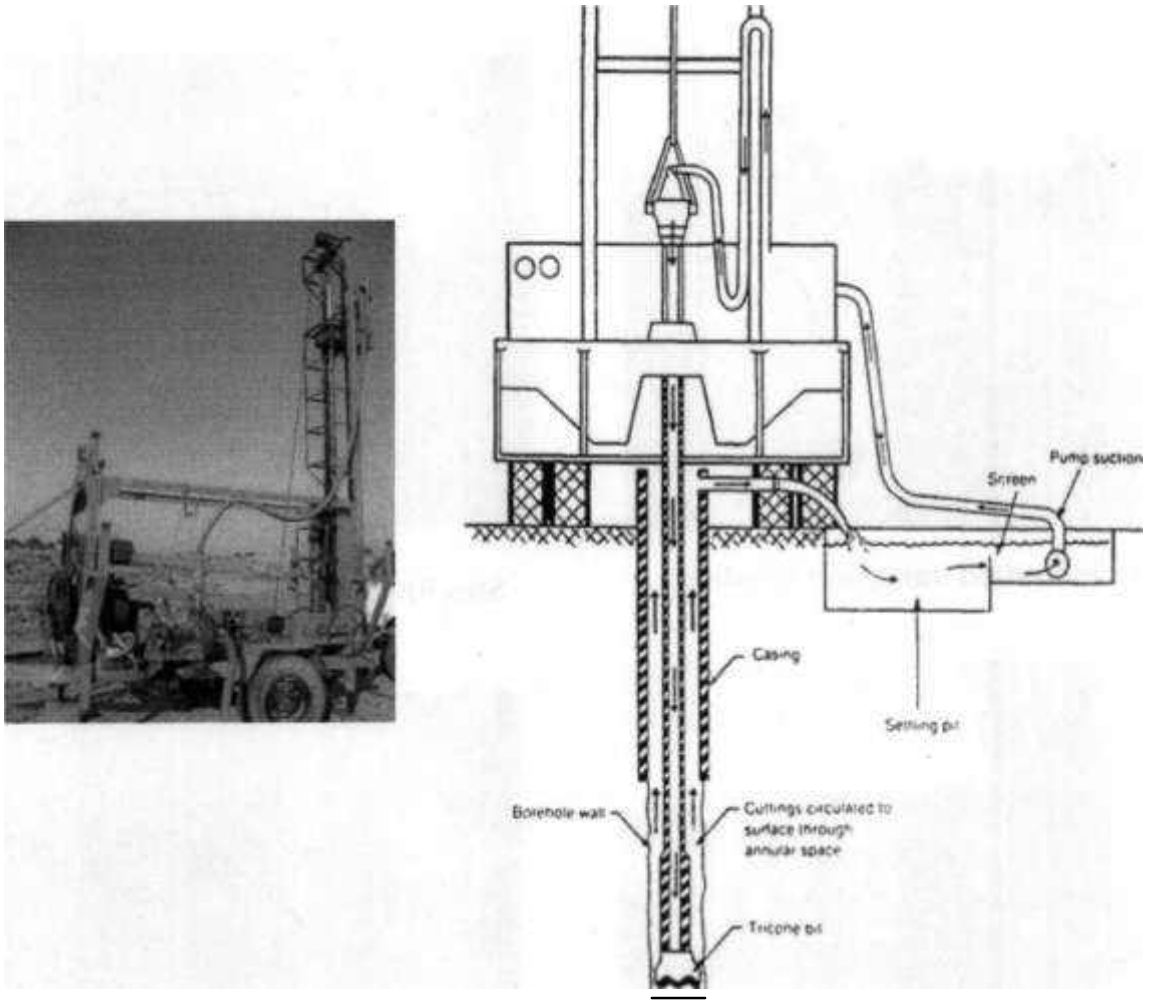
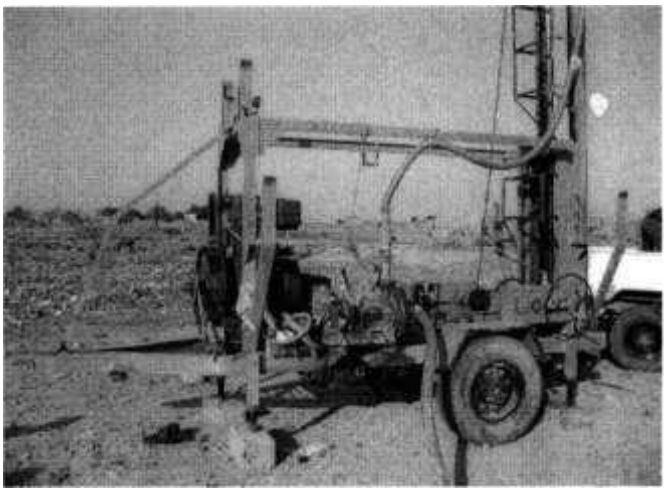


Fig 1: Direct Circulation System Rotary (Mud Rotary Drilling) method using DC mini rig

5.1.3. Step of Sampling:

Step i): Identified sampling location



Step ii): Installation of DC mini rig for drilling bottles

Step iii): Mode of drilling using Direct Circulation System Rotary (Mud Rotary Drilling) method

Step iv): Formation of recycled water micro well

Step v: Soil sample collection in cloth bag

Step vi: Drawing water samples by installation of submersible pump in constructed well

Step vii): Collection of water samples in glass bottles

Step viii): Sealing of construction well using concrete cement material

5.1.4. Preservation of Samples:

Soil samples were collected in cloth bag and glass bottles. Samples of water collected in 2 litre glass bottles and LDPE containers as per USEPA guidelines for waste and solid waste: SW 846. All samples were preserved at refrigerated conditions. During sampling and processing of the samples, precautions were taken to avoid external contamination. This is important since phthalates are ubiquitous chemicals in the indoor

environment. Therefore, use of plasticized plastic equipments were avoided during sampling and processing. For phthalate analysis, all glassware's were properly cleaned with Dichloromethane (DCM/HPLC grade) before use. Detergents were not used during washing of glassware's and all equipments were preconditioned and checked for blank levels of phthalates before analysis. The sample for analysis of heavy metals were preserved by adding 5 ml Nitric acid per liter of water sample.

5.2 ANALYSIS

Parameters of soil and water samples collected and analysed are given below **Table-3** :

S.No.	Sample	Parameters
i)	**Soil**	pH, Heavy metals (Cd, Co, Cr, Cu, Pb, Mo, Ti and Zn), Nitrogen, Phosphorous, Potassium, Phthalates.
ii)	**Water**	Heavy metals (Cd, Co, Cr, Cu, Pb, Mo, Ti and Zn) and Phthalates.
iii)	**Leachates**	TCLP for heavy metals (Cd, Co, Cr, Cu, Pb, Mo, Ti and Zn), *Carbon Black,* Nigrosine Dye, Chlorides, Phthalates.

5.2.1. Determination of Hazardous Characteristics of Wastes: Toxicity Characteristic Leaching Procedure (TCLP)

This method is based on USEPA Method 1311-Toxicity Characteristics Leaching Procedure (TCLP). This is applicable to the determination of mobility of metals and semi-volatile organic compound in solids. The principle involved in leaching procedure consists of 3 main steps:

Step I- Crushing/grinding: The solid sample has been passed through 9.5-mm sieve.

Step II- Determination of appropriate extraction fluid: Depending on the pH of the solid sample, one of two extraction fluids is used to extract the soil.

Step III- Extraction of solid sample: The solid sample is extracted (20:1 liquid to solid ratio) by shaking it end over end for 18 ± 2 hours at a controlled temperature at 30 rpm. The extract also known as the leachate is then filtered and analyzed for desired analytes. The moisture content of the solid sample is determined separately and reported alongwith the analytical results.

Preparation of Extraction Fluid No.1:

- 5.7 ml of glacial acetic acid added to 500 ml of double distilled water.
- Then 64.3 ml of 1 M NaOH added to above solution and diluted to 1 liter.
- The pH of this fluid maintained at 4.93 0.05.

Preparation of Extraction Fluid No.2:

- 5.7 ml of glacial acetic acid diluted to 1 liter.
- The pH of this fluid maintained 2.88 ± 0.05.

Note: The extraction fluids should be monitored frequently for impurities and the pH concentration and it may be discarded, if impurities found or pH is not within specifications.

Determination of Appropriate Extraction Fluid:

- 5.0 g (± 0.1 g) of the sample (<9.5 mm) transferred into a 500 ml beaker or Erlenmeyer flask. 96.5 ml of DDW added to the beaker and covered with a watch glass. It then stirred vigorously for 5 minutes using a magnetic stirrer.
- The pH solution measured and recorded.
- When the pH 5.0, extraction fluid No.1 used.
- When the pH > 5.0, added 3.5 ml 1 M HCl, covered with a watch glass, heated to 50°C±2 for 10 minutes. Solution allowed to cool at room temperature and then pH recorded. When the pH was 5, use extraction fluid No.1. Otherwise, use Extraction fluid No.2

Analysis of leachate:

The leachates have been prepared and analyzed as per standard guidelines.

5.2.2. Estimation of Heavy Metals:

200 ml of water sample or the TCLP extract of soil/plastic material were taken in conical flask, digested it for organic substances, if any, with 20 ml concentrated nitric acid in a fuming chamber. The digested samples were made upto 20 ml with 0.1 N HNO_3 and analyzed for Cd, Co, Cr, Cu, Pb, Mo, Ti and Zn with the help of Atomic Absorption Spectrophotometer (ZEEnit- 700) under following conditions are mentioned at **Table-4.**

Table:- 4

S. No	Metals	Lamp current (m A)	Wave length (nm)	Slit Width (nm)
1	Cd	6	228.8	0.2
2	Co	4	240.7	0.2
3	Cr	6	357.9	0.2
4	Cu	3	324.8	0.5
5	Pb	3	283.3	0.5
6	Mo	3	313.4	0.5
7	Ti	3	320.0	0.5
8	Zn	3	213.9	0.5

5.2.3. Estimation of Phthalates:

A 500 ml of water sample collected from each location or TCLP leachate was extracted three times using 30 ml of dichloromethane (HPLC grade) solvent in one litre separatory funnel each time. The micelle formation was suppressed by adding 10 ml of saturated sodium chloride solution during each operation. The organic layers were combined together and demoistered by passing through anhydrous granular sodium sulphate bed [EPA method-8060, Analysis of phthalate esters in water and waste water (1986); EPA method-3510, Separatory funnel liquid-liquid extraction (1986)]. Each sample was processed for column cleanup prior to analysis on HPLC. For proper cleanup, chromatographic column (300 mm length X 10 mm I.D.) was prepared by placing 10 g of activated Florisil on bed of Pyrex glass wool at the bottom. The column was tapped properly to settle the Florisil and further added 1 cm of anhydrous sodium sulfate to the top [EPA method-3620, Florisil column cleanup-1986]. Column was preluted with 40 ml n-Hexane (v/v). The compounds were eluted with 100 ml of 20% ethyl ether in hexane (v/v). The extract in hexane was concentrated under reduced pressure using rotary evaporator (Buchi, B 490). The exchange of solvent was done by replacing hexane with methanol (HPLC grade) and final volume was made up to 10 ml in volumetric flask.

The methodology was tested using water samples. Each sample was screened for 5 Phthalates viz. Di-methyl phthalate (DMP), Di-ethyl phthalate (DEP), Di-butyl phthalate (DBP), Di (2-ethylhexyl) phthalate (DEHP) and Di-octyl phthalate (DOP) by using HPLC under following conditions:

Equipment: HPLC, Water's make, pump-515; Column: RP, C-18; Temperature: 27° C.
Mobile phase: Methanol-water (90:10), Flow Rate 2 ml/rnin.
Detector: UV-VIS detector (Model 2487; Water's make), Wavelength: 254 nm.

To identify the chromatographic peaks, the five representative samples were analyzed on Gas chromatograph-Mass Spectrophotometer (GC-MS) using following conditions:

Equipment: GC-MS, Turbo Mass, Perkin Elmer, USA.
Column: DB-5ms low bleed (30X0.25 mm), Film thickness: 0.25 Om; Temperature programme: 1 min. hold at 70°C and raised the temperature up to 325°C @ 10^0 C/min.
Injector temperature: 250^0 C.
Mobile phase: Helium, Flow Rate 1.25 ml/min.
Ionization mode: El; Mass resolution (m/z): 30-550; Scan rate: 10/sec; Ionization energy: 70 eV; Detector: Mass; Source temperature: 280^0 C.

Schematic Flow-Diagram of Phthalate Extraction from Water Samples ITCLP Leachate

500 ml of sample was taken in a separating funnel

Add 20 ml of sodium chloride to the sample

Thenafter add 30 ml of dichloromethane to the sample

1.

Resulting sample was shaken vigorously for 5 min with periodic venting to release excess pressure

Stand and allowed the organic layer to separate from water phase for a minimum of 10 min.

Collected organic layer and pool in a separate conical flask

Repeat the extraction two more times using fresh portions of solvent in the same manner

Combined three solvent extracts and process it for column cleanup

Concentrated the extract (eluate) up to dryness on rotavapour

Final volume was made up to 10 ml with filtered methanol solution

Estimation of Phthalate using HPLC

Source: EPA method-3510, Separatory funnel liquid-liquid extraction; 1986.
EPA method-3620, Florisil column cleanup; 1986.

Schematic Flow-Diagram of Phthalate Extraction from Soil Samples

5 gm of dry sample was taken

Extracted using Soxhlet apparatus with the help of 1:1 Acetone/n- Hexane mixture for approx. 18 hours

Collect the extract and process it for column cleanup

Concentrate the extract (eluate) upto dryness on rotavapour

Made up the final volume upto 10 ml with filtered methanol solution

Estimation of Phthalate using HPLC

Source: EPA method-8060, Analysis of phthalate esters in water and waste water; 1986.

5.2.4. Estimation of Chloride in leachates

In the leachate (each 20 ml), add 3 drops of $K_2Cr_20_7$, stirred well and titrated against 0.014 $AgNO_3$. The formula used is as follows:

$$Cl\ mg/L = \frac{S-B) \times 0.5}{\text{ml of sample}} \times 1000$$

5.3 Sampling Conditions

5.3.1 Pre-monsoon Sampling

First phase of pre-monsoon sampling was conducted at four identified locations of Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow during April 12, 2009 to April 15, 2009 while second phase of pre-monsoon sampling was conducted at two identified locations of Municipal Solid Waste Dumpsite, Dudauli, Ghaila, Hardoi Road, Lucknow during May 04, 2009 to May 05, 2009. Conditions during sampling are given below.

Location I: Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow

Date	**Time**	**Site**	**Location of Drilling**	**Temperature**
12.04.09	6: 00 pm — 10: 30 pm	Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow	Point I	**36°±2** C
13.04.09	1:30 pm — 5:45 pm	Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow	Point II	**41° ±2** C
14.04.09	10:15 am — 12:15 pm	Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow	Point III	**42°** ±2 C
15.04.09	3:30 pm — 6: 45 pm	Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow	Point IV	**39°±2C**

Location II: Municipal Solid Waste Dumpsite, Ghaila, Hardoi Road, Lucknow

Date	**Time**	**Site**	**Location of Drilling**	**Temperature**
04.05.09	9: 00 am — 5: 00 pm	Municipal Solid Waste Dumpsite, Ghaila, Hardoi Road, Lucknow	Point I	**35°±2** C
05.05.09	8:30 am — 4:45 pm	Municipal Solid Waste Dumpsite, Ghaila, Hardoi Road, Lucknow	Point II	39°±2 C

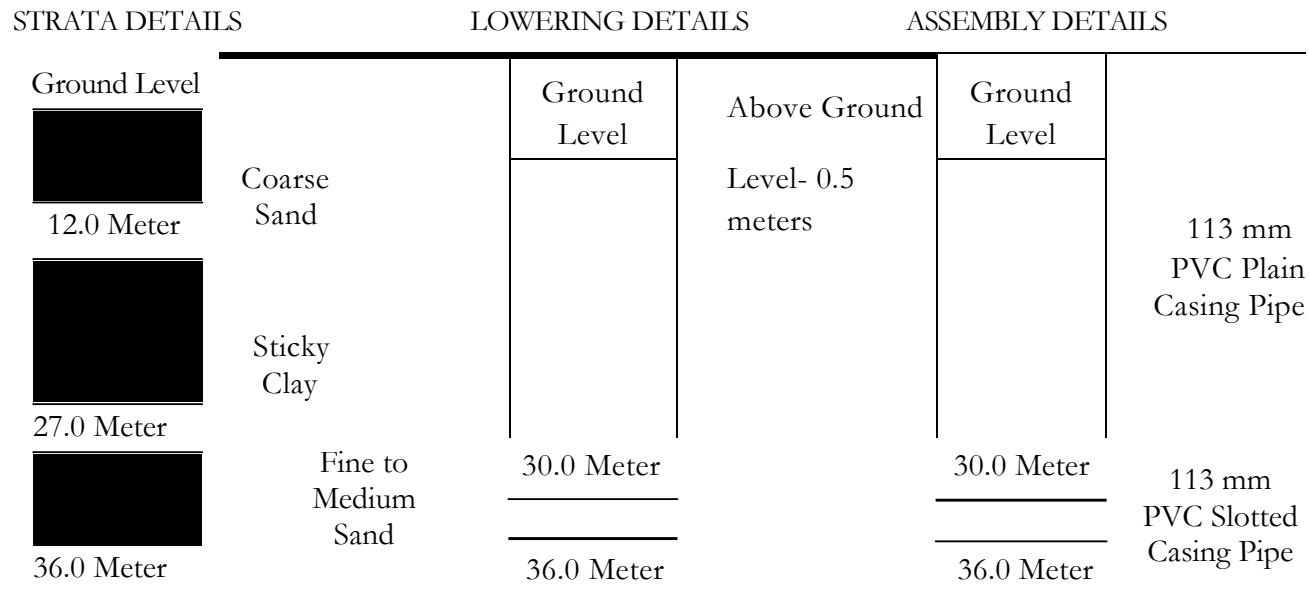
5.3.2 Post-monsoon Sampling

The proposed post-monsoon sampling was delayed for three months due to late monsoon conditions and prolonged water logging after heavy rains at Ghaila Municipal Solid Waste Dumpsite, Hardoi Road, Lucknow. Post-monsoon sampling was conducted at one identified location of Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow during September 28-30, 2009 while last phase of post-monsoon sampling was also conducted at one identified location of Municipal Solid Waste Dumpsite, Ghaila, Hardoi Road, Lucknow during December 9-10, 2009. Conditions during sampling are charted below.

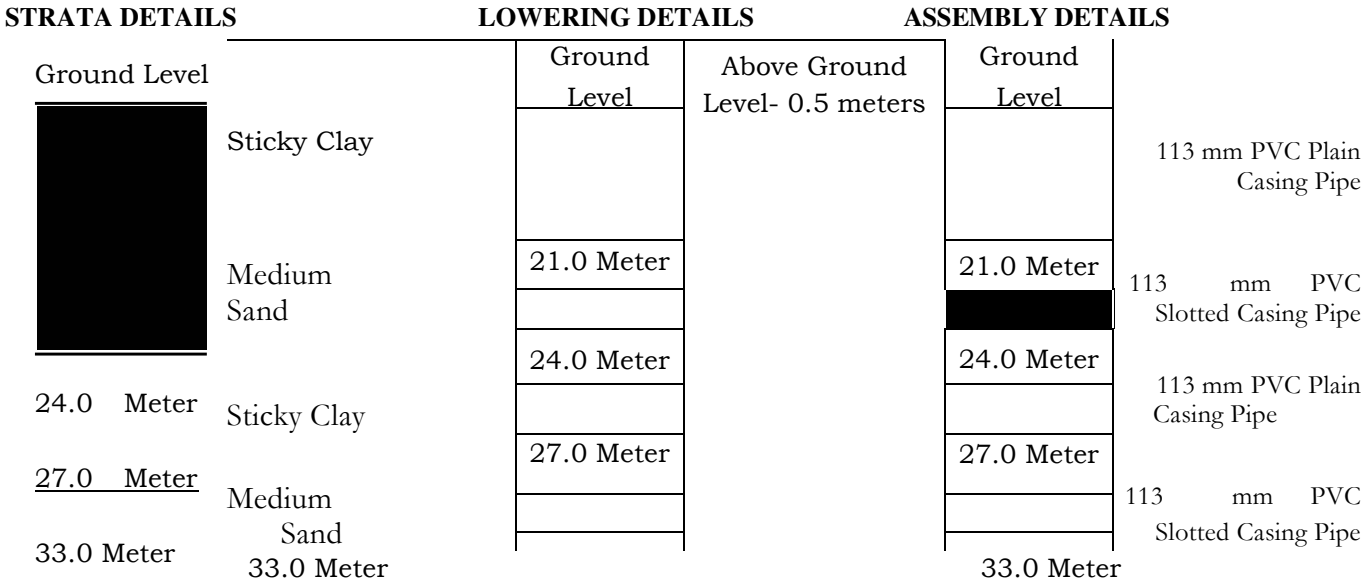
	Date	Time	Site	Location of Drilling	Temperature
Location I	29.10.09	10:00 am — 05: 30 pm	Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow	Point I	29°±2C
Location II	09.12.09	9:30 am — 5:30 pm	Municipal Solid Waste Dumpsite, Ghaila, Hardoi Road , Lucknow	Point II	26°±2C

5.4 Geo-physical and Drilling Features of Dumpsite Area:

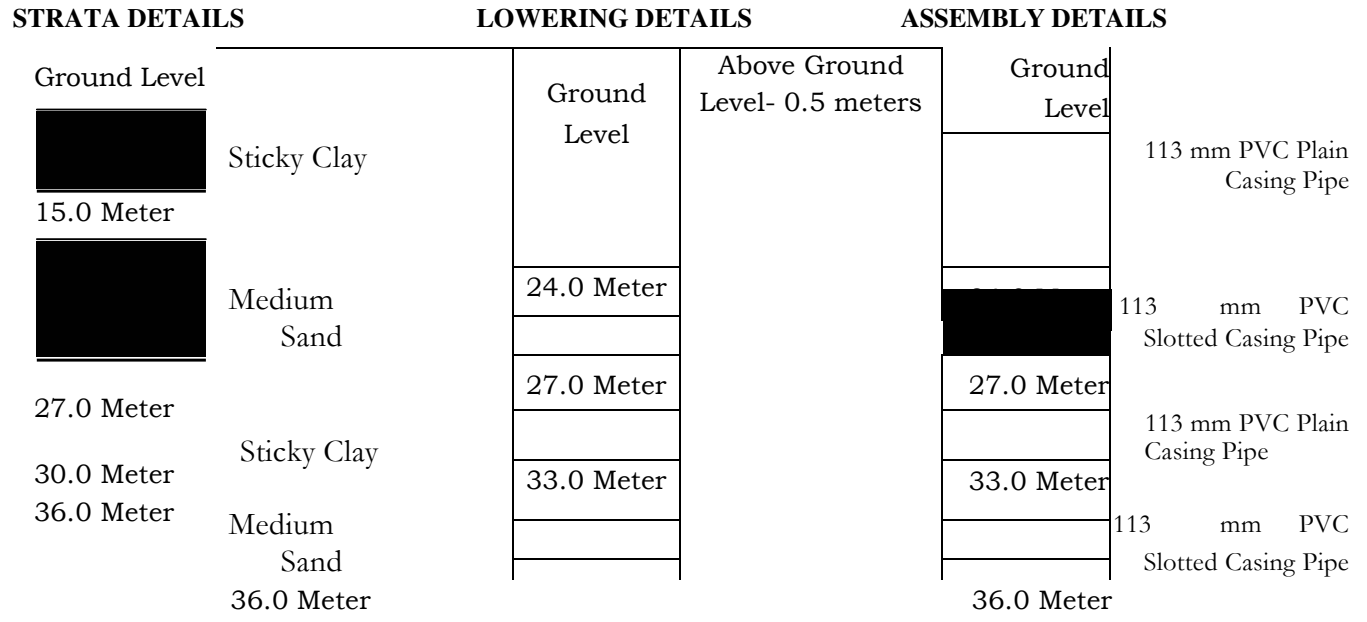
Strata Chart: Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow
Test Well No. 1 Static Water Level: 13.7 meter



Strata Chart: Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow
Test Well No. 2 Static Water Level: 10.70 meter

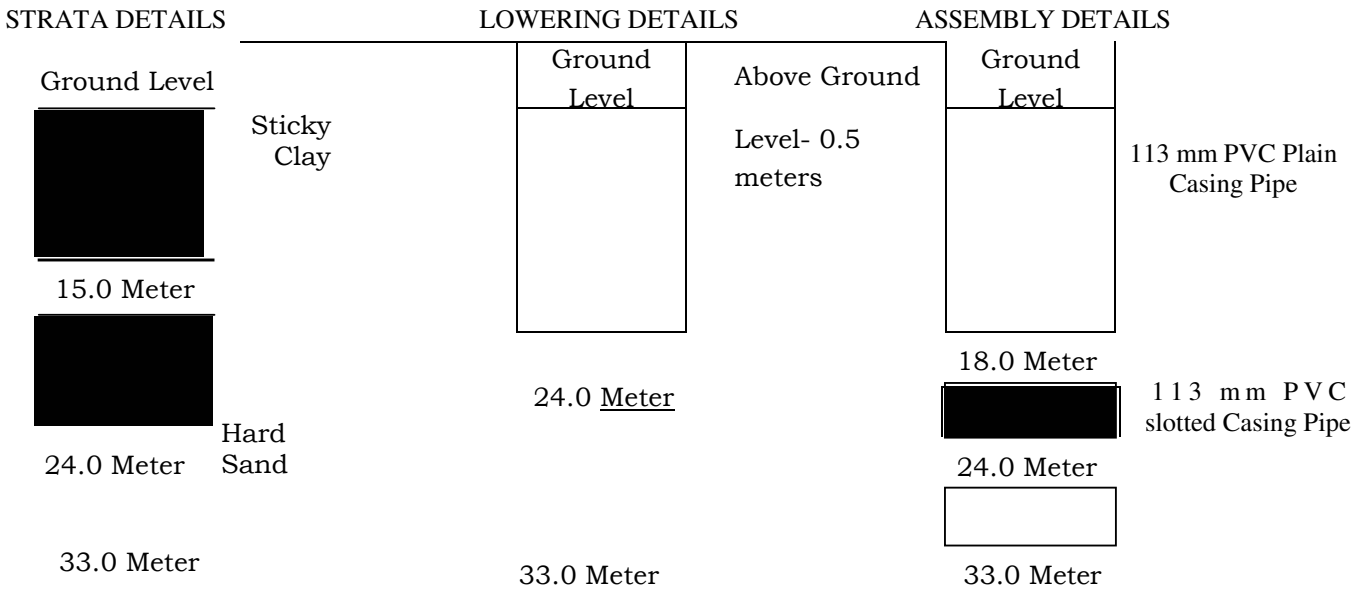


Strata Chart: Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow
Test Well No. 3 Static Water Level: 13.7 meter



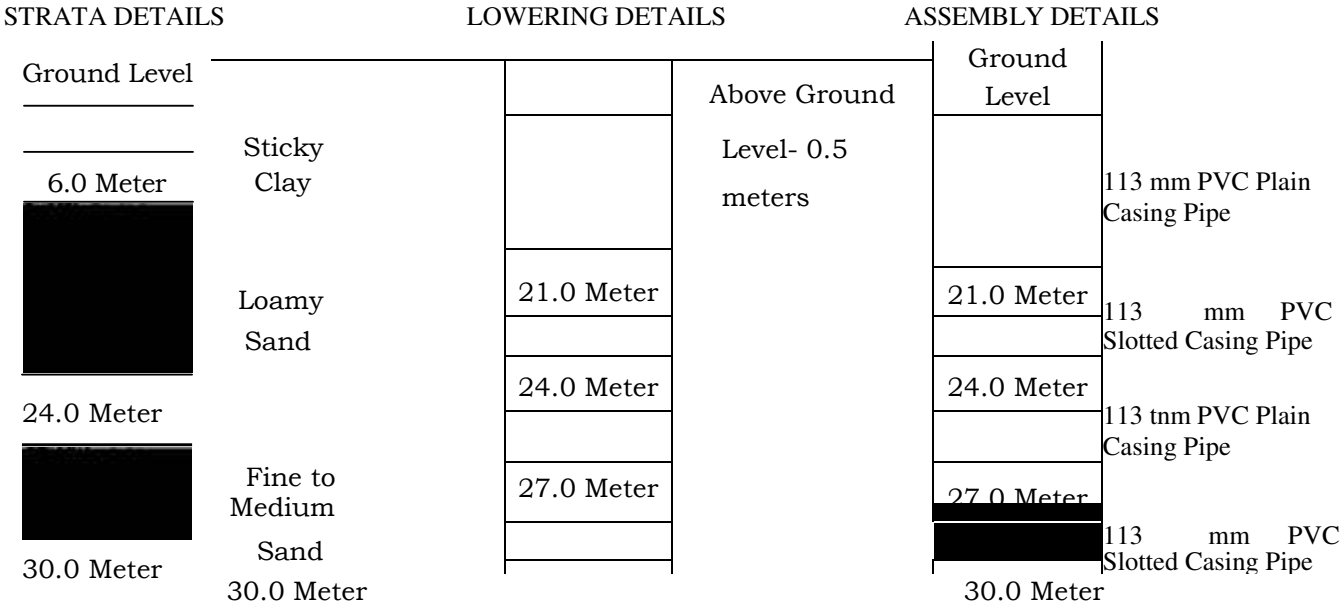
Strata Chart: Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow

Test Well No. 4 Static Water Level: 12.70 meter

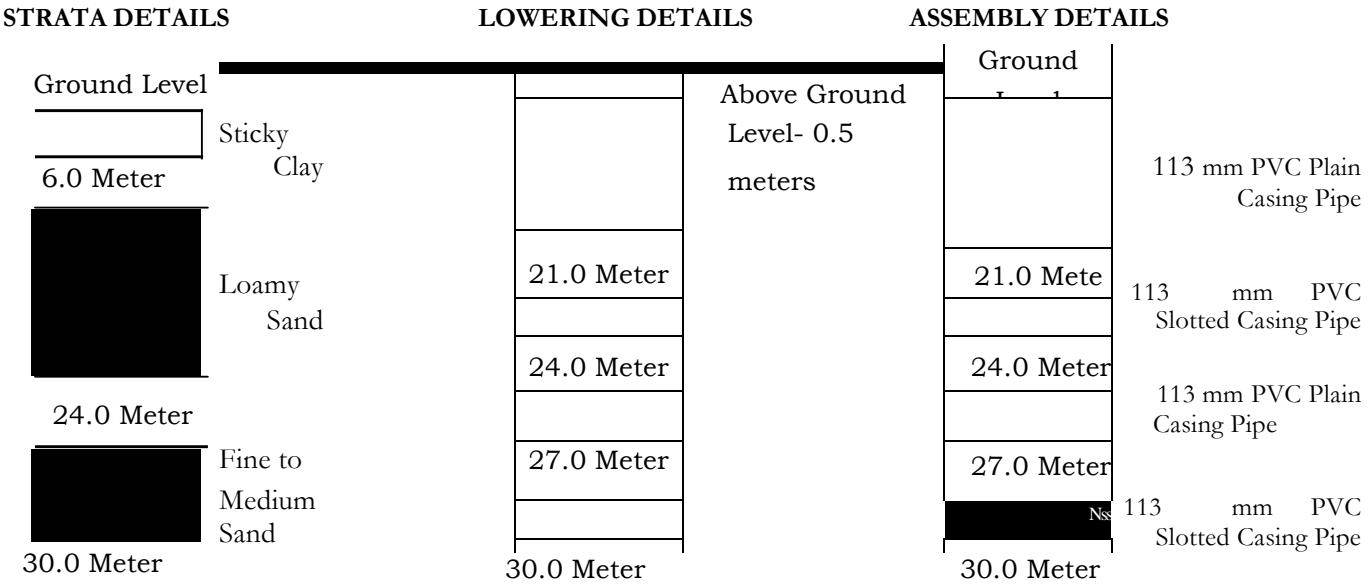


Strata Chart: Municipal Solid Waste Dumpsite, Ghaila, Hardoi Road, Lucknow

Test Well No. **1** Static Water Level: 10.70 meter



Strata Chart: Municipal Solid Waste Dumpsite, Ghaila, Hardoi Road, Lucknow
Test Well No. 2 Static Water Level: 10.70 meter



6. Sampling Details

6.1 List of Soil Samples

Sample Code	IITR Code No.	Texture	Depth	Sample Container	Date of Sampling	Remarks, if any
Point I,	Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road Lucknow (6: 00 pm — 10: 30					
1.	AS 01/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Medium sand	3.4 meter	Cloth	12.04.09	Pre-monsoon [Experimental]
2.	AS 021D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky clay	6.45 meter (3.05 meter)	Cloth	12.04.09	Pre-monsoon [Experimental]
3.	AS 03/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + Gravel	9.50 meter (3.05 meter)	Cloth	12.04.09	Pre-monsoon [Experimental]
4.	AS 04/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky clay + Gravel	12.50 meter (3.0 meter)	Cloth	12.04.09	Pre-monsoon [Experimental]
5.	AS 05/D/Soil/ IITR Dudauli, Sitapur Road, Lucknovt	Sticky clay + Gravel	15.50 meter (3.0 meter)	Cloth	12.04.09	Pre-monsoon [Experimental]

6.	AS 06/0/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy clay + Gravel	18.50 meter (3.0 meter)	Cloth	12.04.09	Pre-monsoon [Experimental]
7.	AS 07/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy clay + Gravel+ Sand	21.50 meter (3.0 meter)	Cloth	12.04.09	Pre-monsoon [Experimental]
8.	AS 08/D/So1l/ IITR Dudauli, Sitapur Road, Lucknow	Loamy clay + Gravel	24.50 meter (3.0 meter)	Plastic	12.04.09	Pre-monsoon [Experimental]
9.	AS 09/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy clay + Gravel	27.50 meter (3.0 meter)	Plastic	12.04.09	Pre-monsoon [Experimental]
10.	AS 10/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy clay + Gravel	30.50 meter (3.0 meter)	Plastic	12.04.09	Pre-monsoon [Experimental]
11.	AS 11/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + Sand	33.50 meter (3.0 meter)	Cloth	12.04.09	Pre-monsoon [Experimental]
12.	AS 12/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sand	36.50 meter (3.0 meter)	Cloth	12.04.09	Pre-monsoon [Experimental]
Point II, Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow (1:30 pm - 5:45 pm)						
13.	AS 13/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky clay+ small gravels	3.4 meter	Cloth	13.04.09	Pre-monsoon [Experimental]
14.	AS 14/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky clay+ small gravels	6.45 meter (3.05 meter)	Cloth	13.04.09	Pre-monsoon [Experimental]
15.	AS 15/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky clay	9.50 meter (3.05 meter)	Cloth	13.04.09	Pre-monsoon [Experimental]
16.	AS 16/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky clay	12.50 meter (3.0 meter)	Cloth	13.04.09	Pre-monsoon [Experimental]

17.	AS 17/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky clay	15.50 meter (3.0 meter)	Cloth	13.04.09	Pre-monsoon [Experimental]
18.	AS 18/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sand + Gravel	18.50 meter (3.0 meter)	Cloth	13.04.09	Pre-monsoon [Experimental]
19.	AS 19/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand	21.50 meter (3.0 meter)	Cloth	13.04.09	Pre-monsoon [Experimental]
20.	AS 20/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand	24.50 meter (3.0 meter)	Cloth	13.04.09	Pre-monsoon [Experimental]
21.	AS 21/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand	27.50 meter (3.0 meter)	Cloth	13.04.09	Pre-monsoon [Experimental]
22.	AS 22/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sand	30.50 meter (3.0 meter)	Cloth	13.04.09	Pre-monsoon [Experimental]
23.	AS 23/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sand	33.50 meter (3.0 meter)	Cloth	13.04.09	Pre-monsoon [Experimental]
Point II, Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow (10:15 am - 12:15 Pm)						
24.	AS 24/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand	3.4 meter	Cloth	14.04.09	Pre-mansoon [Experimental]
25.	AS 25/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand + gravel	6.45 meter (3.05 meter)	Cloth	14.04.09	Pre-mansoon [Experimental]
26.	AS 26/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + garvel	9.50 meter (3.05 m)	Cloth	14.04.09	Pre-monsoon [Experimental]
27.	AS 27/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + garvel	12.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]

28.	AS 28/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + garvel	15.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
29.	AS 29/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + garvel	18.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
30.	AS 30/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand	21.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
31.	AS 31/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand	24.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
32.	AS 32/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand	27.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
33.	AS 33/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand	30.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
34.	AS 34/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sand	33.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
35.	AS 35/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sand	36.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
Point IV, Municipal Solid Waste Dumpsite, Dudaul", Sitapur Road, Lucknow (3:30 pm- 6: 45 pm)						
36.	AS 36/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + Mud	3.4 meter	Cloth	14.04.09	Pre-monsoon [Experimental]
37.	AS 37/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + Mud	6.45 meter (3.05 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
38.	AS 38/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + Gravel	9.50 meter (3.05 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]

39.	AS 39/D/Soil/IITR Dudauli, Sitapur Road, Lucknow	Clay + Gravel	12.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
40.	AS 40/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + Gravel	15.50 meter (3.0 meter)	Cloth		Pre-monsoon [Experimental]
41.	AS 41/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand	18.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
42.	AS 42/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy Sand	21.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
43.	AS 43/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky Clay	24.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
44.	AS 44/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + sand + Gravel	27.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
45.	AS 45/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sand	30.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
46.	AS 46/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sand	33.50 meter (3.0 meter)	Cloth	14.04.09	Pre-monsoon [Experimental]
Point I, Municipal Solid Waste Dumpsite, Ghaila, Hardoi Road, Lucknow (10:30 am- 4: 45 pm)						
47.	AS 47/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Sticky clay	3.4 meter	Cloth	04.05.09	Pre-monsoon [Experimental]
48.	AS 48/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	6.45 meter (3.05 meter)	Cloth	04.05.09	Pre-monsoon [Experimental]
49.	AS 49/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	9.50 meter (3.05 meter)	Cloth	04.05.09	Pre-monsoon [Experimental]

50.	AS 50/G/Soil/IITR, Ghaila, Hardoi Road, Lucknow	Lomy Sand	12.50 meter (3.0 meter)	Cloth	04.05.09	Pre-monsoon [Experimental]
51.	AS 51/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	15.50 meter (3.0 meter)	Cloth	04.05.09	Pre-monsoon [Experimental
52.	AS 52/G/Soil/ IITR, Ghaila, Hardoi Road, Luthnow	Loamy Sand	18.50 meter (3.0 meter)	Cloth	04.05.09	Pre-monsoon [Experimental]
53.	AS 53/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	21.50 meter (3.0 meter)	Cloth	04.05.09	Pre-monsoon [Experimental]
54.	AS 54/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	24.50 meter (3.0 meter)	Cloth	04.05.09	Pre-monsoon [Experimental]]
55.	AS 55/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Sand	27.50 meter (3.0 meter)	Cloth	04.05.09	Pre-monsoon [Experimental]
56.	AS 56/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Sand	30.50 meter (3.0 meter)	Cloth	04.05.09	Pre-monsoon [Experimental]
Point II, Municipal Solid Waste Dumpsite, Ghila, Hardoi Road, Lucknow (8:30 am- 11:30am)						
57.	AS 57/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Sticky clay	3.4 meter	Cloth	05.05.09	Pre-monsoon [Experimental]
58.	AS 58/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Sticky clay	6.45 meter (3.05 meter)	Cloth	05.05.09	Pre-monsoon [Experimental]
59.	AS 59/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	9.50 meter (3.05 meter)	Cloth	05.05.09	Pre-monsoon [Experimental]
60.	AS 60/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	12.50 meter (3.0 meter)	Cloth	05.05.09	Pre-monsoon [Experimental]
61.	AS 61/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	15.50 meter (3.0 meter)	Cloth	05.05.09	Pre-monsoon [Experimental]
62.	AS 62/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	18.50 meter (3.0 meter)	Cloth	05.05.09	Pre-monsoon [Experimental]

63.	AS 63/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	21.50 meter (3.0 meter)	Cloth	05.05.09	Pre-monsoon [Experimental]
64.	AS 641G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy Sand	24.50 meter (3.0 meter)	Cloth	05.05.09	Pre-monsoon [Experimental]
65.	AS 65/G/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Sand	27.50 meter (3.0 meter)	Cloth	05.05.09	Pre-monsoon [Experimental]
66.	AS 66/0/Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Sand	30.50 meter (3.0 meter)	Cloth	04.05.09	Pre-monsoon [Experimental]
67.	AS 67/C/Soil/ IITR, Sitapur Road (FaizullaGanj, near old Kisan Mandi), Lucknow	Clay + gravel	5 cm below from upper layer	Cloth	07.08.08	Pre-monsoon [Control]
68.	AS 68/ C /Soil/ IITR, Ghaila, Hardoi Road, Lucknow	Loamy clay	5 cm below from upper layer	Cloth	07.08.08	Pre-monsoon [Control]
69.	AS 69/ C /Soil/ IITR, Ghaila, Hardoi Road (Near temple, opposite to dumpsite), Lucknow	Rough clay	5 cm below from upper layer	Cloth	07.08.08	Pre-monsoon [Control]
70.	AS 70/ C /Soil/ IITR, Jiamau, Lucknow	Rough clay	5 cm below from upper layer	Cloth	07.08.08	Pre-monsoon [Control]
71.	AS 71/ C /Soil/ IITR, Jiamau, Lucknow	Loamy clay	5 cm below from upper layer	Cloth	07.08.08	Pre-monsoon [Control]
72.	AS 72/ C /Soil/ IITR, Manas Nagar, Jiamau, Lucknow	Rough clay	5 cm below from upper layer	Cloth	06.11.08	Pre-monsoon [Control]
73.	AS 73/ C /Soil/ IITR, RamaBai Sthali, Ashiana Lucknow	Rough clay	5 cm below from upper layer	Cloth	06.11.08	Pre-monsoon [Control]
74.	AS 74/ C /Soil/ IITR, Kila Mohannmadi Nagar, Smriti Park, Ashiana, Lucknow	Rough clay	5 cm below from upper layer	Cloth	06.11.08	Pre-monsoon [Control]
75.	AS 75/ C /Soil/ IITR, B Block, Indira Nagar, Lucknow	Rough clay	5 cm below from upper layer	Cloth	06.11.08	Pre-monsoon [Control]
76.	AS 76/ C /Soil/ IITR, C Block, Lucknow	Rough clay	5 cm below from upper layer	Cloth	06.11.08	Pre-monsoon [Control]
77.	AS 77/ C /Soil/ IITR, Gheru Soil, Lucknow	Rough clay	5 cm below from upper layer	Cloth	3.12.08	Pre-monsoon [Control]

78.	AS 78/C /Soil/ IITR, Alambagh, Lucknow	Rough clay	5 cm below from upper layer	Cloth	3.12.08	Pre-monsoon [Control]
79.	AS 79/ C /Soil/ IITR, IITR Gate, Lucknow	Rough clay	5 cm below from upper layer	Cloth	06.01.09	Pre-monsoon [Control]
80.	AS 80/ C /Soil/ IITR, IITR Gate, Lucknow	Rough clay	5 cm below from upper layer	Cloth	06.08.09	Pre-monsoon [Control]
81.	AS 81/ C /Soil/ IITR, Sitapur Road (FaizullaGanj, near old Kisan Mandi), Lucknow	Rough clay	5 cm below from upper layer	Cloth	29.10.09	Post-monsoon [Control]
82.	AS 82/ C /Soil/ IITR, Kila Mall Ghaila, Lucknow	Rough clay	5 cm below from upper layer	Cloth	29.10.09	Post-monsoon [Control]
83.	AS 83/ C /Soil/ IITR, Ghaila, Hardoi Road (Near temple, opposite to dumpsite), Lucknow	Rough clay	5 cm below from upper layer	Cloth	29.10.09	Post-monsoon [Control]
84.	AS 84/ C /SoiV IITR, Jiamau, Lucknow	Rough clay	5 cm below from upper layer	Cloth	30.10.09	Post-monsoon [Control]
85.	AS 85/ C /Soil/ IITR, Jiamau, Lucknow	Rough clay	5 cm below from upper layer	Cloth	30.10.09	Post-monsoon [Control]
86.	AS 86/ C /Soil/ IITR, Manas Nagar, Lucknow	Rough clay	5 cm below from upper layer	Cloth	30.10.09	Post-monsoon [Control]
87.	AS 87/ C /Soil/ IITR, RamaBai Sthali, Ashiana	Rough clay	5 cm below from upper layer	Cloth	30.10.09	Post-monsoon [Control]
88.	AS 88/ C /Soil/ IITR, IITR Gate, Lucknow	Rough clay	5 cm below from upper layer	Cloth	30.10.09	Post-monsoon [Control]

Sample Code	IITR Code No.	Texture	Depth	Sample Container	Date of Sampling	Remarks, if any
Point I – Municipal Solid Waste Dumpsite Dudauli, Sitapur Road, Lucknow (9:00 am -12:00 pm)						
	AS 89/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Medium sand	3.4 meter	Cloth	29.10.09	Post-monsoon [Experimental]
90.	AS 901D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky clay	6.45 meter (3.05 meter)	Cloth	29.10.09	Post-monsoon [Experimental]
91.	AS 91/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + Gravel	9.50 meter (3.05 meter)	Cloth	29.10.09	Post-monsoon [Experimental]
92.	AS 92/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky clay + Gravel	12.50 meter (3.0 meter)	Cloth	29.10.09	Post-monsoon [Experimental]
93.	AS 93/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sticky clay + Gravel	15.50 meter (3.0 meter)	Cloth	29.10.09	Post-monsoon [Experimental]
94.	AS 94/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy clay + Gravel	18.50 meter (3.0 meter)	Cloth	29.10.09	Post-monsoon [Experimental]
95.	AS 951D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy clay + Gravel+ Sand	21.50 meter (3.0 meter)	Cloth	29.10.09	Post-monsoon [Experimental]
96.	AS 96/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy clay + Gravel	24.50 meter (3.0 meter)	Cloth	29.10.09	Post-monsoon [Experimental]
97.	AS 97/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy clay + Gravel	27.50 meter (3.0 meter)	Cloth	29.10.09	Post-monsoon [Experimental]
98.	AS 98/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Loamy clay + Gravel	30.50 meter (3.0 meter)	Cloth	29.10.09	Post-monsoon [Experimental]
99.	AS 991D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Clay + Sand	33.50 meter (3.0 meter)	Cloth	29.10.09	Post-monsoon [Experimental]
100.	AS 100/D/Soil/ IITR Dudauli, Sitapur Road, Lucknow	Sand	36.50 meter (3.0 meter)	Cloth	29.10.09	Post-monsoon [Experimental]

Sample code	IITR Code No.	Texture	Depth	Sample Container	Date of Sampling	Remarks, if any
Point I Municipal Solid Waste Dumpsite, Ghaila, Hardoi, Lucknow (9:00 am -5:00 pm)						
101.	AS 101/0/Soil/ IITR Ghaila, Hardoi Road , Lucknow	Sticky Clay	3.4 meter	Cloth	09.12.09	Postmonsoon [Experiment]
102.	AS 102/0/Soil/ IITR Ghaila, Hardoi Road , Lucknow	Loamy Sand	6.45 meter (3.05 meter)	Cloth	09.12.09	Postmonsoon [Experiment]
103.	AS 103/ G /Soil/ IITR Ghaila, Hardoi Road, Lucknow	Loamy Sand	9.50 meter (3.05 meter)	Cloth	09.12.09	Postmonsoon [Experimental]
104.	AS 104/C /Soil/ IITR Ghaila, Hardoi Road, Lucknow	Loamy Sand	12.50 meter (3.0 meter)	Cloth	09.12.09	Postmonsoon [Experimental]
105.	AS 105/ G /Soil/ IITR Ghaila, Hardoi Road, Lucknow	Loamy Sand	15.50 meter (3.0 meter)	Cloth	09.12.09	Postmonsoon [Experimental]
106.	AS 106/ G /Soil/ IITR Ghaila, Hardoi Road, Lucknow	Loamy Sand	18.50 meter (3.0 meter)	Cloth	09.12.09	Postmonsoon [Experimental]
107.	AS 107/ G /Soil/ IITR Ghaila, Hardoi Road, Lucknow	Loamy Sand	21.50 meter (3.0 meter)	Cloth	09.12.09	Postmonsoon [Experimental]
108.	AS 108/ G /Soil/ IITR Ghaila, Hardoi Road, Lucknow	Loamy Sand	24.50 meter (3.0 Meter)	Cloth	09.12.09	Postmonsoon [Experimental]
109.	AS 109/C /Soil/ IITR Ghaila, Hardoi Road, Lucknow	Sand	27.50 meter (3.0 meter)	Cloth	90.12.09	Postmonsoon [experimental]
110.	AS 110/ G /Soil/ IITR Ghaila, Hardoi Road, Lucknow	Sand	30.50 meter (3.0 meter)	Cloth	09.12.09	Postmonsoon [Experimental]

6.2 List of Water Samples

Sample Code	IITR Code No.	Depth	Sample Container	Date of Sampling	Remarks, if any
Pre-monsoon Experimental Water Samples (collected from MSW dumpsite)					
Point I, Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow (6:30 am— 7:45 am)					
1.	AS 01/D/Water/ IITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	17.04.09	Premonsoon [Experiment all
2.	AS 02/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	17.04.09	Premonsoon [Experiment all
3.	AS 03/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	17.04.09	Premonsoon [Experiment al]
Point II, Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow (3:00 pm-4:45pm)					
4.	AS 04/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	15.04.09	Premonsoon [Experiment al]
5.	AS 05/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	15.04.09	Premonsoon [Experiment al]
6.	AS 06/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	15.04.09	Premonsoon [Experiment al]
Point III, Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow (11:00am-1:45pm)					
7.	AS 07/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	15.04.09	Premonsoon [Experiment all

8.	AS 08/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	15.04.09	Premonsoon [Experiment all
9.	AS 09/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	15.04.09	Premonsoon [Experiment al]
Point IV, Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow (8:30 am- 10: 15 am)					
10.	AS 10/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	17.04.09	Premonsoon [Experiment al]
11.	AS 11/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	17.04.09	Premonsoon [Experiment al]
12.	AS 12/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	17.04.09	Premonsoon [Experiment al]

Sample Code	**IITR Code No.**	**Depth**	**Sample Container**	**Date of Sampling**	**Remarks, if any**
Point V, Municipal Solid Waste Dumpsite, Ghaila Hardoi Road, Lucknow (10:30 am—3: 30 pm)					
13.	AS 13/GNVater/ IITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	04.05.09	Premonsoon [Experiment al]
14.	AS 14/G/ Water / IITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	04.05.09	Premonsoon [Experiment al]
15.	AS 15/G/ Water / IITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	04.05.09	Premonsoon [Experiment al]

Point VI, Municipal Solid Waste Dumpsite, Ghaila, Hardoi Road, Lucknow (8:00am-11:45am)					
16.	AS 16/G/ Water / IITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	06.05.09	Premonsoon [Experiment al]
17.	AS 17/G/ Water / IITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	06.05.09	Premonsoon [Experiment al]
18.	AS 18/G/ Water / I ITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	06.05.09	Premonsoon [Experiment al]
Pre-monsoon Control Water Samples					
19.	AS 19/C/Water/ IITR HP Water, Dudauli, Sitapur Road, Lucknow	Hand Pump	Glass Bottle	04.05.09	Pre- monsoon [Control]
20.	AS 20/C/ Water / IITR Ghaila, Hardoi Road, Lucknow	Hand Pump	Glass Bottle	07.08.08	Premonsoon [Control]
21.	AS 21/C/ Water / IITR IITR, Main Campus, Lucknow	Tap Water	Glass Bottle	10.01.09	Premonsoon [Control]
22.	AS 22/C/ Ghaila Tube well water,, Hardoi Road, Lko	Tube well water	Glass Bottle	04.05.09	Pre- monsoon [Control]
23.	AS 23/C/ Water / IITR Ghaila Pond water,, Hardoi Road, Lko	Pond Water	Glass Bottle	05.05.09	Premonsoon [Control]
24.	AS 24/C/ Water / IITR Dudauli Tube well water, Sitapur Road, Lko	Tube well water	Glass Bottle	21.04.09	Premonsoon [Control]

Sample Code	IITR Code No.	Depth	Sample Container	Date of Sampling	Remarks, if any
Post-monsoon Experimental Water Samples (collected from MSW dumpsite)					
Point I, Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow (6:30 am— 7: 45 am)					
25.	AS 25/D/Water/ IITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
26.	AS 26/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
27.	AS 27/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]

Point II Municipal Solid Waste Dumpsite Dudauli, Sitapur Road, Lucknow (3:00 pm— 4: 45 pm)					
28.	AS 28D/ Water / IITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
29.	AS 29/D/ Water / IITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
30.	AS 30/D/ Water! I ITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
Point III, Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow (11:00 am— 1: 45 pm)					
31.	AS 31/D/ Water / I ITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
32.	AS 32/D/ Water! I ITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
33.	AS 33/D/ Water / I ITR Dudauli, Sitapur Road, Lucknow	36.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
Point IV, Municipal Solid Waste Dumpsite, Dudauli, Sitapur Road, Lucknow (8:30 am— 10: 15 am)					
34.	AS 34D/ Water! IITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
35.	AS 35/D/ Water / I ITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
36.	AS 36/D/ Water! I ITR Dudauli, Sitapur Road, Lucknow	33.50 meter	Glass Bottle	30.10.09	Post-monsoon [Experimental]
Sample Code	IITR Code **No.**	Depth	Sample Container	Date of Sampling	Remarks, if any
Point V Municipal Solid Waste Dumpsite Ghaila, Hardoi Road, Lucknow (10:30 am— 3: 30 pm)					
37.	AS 37/G/VVater/ IITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	10.12.09	Post-monsoon [Experimental]
38.	AS 38/G/ Water / IITR Ghaila, Hardoi Road, Lucknow	30. 85 meter	Glass Bottle	10.12.09	Post-monsoon [ExRerimental]

39.	AS 39/G/ Water / IITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	10.12.09	Post-monsoon [Experimental]
Point VI, Municipal Solid Waste Dumpsite, Ghaila, Hardoi Road, Lucknow (9:00am-10:45am)					
40.	AS 40/G/ Water / I ITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	10.12.09	Post-monsoon [Experimental]
41.	AS 41/G/ Water / IITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	10.12.09	Post-monsoon [Experimental]
42.	AS 42/G/ Water / IITR Ghaila, Hardoi Road, Lucknow	30.85 meter	Glass Bottle	10.12.09	Post-monsoon [Experimental]
Post-monsoon Control Water Samples					
43.	AS 43/C/VVater/ IITR HP Water, Dudauli, Sitapur Road, Lucknow	Hand Pump	Glass Bottle	30.10.09	Post-monsoon [Control]
44.	AS 44/C/ Water / I ITR Ghaila, Hardoi Road, Lucknow	Hand Pump	Glass Bottle	30.10.09	Post-monsoon [Control]
45.	AS 45/C/ Water / I ITR IITR, Main Campus, Lucknow	Tap Water	Glass Bottle	30.10.09	Post-monsoon [Control]
46.	AS 46/C/ Ghaila Tube well water, Hardoi Road, Lko	Tube well water	Glass Bottle	30.10.09	Post-monsoon [Control]
47.	AS 47/C/ Water / I ITR Ghaila Pond water,, Hardoi Road, Lko	Pond Water	Glass Bottle	30.10.09	Post-monsoon [Control]
48.	AS 48/C/ Water / I ITR Dudauli Tube well water, Sitapur Road, Lko	Tube well water	Glass Bottle	30.10.09	Post-monsoon [Control]

7. Analysis of soil & water samples:

7.1 Physio-chemical Parameters of Soil;

(Soil pH is a measurement of the soil acidity (pH<7) or soil alkalinity (pH>7). Soil solutions were extracted from the dumpsite as well as control soil by **lysimetric method** for determination of pH. The data obtained are presented in Figure 1. Observations reveaied that **the pH of dumpsite soil samples** collected in **post monsoon season was comparatively more basic than the pre monsoon** sampleThe similar trend was also observed in control soil samples. All the samples have pH>7 indicating occurrence of alkaline soil. It may be due to poor soil texture of sampling point 1-4, and upper soil portion of sampling point 5-6 which have thick hard calcareous (kankar) layers of low infiltration capacity in their soil profile. Such soil becomes alkaline due to presence of carbonates and bicarbonates of calcium, magnesium, sodium, and potassium held by soil colloids. During post-monsoon season, high rainfall occurred at both sampling location at **dumped waste containing high plastic contents** as well **as hard soil profile of low infiltration capacity caused water logging** at Ghaila dumpsite area. The irrigated water contained lime which might precipitated in the upper regions of dumpsite area nearest the water delivery inlets and in the water flow path. Due to prolonged water logging it has resulted into higher alkalinity of soil and pH levels rising to 7.0 and above until equilibrium is reached with atmospheric carbon dioxide levels. Such increase in soil pH occurs more rapidly on coarse and medium-textured soils than on clays which are more highly buffered. Higher pH values of soil may be due to above factors at Dudauli dumpsite and Locations 5 and 6 of Ghaila dumpsite area.

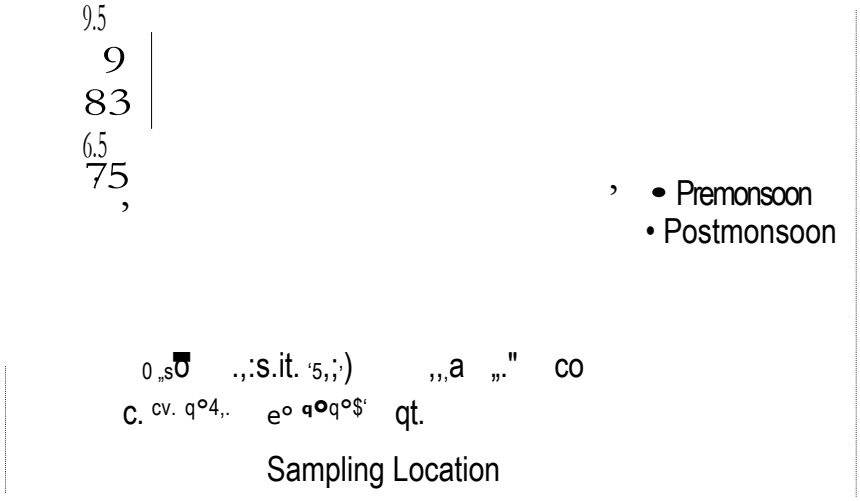


Fig. 1: Mean pH of collected soil samples of each sampling location in different monsoon seasons

7.2 Chemical Property of Soil Samples

Assessment of soil quality with respect to its chemical composition was also done by evaluating essential mineral level viz, available phosphorous as phosphate (in kg/ha), available potassium (in kg/ha), available nitrogen (in kg/ha) and chloride level (mg/kg). The data obtained are presented in **figure 2-5** revealed that control and dumpsite soil samples collected after rainfall (post monsoon samples) were comparatively found to be more enriched with essential minerals/ions. Availability of phosphorous and potassium was found to be higher in control soil samples than dumpsite samples indicating the depletion of nutritional quality of dumpsite soil due to dumping of municipal solid was, However, higher concentration of nitrogen and chloride ion was found throughout the soil profile of dumpsite area. The probable reason may be decomposition of landfilled/dumped waste under environmental conditions leading to formation of different characteristic chemical moieties viz, nitrogen, methane, chloride, phosphate etc. Such species were prominently found in higher concentration at Dudauli Municipal Solid Waste dumpsite area in comparison to Ghaila Municipal Solid Waste dumpsite because of high load of dumped waste in larger area at Dudauli dumpsite. It is worth to mention that significant amount of analytes were found throughout different soil layers and levels were comparatively higher in post monsoon season, specially in case of Ghaila dumpsite samples, indicating constant percolation of such analytes in the soil profile.

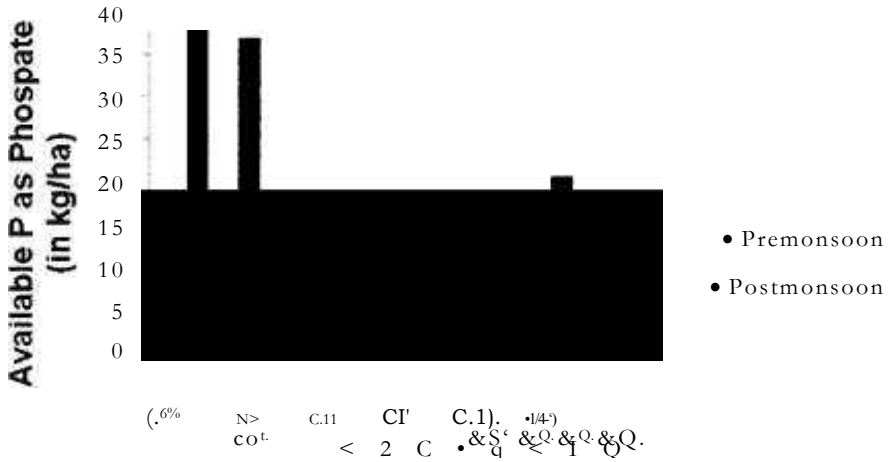


Fig 2: Mean Concentration of Available Phosphorous (P) as Phosphate in Collected Soil Samples of each Sampling location in different Monsoon Seasons

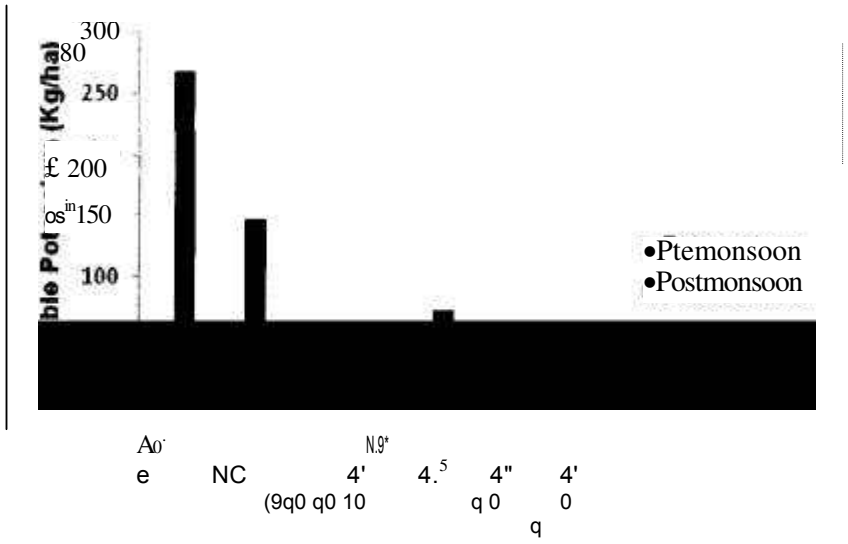


Fig 3: Mean concentration of available potassium in collected soil samples of each sampling location in different monsoon seasons

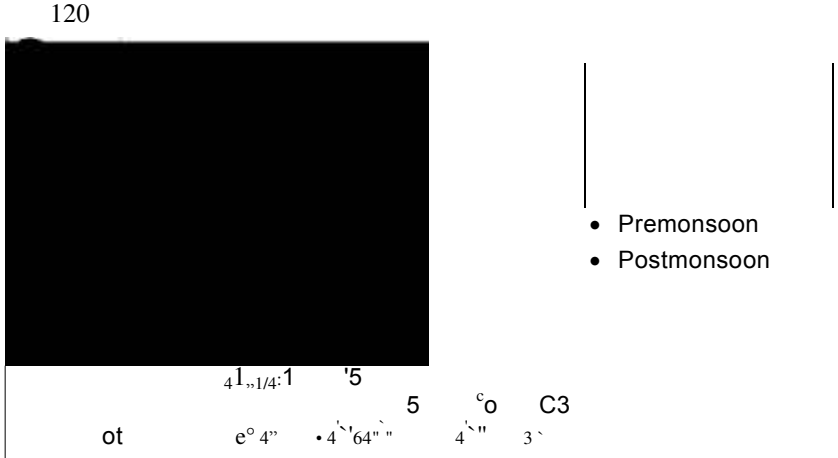


Fig 4: Mean values of available nitrogen in collected soil samples of each sampling location in different monsoon seasons

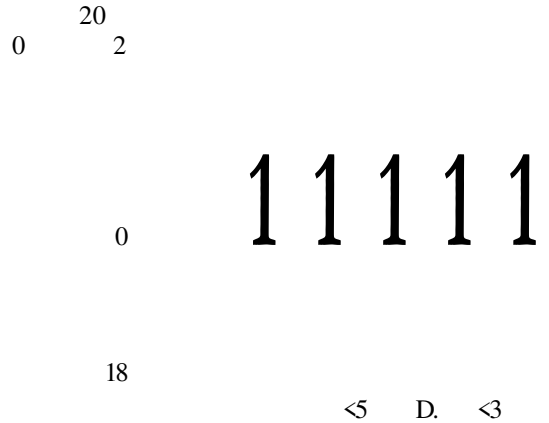


Fig 5: Samples of each sampling location in different monsoon seasons

7.3 Heavy Metals and Organic Contaminants in Soil Samples:

Heavy metals viz Cd,Co,Cr, Cu, Pb, Mo, Ti and Zn were analyzed in all control soil (22 nos.) samples (14 pre monsoon + 08 post monsoon) and experimental/dumpsite soil (88 nos.) samples (66 pre-monsoon + 22 Post monsoon). In addition level of phthalates viz. Di-methyl phthalate (DMP), Diethylphthalate (DEP), Di-butyl phthalate (DBP), Di (2-ethylhexyl) phthalate (DEHP) and Di-octyl phthalate (DOP) were also determined in leachates (TCLP) of soil samples. Data revealed that Ghaila Landfill site having coarse or sandy texture of soil have greater contamination of inorganic and organic moieties throughout soil profile and in deep aquifers because rain water leachates containing pool of contaminants may easily percolate throughi)On the other hand, impact of pollutants appeared more on upper strata soil and side streams at Dudauli waste dumpsite having clay, gravels or rocky soil texture. In addition, seasonal fluctuations also dominates on the quality and quantity of landfill leachate produced. During the wet season period (post monsoon), low-strength leachate may suppose to generate, while during the dry season period (pre monsoon), reduced percolation and enhanced evaporation increase the leachate strength.

Soils have property to bind various chemicals and it depends on the form in which they exist in the environment. It consists of mineral particles, organic matter and organic-mineral particles. They play important role in giving the soil's ability to absorb exchange, oxidize, reduce, catalyze and precipitate chemical and metal ions in particular. The inorganic colloidal fraction of soil is the most responsible for absorption by its mineral particles. Its large surface area and porosity makes it good absorber of organic and inorganic materials. Organic and inorganic moieties physically adsorb on soil surface instead of being chemically absorb. Due to variation in pH, temperature, weathering or flow of water from refusal tips such contaminants may migrate and percolates into lower soil strata or underground water profile. The period of waste dumping was also found to be an important parameter to characterize the leachate and to predict the environmental implications of waste dumping. Age of the landfill corresponding to stabilization stage has a significant effect on characteristic composition of leachate, as found at Dudauli dumpsite where dumping is continued since last five years and Ghaila dumpsite which is active since last three years. The observed value revealed that the quantity of leachate produced may be regarded as proportional to the volume of water percolating through the landfilled waste. Reduction of the quantity of water entering the tip is of great importance in reducing the rate of leachate generation. Leachate production has been found to be higher when the disposed refuse is less compacted since compaction was found to reduce the filtration rate.

7.3 Heavy Metals in Water Samples :

Heavy metals viz. Cd, Co, Cr, Cu, Pb, Mo, Ti and Zn were analyzed in all control water (12 nos.) samples (06 pre monsoon + 06 post monsoon) and experimental/dumpsite water (36 nos.) samples (18 pre monsoon + 18 post monsoon). The analytical data as presented in **table 5** revealed that Cd, Co and Ti were found below detection limit (BDL) in all 48 samples. However, Cu and Zn are present in significant concentration in all samples. Further, levels of Pb, Mo and Cr were found in traces and the concentration above permissible limit was found only in few samples of first strata water. There was no significant difference in level of heavy metals in pre-monsoon and post-monsoon water samples as seen in case of soil samples. This may be due to dilution factor because of rainfall. However, presence of heavy metals in traces in first strata in the underground water of d psite area, may occur due to percolation of such heavy metals from dumping of municipal solid waste including plastic waste. The effect of percolation was more at Ghaila dumpsite area having sandy soil texture than Dudauli dumpsite area with hard clay and gravels in soil profile. The concentration of Heavy Metals is mentioned at **Table-5.**

Table- 5: Concentration of Heavy Metals in Water Samples

CADMIUM (Cd)	**Pre-monsoon Samples**	**Post-monsoon Samples**
Concentration (mg/l)	Control	Control
Total	0	0
Average	0	0
Standard Deviation	0	0
Maximum value	0	0
Minimum value	0	0
	Experimental	Experimental
Total	0	0
Average	0	0
Standard Deviation	-	-
Maximum value	-	-
Minimum value	-	-

COBALT (Co)	**Pre-monsoon *Samples***	**Post-monsoon *Samples***
Concentration (mg/l)	Control	Control
Total	0	0
Average	0	0
Standard Deviation	0	0
Maximum value	0	0
Minimum value	0	0
	Experimental	Experimental
Total	0	0
Average	0	0
Standard Deviation	-	-
Maximum value	-	-
Minimum value	-	-

CHROMIUM (Cr)	Pre-monsoon *Samples*	Post-monsoon *Samples*
Concentration (mg/I)	Control	Control
Total	0	0
Average	0	0
Standard Deviation	0	0
Maximum value	0	
Minimum value	0	0
	Experimental	Experimental
Total	1.108	0.080
Average	0.061	0.004
Standard Deviation	0.058	0.018
Maximum value	0.196	0.080
Minimum value	0	

COPPER (Cu)	Pre-monsoon *Samples*	Post-monsoon *Samples*
Concentration (mg/I)	Control	Controi
Total	0.509	1.465
Average	0.084	0.244
Standard Deviation	0.085	0.324
Maximum value	0.213	0.900
Minimum value	0	0
	Experimental	Experimental
Total	0.857	1.129
Average	0.047	0.062
Standard Deviation	0.100	0.049
Maximum value	0.420	0.180
Minimum value	0	0

LEAD (Pb)	Pre-monsoon Samples	Post-monsoon Samples
Concentration (mg/I)	Control	Control
Total	0	0
Average	0	0
Standard Deviation	0	0
Maximum value	0	0
Minimum value	0	0
	Experimental	Experimental
Total	0.040	0
Average	0.002	0
Standard Deviation	0.022	0
Maximum value	0	0
Minimum value	0.040	0

MOLYBDENUM (Mo)	Pre-monsoon Samples	Post-monsoon Samples
Concentration (mg/I)	Control	Control
Total	0	0
Average	0	0
Standard Deviation	0	0
Maximum value	0	0
Minimum value	0	0
	Experimental _	Experimental
Total		
Average	0.105444	0
Standard Deviation	0.160629	0
Maximum value	0.417	0
Minimum value	0	0

Titenium (Ti)	Pre-monsoon Samples	Post-monsoon Samples
Concentrati on (mg/I)	Control	Control
Total	0	0
Average	0	0
Standard Deviation	0	0
Maximum value	0	0
Minimum value	0	0
	Experimental	Experimental
Total	0	0
Average	0	0
Standard Deviation	–	–
Maximum value	–	–
Minimum value	–	–

ZINC (Zn)	Pre-monsoon Samples	Post-monsoon Samples
Concentration (mg/I)	Control	Control
Total	4.197	3.120
Average	0.699	0.624
Standard Deviation	0.379	0.306
Maximum value	1.066	0.820
Minimum value	0	0
	Experimental	Experimental
Total	25.435	14.300
Average	1.413	0.841
Standard Deviation	1.279	0.648
Maximum value	4.410	2.500
Minimum value	0.006	0.100

7.5 Phthalates in Water Samples

The quality of water collected from dumpsite area was assessed with respect to phthalates. This was conducted to estimate the concentration level of phthalates viz. Di-methyl phthalate (DMP), Di-ethyl phthalate (DEP), Di-butyl phthalate (DBP), Di (2-ethylhexyl) phthalate (DEHP) and Di-octyl phthalate (DOP). The levels of different type of phthalates in the dumpsite water as well as control water samples at selected identified locations are presented in Table 4. During conducting experiment, Limit of Quantification (LOQ) and Limit of Detection (LOD) and recovery were determined by spiked sample method. The data analysed are presented at **Table 6.**

Table - 6

Compound	Spiked Level in water (Ogil)	Mean Recovery	LOQ (0g/1)	LOD (DWl)
DMP	10	70%	1.67	0.55
DEP	10	90%	0.28	0.09
DBP	10	76%	0.34	0.11
DEHP	10	85%	0.83	0.27
DOP	10	75%	0.40	0.13

The processed samples were analyzed using High Performance/Pressure Liquid Chromatography (HPLC). One representative chromatograph of Standard and a sample is presented in **Fig.6.** The five representative samples were analyzed on Gas Chromatography-Mass Spectrophotometer (GC-MS) to get confirmation of the respective chromatographic peaks of phthalates. The identification of the phthalates found in the samples was confirmed on GC-MS by comparing the RT and fragmentation patterns of the compound in the standard and samples.

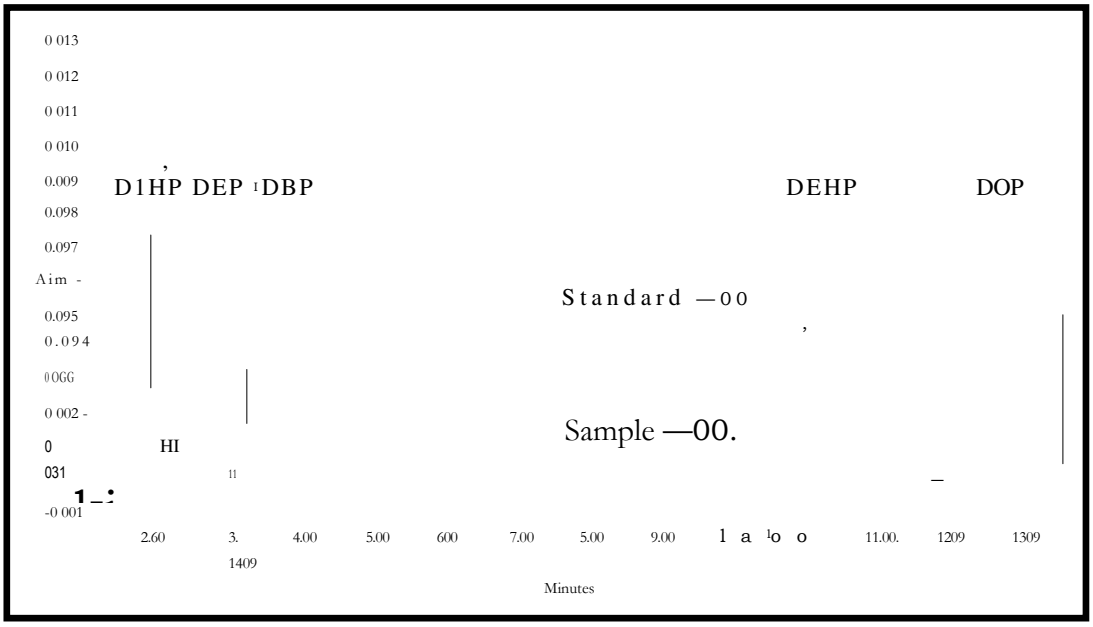
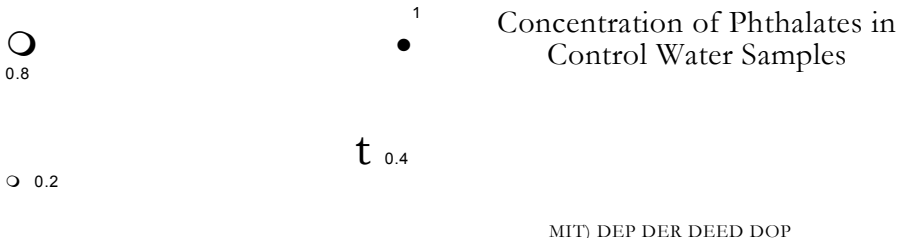


Fig-6: HPLC Chromatograph of representative Phthalate(s)

It is evident from the data of control water samples of all six locations that the values of phthalates are in traces **(Table 7)**. In **pre-monsoon control** water samples the mean values of individual phthalates are BDL, 0.958 mg/l, 0.747 mg/l, 1.005 mg/l and 0.462 mg/l for DMP, DEP, DBP, DEHP and DOP, respectively. These values revealed that DEHP were found to be present in 52.0% of the total phthalate concentration, while the DMP was the least detected phthalate. Detected phthalate concentration was found in the order DEHP>DEP>DBP>DOP»DMP, hence, it found in lesser quantity as compared to DEHP, DEP and DBP. **Data obtained from** the analysis **of post-monsoon control** water samples revealed the occurrence of **phthalates concentration is** comparatively higher than the **pre-monsoon samples (Fig. 7 and Fig. 8).** Mean values of individual phthalates concentration in post-monsoon control water samples are BDL, 1.033 mg/l, 0.832 mg/l, 1.358 mg/l and 0.517 mg/l for DMP, DEP, DBP, DEHP and DOP, respectively. Detected phthalate level was found to follow the same occurrence trend as pre-monsoon samples: DEHP> DEP>DBP>DOP>>DMP. Out of six control water samples, five samples were collected near (within 200 meters residential area) Dudauli and Ghaila Municipal waste dumpsite area from tube well or hand pump, which was used by local people. The presence of traces of phthalates in water samples of the dumpsite areas indicate the effect of dumping of municipal and plastic waste on the surroundings.

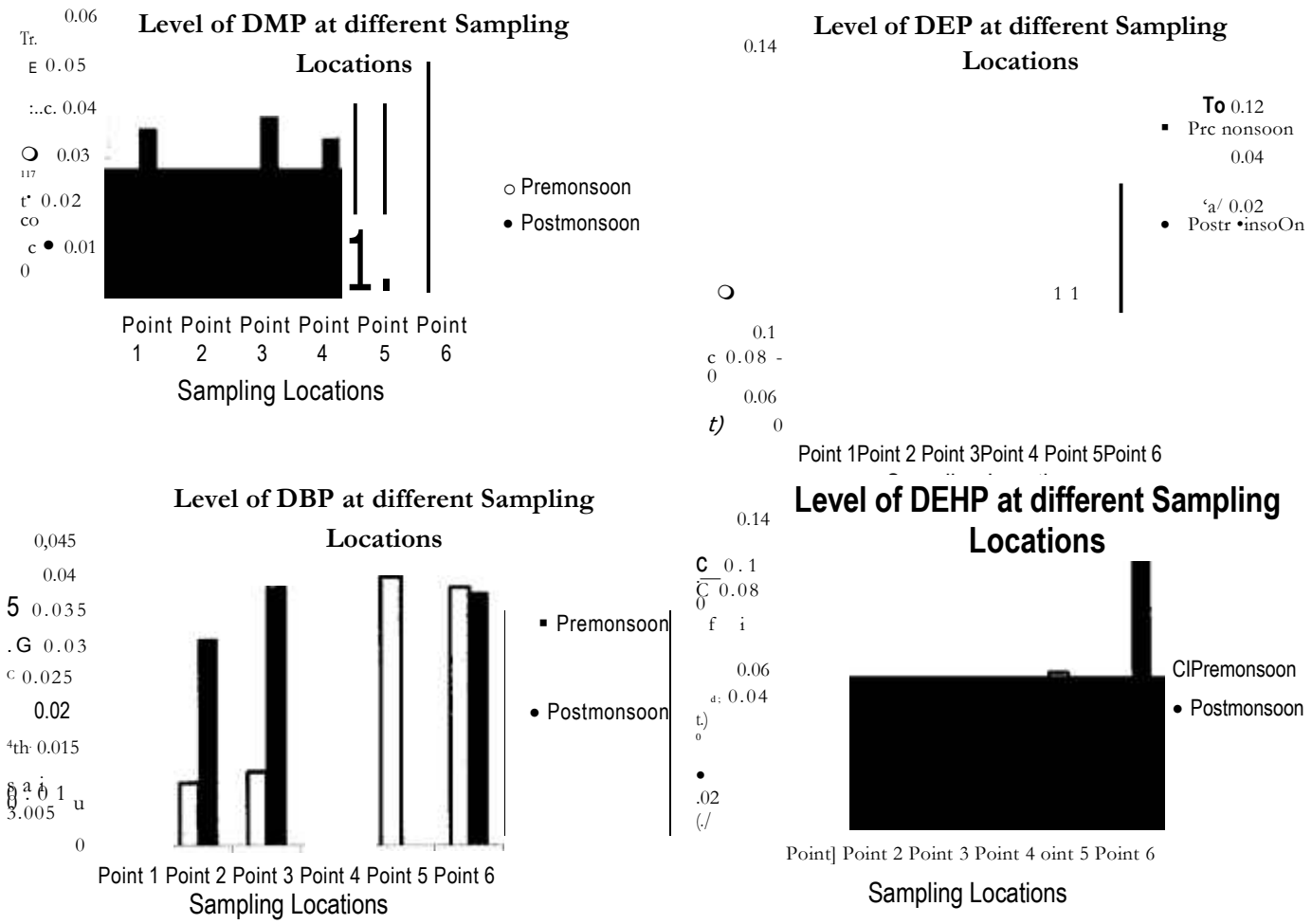
Fig 7: Mean Concentration of Phthalates (mg/l) in Control Water Samples



Control Water **Samples**	Mean Concentrat'on **(±SD)** of **Phthalates (mg/l)**				
	DMP	DEP	DBP	DEHP	DOP
Pre-monsoon	BDL	0.958 ±2.76	0.747 ±2.12	1.005 ±2.46	0.462 ±1.35
Post-monsoon	BDL	1.033 ±2.95	0.832 t2.37	1.358 ±3.45	0.517 ±1.51

Table 7: **Concentration of Phthalates in Experimental Water Samples**

Sampling Location	**Season**	**Mean** Concentration (±SD) **of Phthalates** (in **mg/l)**				
		DMP	DEP	**DBP**	**DEHP**	DOP
Point 1	Pre-monsoon	0.014 ±0.005	0.073 ±0.014	0.003 ±0.005	0.003 ±0.002	0.002 ±0.002
	Post-monsoon	0.036 ±0.012	0.081 ±0.010	0.017 ±0.029	0.012 ±0.013	BDL
Point 2	Pre-monsoon	0.009 ±0.001	0.105 ±0.013	0.009 ±0.005	0.009 ±0.001	BDL
	Post-monsoon	0.021 ±0.010	0.131 ±0.013	0.030 ±0.010	0.053 ±0.033	BDL
Point 3	Pre-monsoon	0.027 ±0.006	0.084 ±0.012	0.011 ±0.004	0.011 ±0.004	0.003 ±0.003
	Post-monsoon	0.038 ±0.007	0.121 ±0.024	0.038 ±0.005	0.007 ±0.005	BDL
Point 4	Pre-monsoon	0.016 ±0.006	0.058 ±0.053	0.006 ±0.002	0.009 ±0.001	BDL
	Post-monsoon	0.034 ±0.008	0.076 ±0.064	BDL	0.031 ±0.010	BDL
Point 5	Pre-monsoon	0.041 ±0. 006	0.085 ±0.015	0.040 ±0.005	0.069 ±0.019	0.003 ±0.005
	Post-monsoon	0.017 ±0.028	0.036 ±0.063	BDL	0.038 ±0.040	BDL
Point 6	Pre-monsoon	0.050 ±0.005	0.0683 ±0.010	0.038 ±0.008	0.067 ±0.007	0.006 ±0.010
	Post-monsoon	0.045 ±0.039	0.079 ±0.071	0.037 ±0.032	0.121 ±0.022	BDL



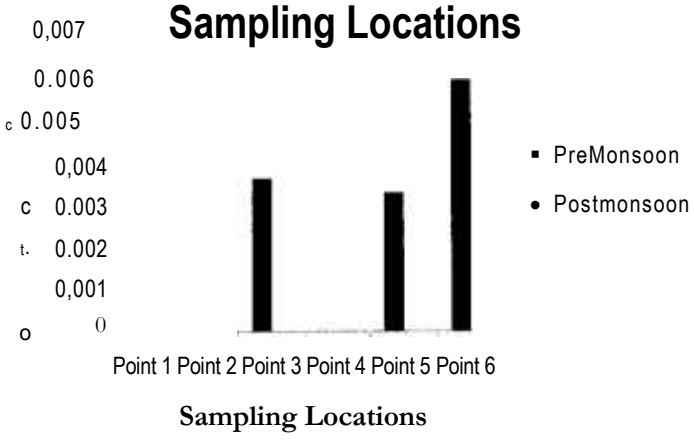


Fig 8: Mean Concentration of Phthalates (mg/I) in Experimental Water Samples

Conclusion:

- Characterization of dumpsite samples could be a yard-stick for the measurement of extent of pollution in surrounding environment. The biotic and abiotic transformation processes of different wastes give rise to pools of organic and inorganic compounds in the gaseous and liquid phases. During landfill operation, leachates are produced, mainly due to the infiltration of rainwater through the refuse tips. Such compounds may percolate through soil and contaminate groundwater basins in the drainage area of the landfill.
- The period of waste dumping (age of landfill site), geological and seasonal factors are important parameters to characterize the leachate and predict the environmental implications of waste dumping.
- The pH of dumpsite soil samples collected in post-monsoon season was found to be comparatively more basic than the pre-monsoon samples. Accumulated dumped waste containing high plastic contents as well as hard soil profile of low infiltration capacity caused water logging. This irrigated water contained much of the lime which might precipitate in the upper regions of dumpsite area and resulted into increase in the alkalinity of the soil.
- Availability of phosphorous and potassium was found to be higher in control soil samples than dumpsite samples indicating the depletion of nutritional quality of dumpsite soil due to dumping and degradation of plastics waste for more than 10 years.
- Decomposition of landfilled/dumped waste under environmental conditions caused higher concentration of nitrogen and chloride ions throughout the soil profile of dumpsite area.
- Presence of heavy metals and phthalates in first strata of underground water of umpsite area is due to migration and percolation of dumping of municipal and plastic waste.
- Data obtained from Toxicity Characteristic Leaching Procedure (TCLP) of dumpsite samples also contained significant amount of analytes indicating migration of chemical moieties from plastic waste.

Recommendation:

It has been observed that dumping of plastic waste may deteriorates soil and underground water quality due to leaching of additives, colours, stabilizes and fillers present in the different categories of plastic products. It is therefore recommended that plastic dumping should not be allowed to preserve the soil and water quality vis-as-vis Environment.

Annexure-III

CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE – CHENNAI

CHARACTERIZATION AND ASSESSMENT OF PLASTIC PACKAGING WASTE AT VIJAYAWADA, ANDHRA PRADESH

1. INTRODCUTION

The CPCB, HO vide letter dated 03.07.2024 requested Regional Directorate to conduct a study in one of the cities in their jurisdiction for implementation of SOP for Characterization and Assessment of Plastic Packaging Waste and Single Use Plastics (SUPs). CPCB, RD Chennai selected Vijayawada city in Andhra Pradesh having million plus population for the study. The meeting was conducted with Smt. K V Satyavathi, Additional Commissioner (Projects) of Vijayawada Municipal Corporation (VMC) on 11th July 2024 for planning of the study and requested to provide all necessary support including manpower for conducting the study jointly with VMC. Accordingly, the study was Jointly conducted by a team of officials from RD Chennai comprising of Ms Sowmya D, Scientist E and Sh Prabhu H Ganchi, Scientist B along with the officials of VMC and Ward Sanitation and Environment Secretaries - Sh Shaik Karimulla, Sh Puppala Sai Pavan Kumar and Sh Turimella Abhishikt during 15th July 2024 to 23rd July 2024.

2. OBJECTIVE

The objectives of the study are as follow:

i. Identification and Quantification of total plastic waste in the municipal solid waste and categorize it into different category i.e. Cat-I, Cat-II, Cat-III, Cat-IV plastic waste and Single Use Plastics (SUPs)
ii. Quantification of plastic packaging waste generated across various sectors (e.g., residential, commercial.)

3. STUDY AREA

Vijayawada is the administrative headquarters of the NTR district, Andhra Pradesh. It is a well-established commercial, political, educational and cultural centre of Andhra Pradesh. The city having a population of 11,95,150 (approximately as per 2024) consists of a dynamic urban landscape unfolds where the majority of residents belong to the middle-income group. The total area under the Vijayawada Municipal Corporation (VMC) is 61.88 sq. kms and the total waste generated in the city is 800 TPD (including 90 TPD of Construction and Demolition Waste). For administrative purpose, city is divided into three zone and named as Circle 1, Circle 2 and Circle 3. All waste generated in the city is collected by VMC through door-to-door collection and transported to waste transfer stations located at Ajith Singh

Nagar and Auto Nagar. The waste from Circle 1 and Circle 2 is sent to transfer station located at Ajith Nagar whereas waste from Circle 3 is sent to transfer station located at Auto Nagar. Out of 800 TPD of waste generated, approximately 600 TPD of waste is sent to Jindal Waste to Energy plant located at Guntur district for disposal from transfer stations. Approximately 90 TPD of Construction and Demolition Waste are disposed through filling in low laying area and remaining 110 TPD of valuables such as plastics, metals etc are collected by rag pickers and recycled. During the study, sample sorting and weighing were carried out at 2 transfer stations.

4. METHODOLOGY

The area of city is divided into three zones Circle 1, Circle 2 and Circle 3 for administrative purpose and subsequently various wards in the zone. The same zones were considered for the study and further divided into residential wards with Middle-income, Economically Weaker Section (EWS), mixed wards/slums and Commercial wards (Market Area).

Since Vijayawada has a million plus population, as per the Table 1 of SOP the sampling is to be carried out for 7(k) days. Accordingly, the total number of vehicle to be sample for 7 days comes out to be 49 (n). Out of 49 samples, 28 samples are collected from generation points and 21 samples from disposal points. The samplings were carried out from 15.07.2024 to 23.07.2024.

The samples were collected from generation point in each of the circle with different income category. Since in this case there are only three zones the fourth sample is again collected from circle 1. Similarly, on the second day, two samples were collected from circle 2 instead of one sample and so on. The vehicle selected from generation point were named as V1, V2, V3 and so on.

In the study, waste transported from transport stations to waste to energy plant is considered as disposal point. All the waste generated in the city is collected and brought to the 2 transfer stations and from there it is lifted and transported to the Waste to Energy plant for final disposal. Thus, the vehicle carrying waste from transfer stations to W2E plant for disposal were named as D1, D2 and D3 for Circle 1, Circle 2 and Circle 3 respectively. Similarly, for next day it is named as D4, D5 and D6 for Circle 1, Circle 2 and Circle 3 and so on for subsequent days.

During the study only two sample were collected from disposal point due to breakdown of weighing machine. The sample collected were D1 and D3. It is informed by the VMC the new weighing machine has been purchased and further study of remaining disposal point will be carried out from 28.08.2024.

The waste collected in identified vehicle (i.e. sample) were discharged in a designated area in transfer stations. Using the Quartering and coning method, the sample was reduced to 120 kg sample for characterization and assessment purpose.

The total plastic waste in 120 kg sample was identified and categorized into various category as Cat-I, Cat-II, Cat –III, Cat –IV plastic waste and Single Use Plastics (SUPs). The SUPs is further sorted into ear buds, balloons etc. The above exercise was repeated for all 28 samples from generation point and 2 sample from disposal point as per SOP.

5. ANALYSIS AND RESULTS

The results of the study are as follow:

5.1 Distribution of the sampling locations

Table 1: Sample location distribution

	CIRCLE 1			CIRCLE 2			CIRCLE 3		
	Vehicle	**Category**	**Location**	**Vehicle**	**Category**	**Location**	**Vehicle**	**Category**	**Location**
DAY 1	**V1**	Middle Income	Midhila Nagar	**V3**	Economically Weaker Sections	Asn-Stp apartments	**V4**	Commercial	Revenue Colony
	V2	Mixed (Res & Com)	Murupilla Chittigari Park Area						
	D1	Random Vehicle		**D2**	Random Vehicle		**D3**	Random Vehicle	
DAY 2	**V5**	Economically Weaker Sections	Police Colony	**V6**	Commercial	Hanuman peta	**V8**	Middle Income	Damodaram Sanjivaya Nagar
				V7	Mixed (Res & Com)	Satyaranayana puram			
	D4	Random Vehicle		**D5**	Random Vehicle		**D6**	Random Vehicle	
DAY 3	**V9**	Commercial	Tara Peta	**V10**	Middle Income	PNT Colony-Ajith Singh Nagar	**V11**	Economically Weaker Sections	Padmavahi Ghat Area
							V12	Mixed (Res & Com)	High School Road Area
	D7	Random Vehicle		**D8**	Random Vehicle		**D9**	Random Vehicle	
DAY 4	**V13**	Middle Income	RTC Work Shop Area	**V15**	Economically Weaker Sections	Subba Raju Nagar	**V16**	Commercial	KP Nagar

	V14	Mixed (Res & Com)	Mango Market Area						
	D10	Random Vehicle		**D11**	Random Vehicle		**D12**	Random Vehicle	
DAY 5	**V17**	Economically Weaker Sections	Frizer Peta	**V18**	Commercial	Governor peta	**V20**	Middle Income	Siva Shankara Road Area-Ramaling eswara Nagar
				V19	Mixed (Res & Com)	Fire Station Area, Prakash Nagar			
	D13	Random Vehicle		**D14**	Random Vehicle		**D15**	Random Vehicle	
DAY 6	**V21**	Commercial	Radham Center Area	**V22**	Middle Income	Bhanu Nagar	**V23**	Economically Weaker Sections	Ranigarit hota
							V24	Mixed (Res & Com)	Darsipeta
	D16	Random Vehicle		**D17**	Random Vehicle		**D18**	Random Vehicle	
DAY 7	**V25**	Middle Income	Vellampal li Colony	**V27**	Economically Weaker Sections	A&B Blocks-Vambay Colony	**V28**	Commercial	Badava Peta
	V26	Mixed (Res & Com)	Iron Yard Area						
	D19	Random Vehicle		**D20**	Random Vehicle		**D21**	Random Vehicle	

Note: - Only D1 and D3 samples were collected and analyzed, study of remaining samples i.e. D2, D4 - D21 is scheduled to be carried out from 28.08.2024.

5.2 Sample collection and Analysis

Table 2A: Plastic Waste characterization (Plastic Packaging category wise): Generation points

Vehicle Load	Sorting sample size (Kg)	Total PW (kg)	Category I PW (Kg)	Category II PW (Kg)	Category III PW (Kg)	Category IV PW (Kg)
1	120	8.83	1.37	3.93	1.84	0.03
2	120	11.16	1.857	4.03	1.94	-
3	120	8.63	1.012	5.08	0.96	0.05
4	120	8.87	1.987	4.21	0.652	0.08
5	120	10.03	1.812	4.54	1.655	-
6	120	10.42	3.757	5.95	0.1	0.06
7	120	7.61	0.807	4.24	1.068	-
8	120	13.44	0.937	8.22	1.59	-
9	120	11.11	0.957	4.96	2.875	0.07
10	120	12.89	1.692	4.155	4.04	0.02
11	120	11.40	1.937	5.02	1.935	-
12	120	10.14	1.757	5.89	0.855	0.05
13	120	9.52	1.117	3.59	1.12	-
14	120	13.05	2.802	4.96	1.875	0.08
15	120	13.37	1.882	4.065	2.895	-
16	120	10.27	2.047	2.13	3.15	-
17	120	13.77	2.782	3.955	2.865	-
18	120	14.03	0.747	7.23	2.96	0.07
19	120	13.50	0.837	6.23	2.63	-
20	120	14.20	0.747	4.31	4.01	-
21	120	13.66	1.707	6.28	3.045	0.06
22	120	12.90	2.802	3.105	3.59	0.09
23	120	10.20	1.877	4.68	2.025	-
24	120	12.31	1.837	4.98	1.825	0.04

25	120	13.84	2.537	4.79	3.14	-
26	120	13.74	3.297	4.21	3.78	0.1
27	120	11.73	1.787	4.23	2.17	-
28	120	13.40	3.867	3.2	2.06	0.07
Total	**3360**	**328.02**	**52.556**	**132.17**	**62.65**	**0.87**

Table 2B: Plastic Waste characterization (Plastic Packaging category wise): Disposal points

Vehicle Load	Sorting sample size (Kg)	Total PW (kg)	Category I PW (Kg)	Category II PW (Kg)	Category III PW (Kg)	Category IV PW (Kg)
1	**2**	**3**	**4**	**5**	**6**	**7**
1	120	7.36	0.95	3.385	0.39	-
2	120	3.412	1.115	0.285	0.19	-
Total	**240**	**10.772**	**2.065**	**3.67**	**0.58**	**0**

Table 3A: Plastic waste characterization (Single Use Plastic) – Generation point

Vehicle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total Sorting Size (kg)	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Total Plastic Waste (Kg)	8.83	11.16	8.63	8.87	10.03	10.42	7.61	13.44	11.11	12.89	11.40	10.14	9.52	13.05	13.37
SUP															
Earbuds (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Balloons (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Candy (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ice Cream (Kg)	-	-	-	-	0.015	-	-	-	0.035	-	-	-	-	-	0.01
Straws (Kg)	-	0.01	0.001	0.01	0.001	0.001	-	0.001	-	-	-	-	-	-	0.001
Plates (Kg)	0.1	0.11	-	-	0.15	-	-	0.2	-	0.055	-	-	0.05	0.25	0.13

Cups (Kg)	0.29	0.3	0.19	0.53	0.3	-	0.15	0.3	0.28	0.109	0.025	0.12	0.215	0.34	0.13
Glass (Kg)	0.019	0.02	0.13	0.095	0.02	0.05	0.15	0.035	-	0.14	0.105	0.22	0.01	0.25	0.015
Forks (Kg)	0.001	0.01	0.001	0.05	0.005	-	0.01	0.001	-	0.01	0.013	0.021	0.01	0.001	0.01
Spoons (Kg)	0.003	0.03	0.012	0.031	0.012	-	0.01	0.001	0.011	0.01	0.02	0.012	0.01	0.001	0.01
Knives (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trays (Kg)	-	-	-	-	-	0.015	0.02	-	-	0.1	-	0.018	0.035	0.2	0.27
Sweet Boxes (Kg)	0.06	0.13	-	-	0.365	0.02	0.095	0.06	-	0.15	-	0.107	0.05	-	0.35
Invitation Cards (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-
Cigarette Packets (Kg)	-	-	-	0.01	0.06	-	-	-	0.04	0.13	0.035	-	0.015	0.033	0.03
< 120 microns	1.13	2.12	1.1	1.2	1.065	0.37	1.028	2.015	1.85	1.89	2.01	1.028	3.1	2.235	3.29
< 50 microns	0.04	0.13	0.09	0.01	0.032	0.012	0.03	0.08	0.03	0.375	0.15	0.06	0.002	0.001	0.28
Plastic Flags (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PVC Banners <100 microns	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-
Polystyrene for decoration (Kg)	-	0.15	-	-	-	-	-	-	-	-	-	-	-	-	-
Total (kg)	**1.643**	**3.31**	**1.524**	**1.936**	**2.025**	**0.468**	**1.493**	**2.693**	**2.246**	**2.969**	**2.358**	**1.586**	**3.697**	**3.311**	**4.526**

Vehicle	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**Total (kg)**	**Average kg/kg of waste**
Total Sorting Size (kg)	120	120	120	120	120	120	120	120	120	120	120	120	120	**3360**	
Total Plastic Waste (Kg)	10.27	13.77	14.03	13.50	14.20	13.66	12.90	10.20	12.31	13.84	13.74	11.73	13.40	**328.02**	**0.097625**
SUP														**0**	
Earbuds (Kg)	-	-	-	0.012	0.001	-	0.002	-	-	-	-	-	-	**0.015**	**0.0000045**
Balloons (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**	**0.0000000**

Candy (Kg)	-	-	-	-	-	-	-	-	0.009	-	-	-	-	**0.009**	**0.0000027**
Ice Cream (Kg)	-	0.03	-	0.02	-	0.059	-	-	0.022	-	-	-	-	**0.191**	**0.0000568**
Straws (Kg)	0.005	0.002	-	0.008	0.006	-	-	-	0.004	0.01	-	0.001	0.01	**0.071**	**0.0000211**
Plates (Kg)	0.85	0.31	0.22	0.23	0.57	-	0.042	0.115	0.13	0.815	0.65	0.1	-	**5.077**	**0.0015110**
Cups (Kg)	0.27	0.18	1.17	0.33	0.23	0.41	0.295	0.015	0.11	0.3	0.065	0.27	0.65	**7.574**	**0.0022542**
Glass (Kg)	0.07	0.018	0.001	0.11	0.015	-	0.12	0.11	0.19	0.75	0.015	0.085	1.36	**4.103**	**0.0012211**
Forks (Kg)	0.02	0.006	-	0.001	0.002	-	0.03	0.004	0.018	0.001	0.001	0.001	0.045	**0.272**	**0.0000810**
Spoons (Kg)	0.08	0.011	0.001	0.02	0.002	0.021	0.015	0.02	0.013	0.001	0.02	0.01	0.045	**0.432**	**0.0001286**
Knives (Kg)	-	-	-	-	0.01	-	-	-	0.012	-	-	-	-	**0.022**	**0.0000065**
Trays (Kg)	0.22	0.011	0.185	0.025	0.005	-	0.13	-	0.015	0.01	0.045	0.07	0.55	**1.924**	**0.0005726**
Sweet Boxes (Kg)	0.08	0.365	0.22	0.19	0.27	0.035	0.155	-	0.158	0.115	0.32	0.185	0.54	**4.02**	**0.0011964**
Invitation Cards (Kg)	-	-	0.47	-	-	0.12	-	-	-	-	-	-	-	**0.79**	**0.0002351**
Cigarette Packets (Kg)	0.135	0.045	0.135	0.029	0.05	0.04	0.118	0.055	-	0.035	0.035	0.055	0.22	**1.305**	**0.0003884**
< 120 microns	1.115	3.125	0.6	2.6	3.9	1.85	2.015	1.16	2.855	1.29	1.14	2.73	0.78	**50.591**	**0.0150568**
< 50 microns	0.1	0.039	0.025	0.23	0.04	0.03	0.382	0.14	0.09	0.045	0.03	0.04	-	**2.513**	**0.0007479**
Plastic Flags (Kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**	**0.0000000**
PVC Banners <100 microns	-	-	-	-	-	-	-	-	-	-	-	-	-	**0.3**	**0.0000893**
Polystyrene for decoration (Kg)	-	-	-	-	0.035	-	-	-	-	-	-	-	-	**0.185**	**0.0000551**
Total (kg)	**2.945**	**4.142**	**3.027**	**3.805**	**5.136**	**2.565**	**3.304**	**1.619**	**3.626**	**3.372**	**2.321**	**3.547**	**4.2**	**79.394**	

Table 3B: Plastic waste characterization (Single Use Plastic) – Disposal point

Vehicle	1	2	Total (kg)	Average kg/kg of waste
Total Sorting Size (kg)	120	120	240	
Plastic waste (kg)	7.36	3.412	10.772	0.04488
SUP			0	
Earbuds (Kg)	-	0.001	0.001	0.0000042
Balloons (Kg)	-	-	0	0.0000000
Candy (Kg)	-	-	0	0.0000000
Ice Cream (Kg)	-	0.006	0.006	0.0000250
Straws (Kg)	-	0.001	0.001	0.0000042
Plates (Kg)	0.05	0.12	0.17	0.0007083
Cups (Kg)	-	0.11	0.11	0.0004583
Glass (Kg)	0.02	0.01	0.03	0.0001250
Forks (Kg)	0.01	0.003	0.013	0.0000542
Spoons (Kg)	-	0.004	0.004	0.0000167
Knives (Kg)	-	-	0	0.0000000
Trays (Kg)	-	0.12	0.12	0.0005000
Sweet Boxes (Kg)	0.02	0.045	0.065	0.0002708
Invitation Cards (Kg)	-	-	0	0.0000000
Cigarette Packets (Kg)	-	0.007	0.007	0.0000292
< 120 microns	2.5	1.2	3.7	0.0154167
< 50 microns	0.015	0.04	0.055	0.0002292
Plastic Flags (Kg)	-	-	0	0.0000000
PVC Banners <100 microns	-	0.1	0.1	0.0004167
Polystyrene for decoration (Kg)	-	-	0	0.0000000
Total (kg)	**2.615**	**1.767**	**4.382**	

5.3 Assessment of Plastic Waste

1. Quantity of Plastic Waste Generation

Average quantity of plastic waste generated (kg of plastic waste/ kg of mixed waste)

Q_1= (328.02/3360) = 0.097625 = 9.76%

On an average the total mixed waste generated in a day is 800 TPD (inclusive of 90 TPD of Construction and Demolition waste)

Thus, total mixed generated in a year = 800 x 365 = 292000 TPA = Approximately 3,00,000 TPA

From above, the Quantity of Mixed Waste generated in the town is considered as (Q) = 3,00,000 Tons per annum

Quantity of Plastic Waste Generated (Q_T) = Q_1*Q = (328.02/3360) x 300000 = 29287.5 TPA

Quantity of Plastic Waste Generated per day = 78.1 TPD

2. Quantity of Plastic Packaging Waste Generation

Average quantity of plastic packaging waste generated (kg of plastic packaging waste / kg of mixed waste)

Q_2 = (52.556 +132.17 + 62.65 + 0.87)/3360

Q_2 = 248.246/3360

Q_2 = 0.073883 = 7.4%

Quantity of Plastic Packaging Waste Generated (Q_{pack}) = Q_2*Q

Q_{pack} = 0.073883 x 300000 = 22165 TPA

3. Quantity of SUP Waste Generation

Average quantity of SUP waste generated (SUP in kg / kg of mixed waste)

Q_3 = 79.394/3360

Q_3 = 0.02363 = 2.36%

Quantity of SUP Waste Generated (Q_{SUP}) = Q_3*Q

Q_{SUP} = 0.02363 x 300000 = 7089 TPA

4. Quantity of Other (Non-packaging waste)

$Q_{other} = Q_T - Q_{pack}$

Q_{other} = 29287.5 - 22165

Q_{other} = 7122.5 TPA (This includes SUP and other plastic waste excluding packaging waste)

5. Quantity of Plastic Waste Disposed

Average quantity of plastic waste generated (kg of plastic waste/ kg of mixed waste)

Q_{1d}= (10.772/240) = 0.044883= 4.48%

Vijayawada municipal corporation is sending approximately 600 TPD of mixed municipal solid waste to waste to energy plant at Guntur for final disposal.

Quantity of Mixed Waste Disposed (Q_D) = 600 TPD X 365 = 2,19,000 TPA

Quantity of Plastic Waste Disposed (Q_{TD}) = Q_{1d}*Q_D

Q_{TD} = (10.772/240) x 2,19,000

Q_{TD} = 9829 TPA

6. Quantity of Plastic Packaging Waste Disposed

Average quantity of plastic packaging waste Disposed (kg of plastic packaging waste / kg of mixed waste)

Q_{2d} = (2.065 + 3.67+ 0.58)/240

Q_{2d} = 6.315/240

Q_{2d} = 0.0263125 = 2.63%

Quantity of Plastic Packaging Waste Disposed (Q_{packD})= Q_{2d}*Q_D

Q_{packD} = 0.0263125 x 2,19,000 = 5762 TPA

7. Quantity of SUP Waste at Disposal

Average quantity of SUP waste at Disposal (SUP in kg / kg of mixed waste)

Q_{3d} = 4.382/240

Q_{3d} = 0.01826 = 1.82%

Quantity of SUP Waste Disposed (Q_{SUPD}) = Q_{3d}*Q_D

Q_{SUPD} = 0.01826 x 2,19,000 = 3999 TPA

8. Quantity of Other (Non-packaging waste) Disposed

Q_{otherD} = Q_{TD}-Q_{packD}

Q_{otherD} = 9829 - 5762

Q_{otherD} = 4067 TPA (This includes SUP and other plastic waste excluding packaging waste)

9. Quantity of Plastic waste Utilised/Processed

$Q_{utilised/processed}$ = Q_T-Q_{TD}

$Q_{utilised/processed}$ = 29287.5 – 9829 = 19,458 TPA

At transfer stations, approximately 19,458 TPA of plastic waste is collected and utilized/ processed through rag pickers prior to sending remaining mixed waste for final disposal at waste to energy plant.

6. OBSERVATIONS

6.1 Quantification of Plastic Waste

a. At Generation Location

Type of Waste	Quantity (TPA)	% of Total solid waste generated
Plastic Waste generated	29287.5	9.76 %
Plastic Packaging Waste generated	22165	7.39 %
Single Use Plastics (SUPs) generated	7089	2.36 %
Other plastic wastes	33.5	0.007 %

i. In Vijayawada Municipal Corporation (VMC) jurisdiction, approximately, 800 TPD of municipal solid waste including 90 TPD of C&D waste is generated. This accounts for approximately 3,00,000 TPA of municipal solid waste generation.

ii. The study shows that in Vijayawada, 1 kg of municipal solid waste consist of 0.097625 kg i.e. 9.76% of plastic waste at generation sites. Quantity of Plastic Waste Generated per day is 78.1 TPD and per annum is 29287.5 TPA

iii. Average quantity of plastic packaging waste in municipal solid waste is 7.4% and SUP is 2.36%. It is estimated that approximately 22165 TPA of Plastic Packaging Waste and 7089 TPA of SUP waste are generated. The quantity of Non-packaging waste generated is 7122.5 TPA, which includes SUP and other plastic waste excluding packaging waste.

iv. In total plastic waste generated, 75.68% is plastic packaging waste and 24.20% is SUPs.

b. At Disposal Location

Type of Waste	Quantity (TPA)	% of Total waste disposed
Plastic Waste disposed	9829	4.48 %
Plastic Packaging Waste disposed	5762	2.63 %
Single Use Plastics (SUPs) disposed	3999	1.82 %

i. Vijayawada municipal corporation is disposing approximately 600 TPD of MSW through waste to energy plant located at Guntur. At disposal locations, average quantity of plastic waste present per kg of mixed municipal solid waste is 0.044883 kg i.e. 4.48%. Annually 2,19,000 TPA of mixed municipal solid waste is disposed through waste to energy plant and out of this 9829 TPA is plastic waste.

ii. At disposal site, average quantity of plastic packaging waste content in municipal solid waste is 2.63% and SUP is 1.82%. It is estimated that approximately 5762 TPA of Plastic Packaging Waste and 3999 TPA of SUP waste are disposed.

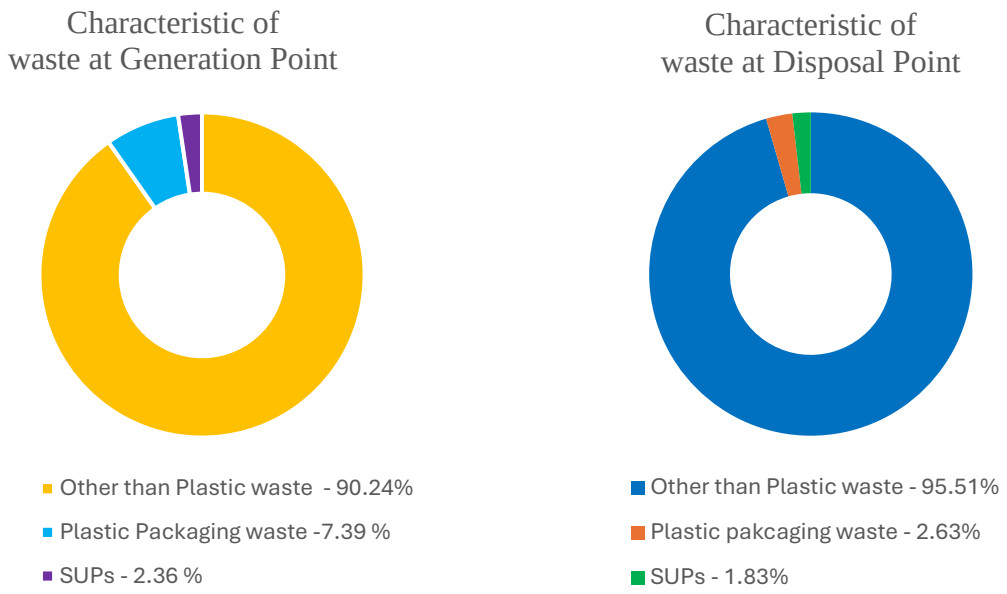
iii. Approximately, 25.99 % of plastic packaging waste generated and 56.41% of SUPs generated are disposed through waste to energy plant.

c. Utilized/processed through rag pickers

Type of Waste	Quantity (TPA)	% of Total plastic waste generated
Plastic Waste generated	29287.5	-
Plastic Waste disposed	9829	33.56 %
Plastic Waste utilized/processed	19458.5	66.44 %

i. This indicates, at transfer stations approximately 19,458 TPA of plastic waste from municipal solid waste are collected by rag pickers or informal sector and further utilized/processed.

ii. Approximately, 66.44 % of plastic waste generated is utilized/processed and 33.56% of plastic waste is disposed through waste to energy plant.



6.2 Manpower and Equipment Cost

Category	Numbers required	Working Hours	Cost per Hour/ Cost per item	Total Cost (For 7 days)
Workers	10	8 hours/ Day	₹ 65/-	₹ 36,400/-
Workers Health Allowance	10	8 hours/ Day	₹ 25/-	₹ 14,000/-
Collection bins 80 Liters Capacity	10	For entire exercise	₹ 1,300/-	₹ 13,000/-
Collection Bins 12 Liters Capacity	20	For entire exercise	₹ 400/-	₹ 8,000/-
Weighing machine Max 50Kgs with 10 grams accuracy	1	For entire exercise	₹ 4,750/-	₹ 4,750/-

Weighing machine Max 25Kgs with 1 gram accuracy	1	For entire exercise	₹ 2600/-	₹ 2,600/-
PPE Kits	10	Per Day	₹ 350/-	₹ 24,500/-
Tarpaulin sheets (30FT X 18FT)	4	For entire exercise	₹ 1500/-	₹ 6,000/-
Cellophane Tape	1	For entire exercise	₹ 94/-	₹ 94/-
			TOTAL	**₹ 1,09,344**

The total cost incurred in the entire study is ₹1,09,344/-.

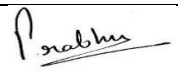
6.3 Challenges identified during the study

1. The quantity of waste generated varies with the season in a locality.
2. The characteristic of MSW varies with the season. During rainy season it is difficult to carry out the study due to high moisture content in the waste. Carrying out this exercise during a rainy day may interfere with the result due to added weight of water drops on wet plastic. Therefore, it is better to avoid sampling on rainy days and to be carried out only on dry days.
3. It is very difficult to carry out this task without providing prior training to the workers about the 4 categories of waste and SUP that need to be separated. Prior training should be provided to workers at least for 2 hours in categorization of plastic waste by showing color pictures of different categories of plastic wastes.
4. The selection of the workers for carrying out categorization should be based on their eye sight. The workers with good vision and healthy should be selected for this task.
5. Preference should be given to workers who know how to read so that they can put the categorized plastic in its appropriate bin by reading the label on it. This will speed up the process of assessment.
6. Sometimes the plastic waste came with added dirt and mud which add up weight to actual weight of plastic. In such cases cleaning the dirt and mud and weighing delay the assessment process.
7. The flower waste came with sharp ball pins and staples stuck to flower stalks turned out to be dangerous to workers who are categorizing the waste. Workers should be careful while handling flower waste which is used for decoration purpose.

8. Sometimes the medical waste may also appear in sample which is collected from residential areas. The collection staff of the vehicles should be intimated prior to the collection so that they can make sure that no medical waste mixes with the sample.
9. Categorizing the SUP which is >120 microns and <50 microns is difficult process which need a gauge to measure. This turned out to be a lengthy and time taking process.
10. It is difficult to identify compostable plastic compare to other three categories.
11. The CPCB registration number is printed with small letters often not visible due to added dirt. This makes it difficult to identify compostable plastic.
12. Detection and quantification of small size plastic items like earbuds etc. was more difficult and time consuming.

7. RECOMMENDATIONS

1. The sampling and characterization may be carried out during non- rainy days to get realistic results.
2. Proper training should be given to the workers involved in the characterization and assessment of Plastic packaging waste.
3. Number of samples may be reduced as sampling for 7 days in Million plus cities in time and manpower consuming.
4. Community may be educated regarding different category of Plastic waste and their segregation at source for better management of plastic waste.

Name(s) officials:	Sowmya D, Scientist 'E' Prabhu H Ganchi, Scientist 'B'
 (Prabhu H Ganchi) Scientist 'B'	 (Sowmya D) Scientist 'E'

PHOTOGRAPHS

	
Bins for the collection of Plastic waste into different category	**Identification of a category of plastic waste by VMC official.**
	
Dumping of waste in a designated area for sorting	**Cone and Quarter Method for sampling of waste**
	
Sorting of the plastic waste into different category	**Sorting of the plastic waste into different category**

Central Pollution Control Board
Regional Directorate, Bhopal

Report On Assessment and Characterization of Plastic Waste at Bhopal M.P.

With reference to HO letter dated 03.07.2024 regarding the assessment and Characterization of Plastic Waste, study carried out at Bhopal during 05.08.2024 to 09.08.2024 at various Garbage Transfer Stations and final disposal site at Aadampur.

The main objectives of the study are as follows:

i. Assessment and Characterization of Plastic Waste.
ii. Quantification of plastic in MSW.
iii. Characterisation of plastic waste under EPR categories.
iv. Characterization and quantification of banned SUP items in MSW.

The RD, Bhopal conducted study in Bhopal under 'Assessment and Characterization of Plastic Waste in Bhopal'. The study involved assessment and characterization of plastic waste in different areas of Bhopal. The protocol of ASTM as well as methodology involving quartering and coning process as per SOP of CPCB has been followed for sampling for quantification of plastic waste from the total solid waste from generation and disposal sites. The objective of this study is to identify the current status of the waste composition, and generation, and also to understand the existing ecosystem of plastic production, plastic waste recycling, and its management in Bhopal. Bhopal is having a door-to-door collection, good waste segregation, and waste processing infrastructure.

To assess the management of plastic waste w.r.to above points the Garbage Transfer Station and material recovery facility (MRF) established by Bhopal Municipal Corporations were visited along with the officials of MPPCB and Municipal Corporation. The following team members conducted the study:

1. Dr Anoop Chaturvedi, Scientist B
2. Sh Arvind Singh Scientist, MPPCB Bhopal
3. Sh. Aarsh Tiwari, SSA
4. Sh. Jagjeevan JLA
5. Ms. Alfa Monika Lakda, JLA
6. Sh. Shiv Kumar Kushwaha,JLA
7. Sh Surendra Ku Bhatiya, MTS
8. Officials of Municipal corporation

The population of Bhopal is approximately 1798218 as per census 2011, a dynamic urban landscape unfolds where the majority of residents belong to the middle-income group. Apart from residential areas there are few slum areas within the city with market hubs including wholesale and retail shops. To efficiently manage the generated waste, Nagar Nigam has signed MOU with waste management agency. All generated waste is collected by Nagar Nigam from 11 Garbage Transfer Stations (GTS) located in different areas. The Material Recovery Facility has been installed in all the GTS to recover the recyclable items including plastic. Recyclable material are manually separated and remaining are being sent to the disposal site of the city i.e. Aadampur for further recovery of RDF.

During the characterization exercise, the waste was primarily categorized as dry and wet waste. The dry waste was further categorized into dry waste other than plastic (cardboard; paper and millboard; shoes-leather and rubber separately; cloth; metal; glass; domestic Hazardous waste; compostable bags) and plastic waste further categorized in 4 categories as per EPR (PET; HDPE; LDPE; PVC; PP; PS; MLP and packaging wrappers) and SUP to get a clear understanding of the waste types obtained during the characterization.

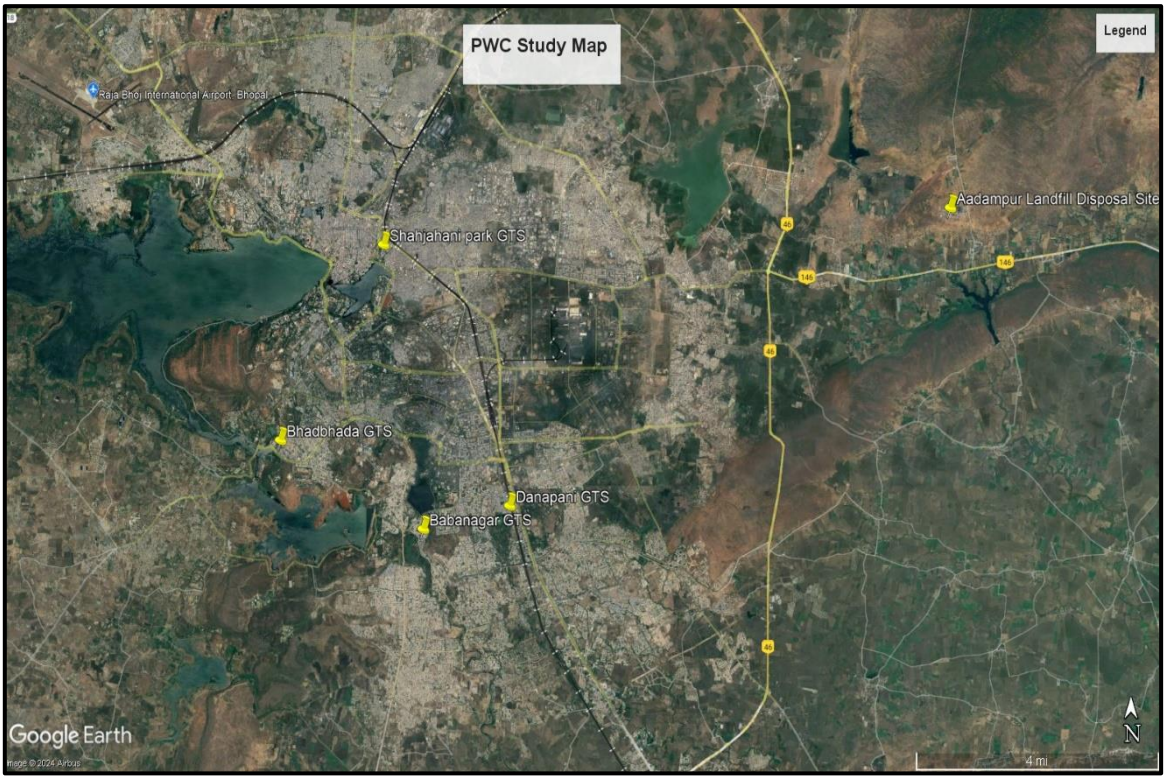
Step One: Determination of parameter for waste Characterization

- No. of Vehicle to be sampled (n): 45 (9 vehicle in a day)
- Duration of sampling (No of Days) (k): 5
- Vehicle load size: 315 to 530 kg
- Sorting Sample size: 85 to 150 kg

Step Two: Distribution of the sampling locations

City area is divided into four zones East, West, North & South and subsequently various wards in the zone are divided into Middle-income residential wards, Economically Weaker Section (EWS) residential wards/slums and Commercial wards (Market Area) and others. In addition, one disposal point is also identified in each Zone and centralised disposal site of city. Location distribution, Map & details are given below:

S.No	Location	Zone covered	Remark
01	Dana-Pani GTS	6, 10, 11, 12, 19	It covers Arera colony and Shahpura area.
02	Baba Nagar GTS	7, 8, 18, 21	It covers Kolar road and E-8 area
03	Bhadbhada GTS	6, 8, 21	It covers New market, neelbad, Nehru nagar area
04	Shahjhani Park GTS	5, 7, 11	It covers old Bhopal area
05	Aadampur landfill site	All zones	It is located at outside of Bhopal and having RDF and composting facility.



According to the present waste collection process in Bhopal, plastic is collected with dry waste and from there it goes to a GTS for further sorting of recyclable material in MRF and sent to disposal site through big size capsule containers having the capacity of 14 to 18 Ton. The MRF is a facility that receives materials and then uses a combination of equipment and manual labour to separate and densify materials in preparation for shipment downstream to recyclers of the particular materials recovered. Typical materials recovered at MRFs includes ferrous metal, thermocol, PVC & Nylone shoe soles, PET, HDPE, and mixed paper etc. after preliminary sorting of the plastic the collected waste sent to main disposal site for further conversion of remaining waste material into RDF. The RDF bales are then sold to local cement manufacturers unit.

As per information in Bhopal approx. 800 TPD mixed solid waste generated and 35 TPD inert sent for final disposal after recovery of material, composting and RDF.

Step Three: Sample Preparation

A total 5 locations (GTS & Dumping Site) were selected for discharge of designated vehicle loads, manual sorting activities, and weighing operations. The location found to be flat, level, and away from the normal waste handling and processing areas.

- The entire vehicle load was discharged in a designated area.
- The sampled waste was mixed and using the Quartering and coning, the vehicle load size (315-530 kg) reduced to Sorting sample size (85-150 kg).
- The entire vehicle load has been disposed on the ground and divided into four parts. Two samples positioned diagonally opposite to each other were selected for the next step, the other two were discarded. The process was repeated to reduce the size of the sample from 100 % to 25 %.

Step Four.: Assessment of Plastic Waste is given below:

1. Quantity of Plastic Waste Generation
   39650.76 TPA

2. Quantity of Plastic Packaging Waste Generation
   34457.97 TPA

3. Quantity of SUP Waste Generation
   5695.09

4. Quantity of Other (Non-packaging waste)
   252349.24 TPA

5. Quantity of Plastic Waste Disposed
   677.82 TPA

6. Quantity of Plastic Packaging Waste Disposed
   594.03 TPA

7. Quantity of SUP Waste Disposed
   113.48 TPA

8. Quantity of Other (Non-packaging waste) Disposed
   12097.17 TPA

9. Quantity of Plastic waste Utilised/Processed
   38972.934 TPA

The average quantity of plastic waste generation has been estimated as 13.57% of total mixed solid waste. The single-use plastics (SUP) with respect to total mixed solid waste is found approx. 2 % and after collection by Nagar Nigam approximately 98 % of plastic either processed in MRF/RDF/Recycled.

Challenges Faced During the Study

- Cherry Picking of the waste especially category-1 is common issue in all the GTS.
- Waste collection and segregation/sorting at MRF centre is integral part of GTS. After segregation of valuable materials, remaining waste sent to landfill site for making of RDF. Hence finalisation of end disposal point was found to be difficult.
- Non-Woven bags not considered either in EPR or SUP during study.
- The quantity of inert waste disposed at landfill site was taken from Form-V i.e. annual report of PWM.

- Quantity of plastic waste may vary during festive season, summer & rainy season etc.

The plastic waste characterisation and quantification data for both generation and disposal points are enclosed in the Annexures as given below.

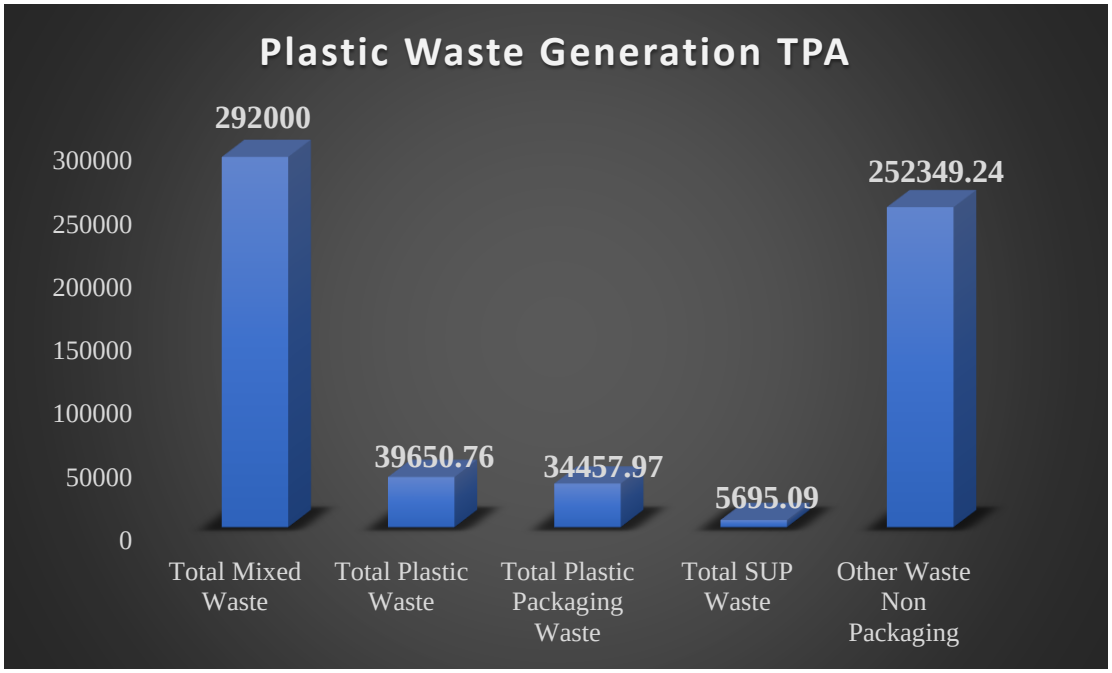
Annexure-I: Plastic Waste Generation Data

Annexure II: Single Use Plastic Generation Data

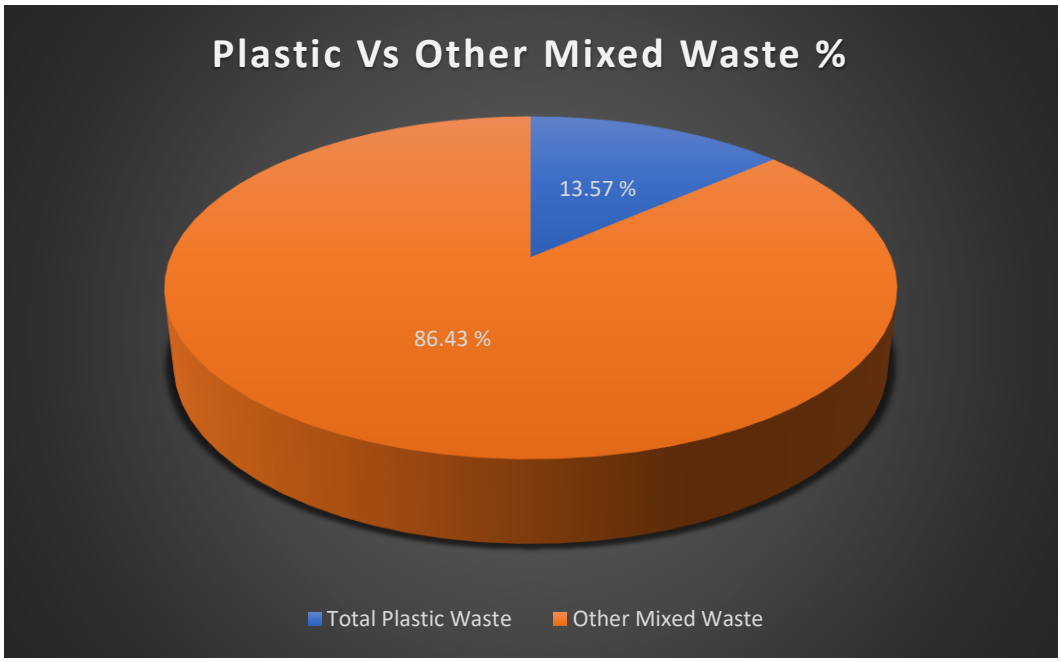
Annexure III: Plastic Waste Disposal Data

Annexure IV: Single Use Plastic Disposal Data

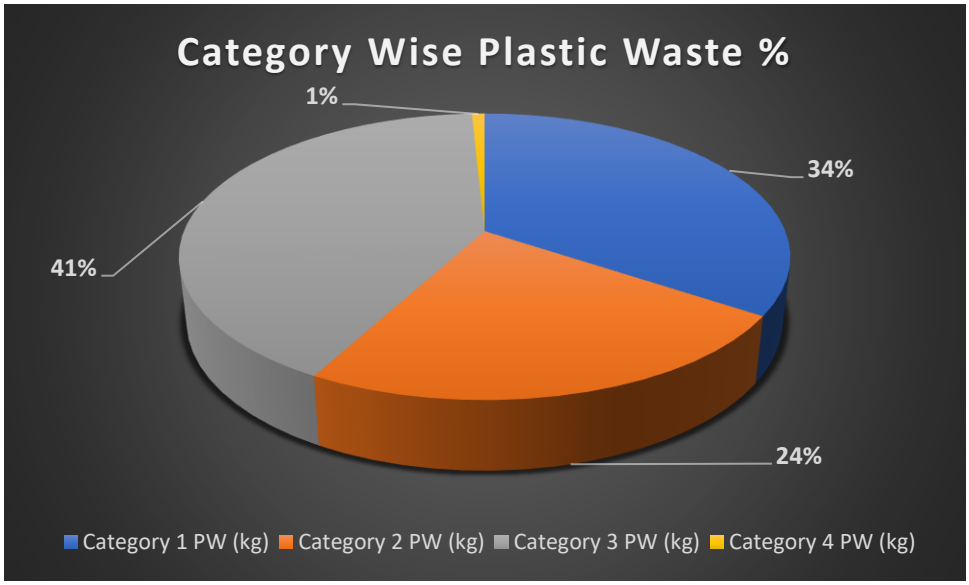
Plastic Waste Generation TPA



Plastic Vs Other Mixed Waste %



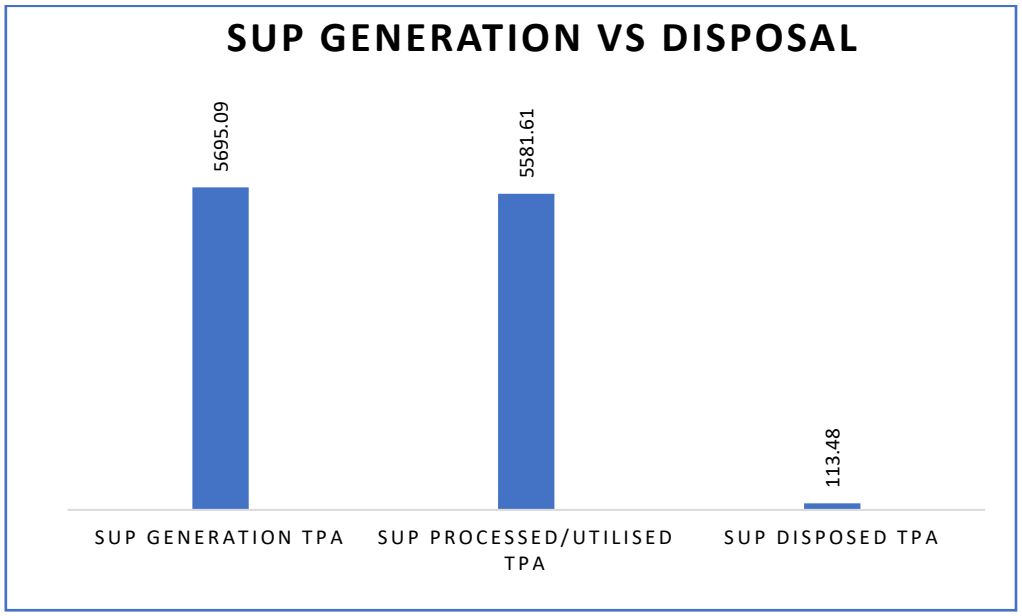
Category Wise Generated Plastic Waste %



% of Packaging Waste and SUP at Generation Point

Plastic Waste Utilisation

SUP Generation Vs Disposal Data



Photograph of Study

Characterisation Team at GTS

Preparation of Characterisation

Mixed Waste Sorting

Quartering & Coning of Mixed Waste

Quartering & Coning of Mixed Waste

Waste Characterisation at Disposal Site

Quartering & Coning at GTS & Disposal Site

Mixed Waste Sorting

Quantification of Category-I Plastic

Sample Preparation at Aadampur Dumping Site

Weighing of Sorted Plastic Waste

Central Pollution Control Board Regional Directorate Bhopal
Plastic Waste characterization at Generation points

Vehicle No	Date & Location	Area	Total Waste (Dry + Wet)	Sorting Sample Size (Kg)	Total Plastic Waste (Kg)	Category 1 PW (kg)	Category 2 PW (kg)	Category 3 PW (kg)	Category 4 PW (kg)
MP04-LD-0144	Danapani 05.08.2024	Zone-12 Ward 58	460	115	14.6	3.8	3.08	5.6	0.2
MP04-DB-1310		Zone-10 Ward 49	330	85	11.9	2.8	2.7	4.7	0.1
MP04-GB-3480		Zone-6 Ward 51	470	120	15.2	4.2	2.93	6.2	0.15
MP04-GB-3157		Zone-13 Ward 53	345	90	14.9	4.8	3	5.3	0
MP04-LD-0155		Zone-13 Ward 55	385	100	15.8	5.2	3.4	5.45	0.1
MP04-GB-3282		Zone-19 Ward 85	475	120	13.3	3.7	2.38	4.8	0
MP04-ZG-5178		Zone-10 Ward 49	355	90	12.5	3.6	2.89	4.5	0
MP04-GB-3258	Baba Nagar 06.08.2024	Zone-8 Ward 46	425	106	15.9	4.05	3.1	6.4	0.2
MP04-GB-3060		Kolar Road Zone-18	450	112	17.2	3.45	3.45	8.15	0.6
MP04-LD-6276		Kolar Road Zone-18	480	120	16.2	4.2	3.25	4.95	0.15
MP04-GB-3083		Zone-8 Ward 30	390	90	15.4	4.6	3	5.7	0
MP04-GB-4839		Zone-18 Ward 83	485	120	16.85	5.2	3.3	6.1	0.1
MP04-GB-3438		Zone-21 Ward 25	345	90	14.4	5	2.4	5.4	0.1
MP04-GB-4595		Zone-7 Ward 31	500	125	16	4.8	3.5	5.7	0.15
MP04-GB-4559	Bhadbhada 07.08.2024	Zone-8 Ward 27	315	80	11	3	2.55	4	0
MP04-GB-3057		Zone-6 Ward 47	405	110	13.5	4	2.5	4.85	0
MP04-LD-0126		Zone-8 Ward 29	415	110	14.45	4.6	3.3	5.3	0
MP04-LD-0388		Zone-21 Ward 24	355	90	12.3	3.2	2.9	4.7	0.1
MP04-GB-3156		Zone-8 Ward 28	460	120	15.7	4.5	2.8	5.8	0.15
MP04-LD-6280		Zone-21 Ward 32	490	120	13.6	3.8	3.3	4.8	0.1
MP04-GB-3316		Zone-7 Ward 31	420	105	14	4.7	2.5	5.2	0
MP04-LD0122	Shahjani Park 08.08.2024	Zone-5 Ward 22	575	140	17.2	5.6	3	6.3	0.2
MP04-GB-3165		Zone-7 Ward 34	560	130	14.2	4.2	3	4.9	0
MP04-LD-0141		Zone-11 Ward 41	460	115	12.9	3.85	2.5	4.4	0.1
MP04-LD-6290		Zone-11 Ward 70	585	150	16.4	4.55	2.9	5.9	0.15
MP04-ZG-4563		Zone-5 Ward 19	530	130	14.6	5.2	2.95	4.45	0.1
MP04-ZG-4535		Zone-7 Ward 35	500	125	16.3	4.4	3	6.2	0.15
MP04-LD-3276		Zone-7 Ward 33	440	110	13.8	4.1	3.05	4.2	0
MP04-LD-1456	Danapani & Bhadbhada 09.08.2024	Zone-21 Ward 32	355	90	15.3	3.9	4.6	5.2	0
MP04-GB-3190		Zone-8 Ward 30	420	100	14.8	5.1	2.75	4.95	0.15
MP04-LD-6286		Zone-10 Ward 45	400	100	15.4	6.3	3.35	4.25	0
MP04-LC-9659		Zone-12 Ward 59	405	100	16.7	5.7	3.65	5.3	0.2
MP04-GB-3369		Zone-7 Ward 33	485	120	17.8	6.2	3.4	5.8	0.15
MP04-ZG-4572		Zone-11 Ward 35	525	125	16.7	5.1	3.4	6.1	0.1
MP04-GB-2950		Zone-18 Ward 83	395	100	16.4	4.6	3.55	6.2	0.1
Total				3853	523.2	156	107.33	187.75	3.6

1	Average Quantity of Plastic waste Generated (Kg of plastic waste/kg of mixed waste) **Q1**	0.135790293
	Quantity of Mixed Waste generated in town TPA **Q**	292000
	Quantity of Plastic Waste Generation TPA **QT**=Q1*Q	39650.76564

2	Average Quantity of plastic packaging waste generated (Kg of plastic packaging waste/kg of mixed waste) Q2	0.118006748
	Quantity of Mixed Waste generated in town TPA **Q**	292000
	Quantity of Plastic Packaging Waste Generation TPA **Qpack**=Q2*Q	34457.97041

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Central Pollution Control Board Regional Directorate Bhopal
Plastic Waste characterization (SUP) at Generation points

	Vehicle Load No.	MP04-LD-0144	MP04-DB-1310	MP04-GB-3480	MP04-GB-3157	MP04-LD-0155	MP04-GB-3282	MP04-ZG-5178	MP04-GB-3258	MP04-GB-3060	MP04-LD-6276	MP04-GB-3083	MP04-GB-4839	MP04-GB-3438	MP04-GB-4595	MP04-GB-4559	MP04-GB-3057	MP04-LD-0126	MP04-LD-0388	MP04-GB-3156	MP04-LD-6280	MP04-GB-3316	MP04-LD0122	MP04-GB-3165	MP04-LD-0141	MP04-LD-6290	MP04-ZG-4563	MP04-ZG-4535	MP04-LD-3276	MP04-LD-1456	MP04-GB-3190	MP04-LD-6286	MP04-LC-9659	MP04-GB-3369	MP04-ZG-4572	MP04-GB-2950	Average Kg/Kg
	Sorting Sample Size (Kg)	115	85	120	90	100	120	90	106	112	120	90	120	90	125	80	110	110	90	120	120	105	140	130	115	150	130	125	110	90	100	100	100	120	125	100	
	Plastic Waste (Kg)	14.6	11.9	15.2	14.9	15.8	13.3	12.5	15.9	17.2	16.2	15.4	16.85	14.4	16	11	13.5	14.45	12.3	15.7	13.6	14	17.2	14.2	12.9	16.4	14.6	16.3	13.8	15.3	14.8	15.4	16.7	17.8	16.7	16.4	
	SUPs (Kg)																																				
Plastic Sticks	Earbuds	0.002	0	0	0.002	0	0.004	0	0	0	0.002	0	0.004	0	0	0	0.004	0	0	0.002	0	0	0.002	0	0	0.004	0	0	0.002	0	0	0	0.002	0	0.002	0	0.006	9.86244E-06
	Balloons	0	0	0	0.01	0	0	0	0	0.012	0	0	0	0	0	0	0.01	0	0	0.011	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0	0.012	1.687E-05
	Candy	0	0	0	0	0.015	0	0	0	0	0	0.014	0	0	0	0	0	0	0	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.14197E-05
	Ice Cream	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Straws	0.004	0	0	0.012	0	0	0	0.008	0	0	0	0	0.016	0	0	0	0.008	0	0.004	0	0.008	0	0	0	0	0.012	0	0	0	0	0	0.004	0	0	0	0.008	2.18012E-05
Cutlery Items	Plates	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0.15	0	0	0	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	9.08383E-05
	Cups	0.015	0	0	0	0	0	0	0	0	0.015	0	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0.016	0	0	0	0	0	0	0	0	0	0	1.45341E-05
	Glass	0.04	0.06	0	0	0.1	0	0.15	0	0.2	0	0	0	0.15	0	0	0.3	0	0	0	0.2	0	0	0	0	0.1	0	0.15	0	0	0	0.06	0	0	0.12	0	0.000423047
	Forks	0	0	0.012	0	0	0.014	0	0	0	0	0	0.015	0	0	0.012	0	0	0.015	0	0	0	0.012	0.013	0.014	0	0	0	0.013	0.011	0.014	0	0	0	0	0	3.7633E-05
	Spoons	0.01	0.012	0.015	0	0.012	0	0	0.01	0	0	0	0.02	0	0.01	0.016	0	0.01	0	0	0.01	0.02	0	0	0.008	0	0.012	0	0.028	0.016	0	0.008	0	0.01	0	0	5.89151E-05
	Knives	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Trays	0.025	0.01	0.016	0	0.01	0	0.02	0.016	0	0.02	0	0.025	0.01	0	0	0.025	0	0.016	0.015	0	0	0.024	0.01	0	0.02	0	0.015	0	0	0	0.012	0	0.025	0	0.01	0.015	8.79834E-05
Packaging /Wrapping Films	Sweet Box	0.1	0	0	0	0.2	0	0	0	0.1	0	0	0	0	0.2	0	0	0	0	0	0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000181677
	Invitaion Card	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cigarette Packets	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carry Bags	<120 microns	1.32	0.95	1.42	1.6	1.3	2.02	1.31	1.85	1.1	1.65	1.8	1.5	1.2	1.45	1.25	1.85	1.1	0.95	2.1	1.1	1.2	1.75	1.6	1.4	1.9	1.35	2.2	1.75	1.2	0.95	1.15	1.25	1.7	1.3	1.35	0.013202699
Plastic Sheets	<50 microns	0.5	0.3	0.75	0.4	0.8	0.85	0.75	0.9	0.6	0.9	0.8	0.5	0.3	0.9	0.25	0.6	0.3	0.3	0.7	0.4	0.6	0.3	0.5	0.7	0.6	0.45	0.8	0.65	0.8	0.35	0.35	0.4	0.85	0.8	0.65	0.005346483
Other Items	Plastic flags	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	PVC banners < 100 µm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	polystyrene for decoration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	2.016	1.332	2.213	2.024	2.537	2.888	2.23	2.784	2.012	2.587	2.614	2.064	1.676	2.71	1.528	2.789	1.418	1.281	2.832	1.835	1.828	2.088	2.123	2.122	2.624	1.94	3.175	2.443	2.027	1.326	1.574	1.675	2.562	2.23	2.041	

3	Average Quantity of SUP waste generated (SUP in Kg/Kg of mixed waste) **Q3**	0.019503763
	Quantity of Mixed Waste generated TPA	292000
	Quantity of SUP Waste generated TPA **QSUP**	5695.098884

4	Quantity of other (Non-Packaging waste)	252349.24

Central Pollution Control Board Regional Directorate Bhopal
Plastic Waste characterization at Disposal points

Vehicle Load No	Date	Area	Sorting Sample Size (Kg)	Total Plastic Waste (Kg)	Category 1 PW (kg)	Category 2 PW (kg)	Category 3 PW (kg)	Category 4 PW (kg)
1	05.08.2024	5 Garbage Transfer Point & Final Disposal Site at Aadampur	95	6.06	0.23	1.60	3.62	0.02
2			110	6.66	0.31	2.00	4.00	0.00
3	06.08.2024		115	6.56	0.27	1.77	3.69	0.01
4			110	5.75	0.15	1.73	3.62	0.02
5	07.08.2024		100	5.69	0.31	0.85	3.00	0.00
6			105	5.63	0.23	1.42	3.42	0.00
7	08.08.2024		115	5.69	0.31	0.50	3.35	0.01
8			120	6.50	0.54	2.31	3.88	0.02
9	09.08.2024		100	4.17	0.22	0.93	2.09	0.01
10			110	4.60	0.25	0.91	2.65	0.01
Total			1080	57.30	2.81	14.02	33.31	0.08

5	Average Quantity of Plastic waste Generated (Kg of plastic waste/kg of mixed waste) **Q1**d	0.053058862
	Quantity of Mixed Waste disposed in town TPA **Qd**	12775
	Quantity of Plastic Waste Disposed TPA **QTd**=Q1*Q	677.8269676

6	Average Quantity of plastic packaging waste disposed (Kg of plastic packaging waste/kg of mixed waste) Q2d	0.046499288
	Quantity of Mixed Waste disposed in town TPA **Qd**	12775
	Quantity of Plastic Packaging Waste disposed TPA **Qpackd**=Q2*Q	594.028401

8	Quantity of other (Non-Packaging waste) Disposed TPA **Qother D**	12097.17303

9	Quantity of Plastic waste utilised/processed TPA	38972.934

Central Pollution Control Board Regional Directorate Bhopal
Plastic Waste characterization (SUP) at Disposal points

		Vehicle Load No.1	Vehicle Load No.2	Vehicle Load No.3	Vehicle Load No.4	Vehicle Load No.5	Vehicle Load No.6	Vehicle Load No.7	Vehicle Load No.8	Vehicle Load No.9	Vehicle Load No.10	Average Kg/Kg of waste
	Sorting Sample Size (Kg)	95	110	115	110	100	105	115	120	100	110	
	Plastic Waste (Kg)	6.06	6.66	6.56	5.75	5.69	5.63	5.69	6.50	5.84	6.44	
	SUPs (Kg)											
Plastic Sticks	Earbuds	0	0	0	0	0	0	0	0	0	0	0
	Balloons	0	0	0	0	0	0	0	0	0	0	0
	Candy	0	0	0	0	0	0	0	0	0	0	0
	Ice Cream	0	0	0	0	0	0	0	0	0	0	0
	Straws	0.001	0	0.004	0	0	0	0	0.001	0	0	5.55556E-06
Cutlery Items	Plates	0	0	0	0	0	0	0	0	0	0	0
	Cups	0	0.005	0	0	0	0	0.006	0	0	0	1.01852E-05
	Glass	0.02	0	0	0.01	0	0	0.01	0	0	0	3.7037E-05
	Forks	0	0	0.004	0	0.006	0	0	0	0	0	9.25926E-06
	Spoons	0.004	0	0.007	0	0	0	0	0	0.004	0	1.38889E-05
	Knives	0	0	0	0	0	0	0	0	0	0	0
	Trays	0	0.005	0.01	0	0.008	0	0.015	0	0	0.004	3.88889E-05
Packaging /Wrapping Films	Sweet Box	0	0	0	0	0	0	0	0	0	0	0
	Invitaion Card	0	0	0	0	0	0	0	0	0	0	0
	Cigarette Packets	0	0	0	0	0	0	0	0	0	0	0
Carry Bags	<120 microns	0.32	0.1	0.3	0.3	2	0.3	2	0.4	1.1	1.65	0.007842593
Plastic Sheets	<50 microns	0.1	0.1	0	0.1	0.2	0.2	0.1	0.2	0	0	0.000925926
Other Items	Plastic flags	0	0	0	0	0	0	0	0	0	0	0
	PVC banners < 100 µm	0	0	0	0	0	0	0	0	0	0	0
	polystyrene for decoration	0	0	0	0	0	0	0	0	0	0	0
	Total	0.445	0.21	0.325	0.41	2.214	0.5	2.131	0.601	1.104	1.654	

7	Average Quantity of SUP waste at disposal (SUP in Kg/Kg of mixed waste) **Q3**d	0.008883333
	Quantity of Mixed Waste disposed TPA	12775
	Quantity of SUP Waste disposed TPA **QSUPd**	113.4845833

Report on Characterization and Assessment of Plastic Packaging Waste and SUPs in Kolkata

CENTRAL POLLUTION CONTROL BOARD
REGIONAL DIRECTORATE, KOLKATA

(AUGUST, 2024)

Contents

1. Introduction

The Plastic Waste Management (PWM) Rules of 2016, along with subsequent amendments, provide a comprehensive statutory framework for the effective management of plastic waste in India. Local bodies are required to assess the quantity of plastic waste generated within their jurisdictions and report this data annually to the State Pollution Control Boards (SPCBs) or Pollution Control Committees (PCCs).

To address the inconsistencies in plastic waste assessment methodologies across different regions, the Central Pollution Control Board (CPCB) has developed a Standard Operating Procedure (SOP) for plastic waste characterization and assessment. This SOP provides a standardized approach, ensuring accurate and consistent data collection and reporting across the country. The procedures outlined include sampling methods, waste characterization, data validation, and reporting guidelines, supporting better regulatory compliance and effective plastic waste management in India.

As part of the action plan for Plastic Waste Management, the Regional Directorates (RDs) are tasked with carrying out the characterization and assessment of plastic packaging waste and single-use plastics (SUPs) in one city within their jurisdiction, following the procedures outlined in the SOP.

In accordance with these directives, the Regional Directorate, Kolkata conducted the characterization and assessment of plastic packaging waste within the Kolkata Municipal Corporation (KMC) area. The Dhapa landfill site was designated as the disposal point, and 18 Wards under the KMC, whose waste is disposed of at the Dhapa landfill site, were selected as the generation points for this study. The study was carried out during 23.08.2024 to 30.08.2024 and KMC alongwith WBPCB also participated actively in the study.

2. Actions Taken for initiation of study

Upon receiving communication from Central Pollution Control Board, Delhi regarding characterization and assessment of plastic packaging waste vide their letter no. CP-20/117/2021-UPC-II-HO-CPCB-HO-Part (7) dated 03.07.2024, several key actions were undertaken to initiate and carry out this study:

- 15.07.2024: A letter was sent by CPCB RD Kolkata to West Bengal Pollution Control Board (WBPCB) requesting for coordination with the study.
- 05.08.2024: A meeting was held at the State Urban Development Agency (SUDA) with officials from SUDA, KMC, and WBPCB to request these concerned authorities for their valuable cooperation in carrying out the study.
- 07.08.2024: A follow-up meeting was conducted at WBPCB with officials from WBPCB, SUDA and KMC. During this meeting, CPCB presented a brief overview along with methodology of the study and discussed the future plan of action.
- 08.08.2024: A letter was sent to Chief Municipal Engineer, KMC requesting for ‘Sample Plan Location Distribution’ and necessary arrangements for the study.

- 12.08.2024: CPCB, WBPCB, and KMC officials conducted a field visit to assess the availability of on ground logistics and identify additional requirements for the study.
- 20.08.2024: In a meeting held at KMC; CPCB and KMC officials decided the sampling locations based on their socioeconomic status and finalized the corresponding dates for sampling of those locations. Accordingly, the study was commenced on 23.08.2024.

3. Study Area: Kolkata Municipal Corporation

Kolkata is the capital city of West Bengal. Kolkata Municipal Corporation comprises of 16 Boroughs divided into 144 Wards. According to its District Environment Plan 2021, Kolkata generates 4500 MT of solid waste per day, of which 217 TPD is plastic waste.

For our study, 18 Wards under the KMC were distributed across four zones i.e. North, South, East, and West, based on their geographic locations. KMC further provided the socioeconomic categorization of each these Wards, which was essential for the study. Solid waste generated from 18 wards is around 19,50,30.58 TPA and disposed at Dhapa landfill. Dhapa landfill is situated in the Eastern side of Kolkata i.e. in Ward No. 57 under Borough No. VII). The selected Wards are highlighted in the below provided figure.

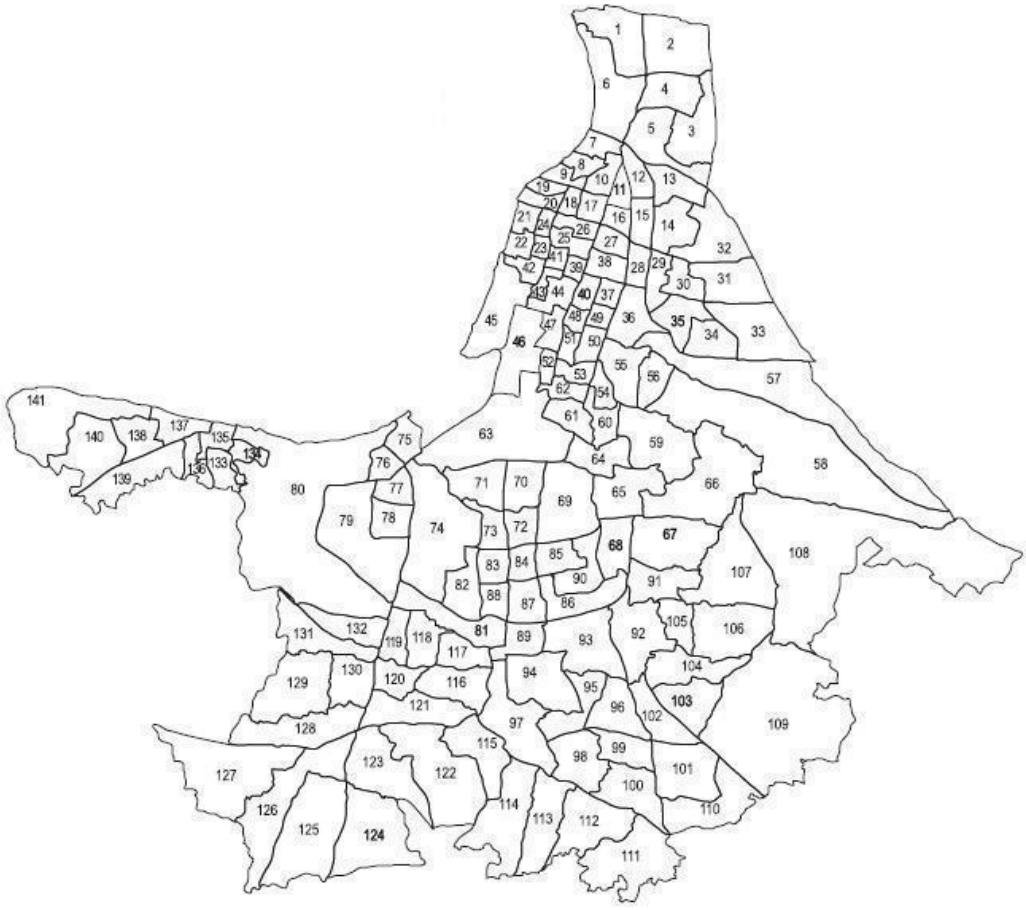

Fig: Wards of Kolkata Municipal Corporation

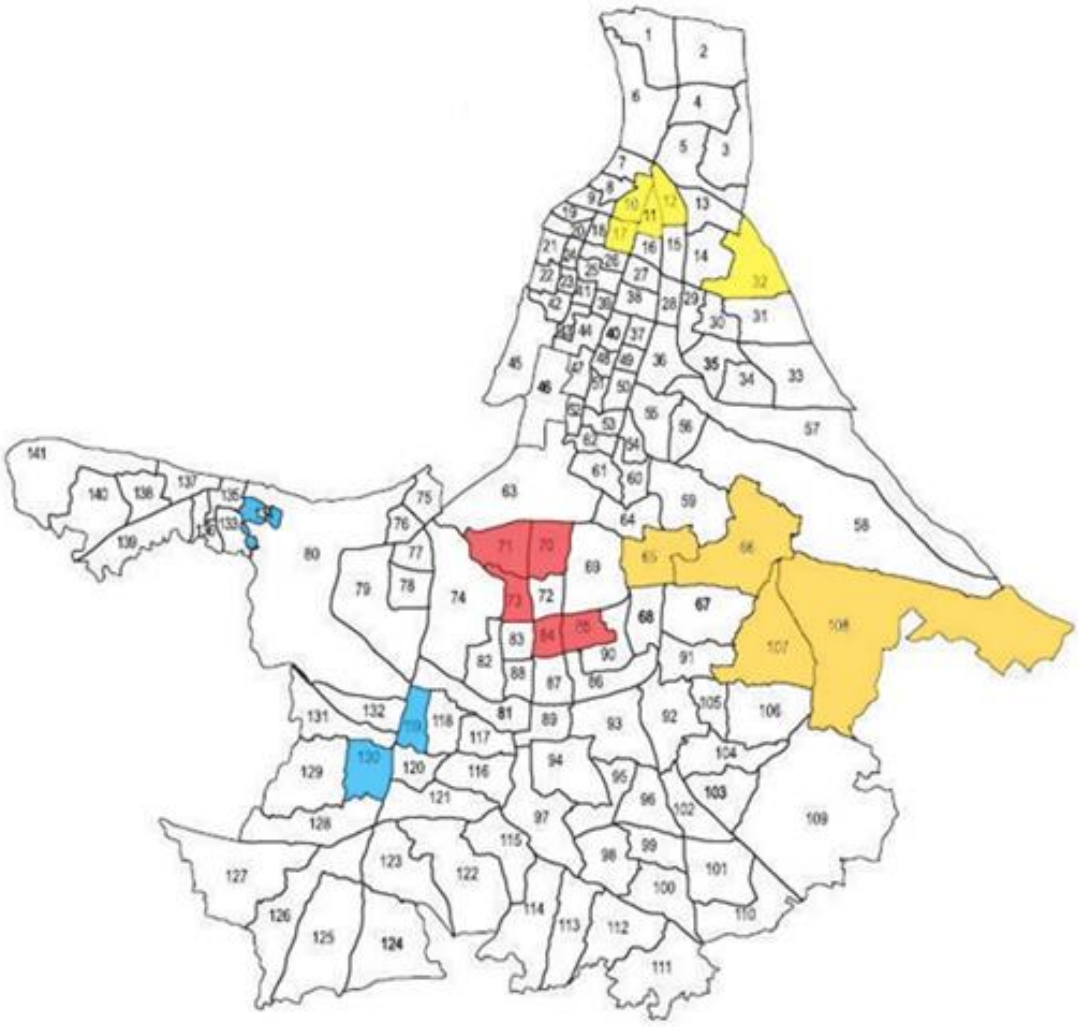

Fig: Wards selected for the study

	North Kolkata
	South Kolkata
	East Kolkata
	West Kolkata

3.1 Ward-wise Waste Generation and Disposal (as per information provided by KMC)

Sl. No.	Location	Ward No.	Total waste (Wet+Dry) generated (TPA)	Total waste (Wet+Dry) disposed (TPA)
1.	North Kolkata	12	2893.53	2893.53
		32	15504.75	15504.75
		10	4453.77	4453.77
		11	5248.88	5248.88
		17	4362.34	4362.34
2.	South Kolkata	84	7536.37	7536.37
		70	6585.36	6585.36
		71	7919.89	7919.89
		85	3095.95	3095.95
		73	7008.08	7008.08
3.	East Kolkata	107	28670.73	28670.73
		65	19011.02	19011.02
		108	19763.04	19763.04
		66	44754.03	44754.03
4.	West Kolkata	144	2757.37	2757.37
		119	2532.67	2532.67
		134	6267.44	6267.44
		130	6665.36	6665.36
		Total	195030.58	195030.58

3.2 Sampling Location Distribution

Considering categories to be covered as per SOP, these below-mentioned 18 Wards were selected to cover all the categories such as MI, EWS, CW, MX. These Wards were suggested by KMC considering ease of vehicle movement and sample collection for the study.

Table 1: Sampling Wards and schedule

		North Kolkata		South Kolkata		East Kolkata		West Kolkata		Total sampling point
Date	Day	Category	Location	Category	Location	Category	Location	Category	Location	
23.08.2024	1	MI	Borough 2, Ward 12	EWS	Borough 8, Ward 84	CW	Borough 12, Ward 107	MX	Borough 16, Ward 144	4+4
24.08.2024	2	EWS	Borough 3 , Ward 32	CW	Borough 8, Ward 70& 71	MX	Borough 7, Ward 65	MI	Borough 13, Ward 119	4+4
27.08.2024	3	CW	Borough 2, Ward 10& 11	MX	Borough 8, Ward 85	MI	Borough 7, Ward 108	EWS	Borough 15, Ward 134	4+4
28.08.2024	4	MX	Borough 2 , Ward 17	MI	Borough 9, Ward 73	EWS	Borough 7, Ward 66	CW	Borough 14, Ward 130	4+4
29.08.2024	5	-	-	CW	Borough 8, Ward 70& 71	CW	Borough 12, Ward 107	MX	Borough 16, Ward 144	3+4
30.08.2024	6	EWS	Borough 3 , Ward 32	-	-	-	-	MI	Borough 13, Ward 119	2+4

Key:
- MI: Middle Income
- EWS: Economically Weaker Section
- CW: Commercial Wards
- MX: Mixed

4. Methodology

The sampling of mixed waste at the Dhapa landfill was conducted from 23rd August to 30th August 2024 in the presence of officials from the CPCB and KMC. Prior to the commencement of the study, KMC personnel involved in on-site segregation were thoroughly briefed to ensure the study adhered to the SOP. However, it is important to note that heavy to moderate rainfall on three out of the six sampling days may have slightly added to the weight of the waste, as characterization had to be carried out in an open area.

Waste collected from the respective Wards was delivered to their designated Compactor Stations. Each day, 200 to 400 kg of mixed waste (depending on availability) from the selected Wards was sampled to assess and characterize plastic waste at the generation point. However, the compactor stations also received mixed waste from other Wards which were not part of this study. After compaction at the stations, the waste was transferred to the Dhapa landfill site vide tipper trucks arranged by the KMC as per requirement of sampling as mentioned in the SOP. From the waste sent at the landfill site, 200 to 400 kg was sampled to assess and characterize plastic waste at the disposal point.

Characterization was carried out by reducing the sample size to 100 to 150 kg using the coning and quartering method as outlined in the SOP. Plastics were then manually segregated from the reduced sample, and the weights of total plastic waste and each category of plastic waste, including SUPs, were recorded.

Pic: Collection of waste by Kolkata Municipal Corporation at Ward level

Pic: Coning of waste before reduction

Pic: Quartering of waste for reduction

Pic: Segregation of waste as per category

Pic: Weighing of segregated waste

5. Conclusion

The study provides a summarized account of plastic waste generation, disposal, and processing in Kolkata, highlighting the probable scale of plastic waste management in the region.

As per Annual Reports of 2020-21 on Solid Waste and Plastic Waste published by CPCB, percentage of plastic waste generated in West Bengal is approximately 0.08% of solid waste generated. As per 'District Environment Plan 2021' of Kolkata, percentage of plastic waste generated is approximately 0.05% of solid waste generated.

From the above study of 18 Wards under KMC and about 9560 Kg of municipal solid waste at generation point and 13165 Kg at disposal point were assessed over the 6 days period at an average of 1,643.33 Kg per day of solid waste from generation point and 2,194.16 Kg per day of solid waste from disposal point.

It is observed that 249 Kg of plastic waste from solid waste of generation point and 261.83 Kg of plastic waste from solid waste of disposal point were segregated out of the total waste of 9560 Kg of generation point and 13165 Kg of disposal point respectively. Thus, plastic waste is found to be around 0.03% of total solid waste for generation point and 0.02% of total solid waste for disposal point respectively. SUPs are found to be 157.92 Kg out of total plastic waste at generation point and 161.46 kg out of total plastic waste at disposal point. Considering the category of plastic waste w.r.t generation point; Cat-I is 1.85%, Cat-II is 6.37% and Cat-III is 3.45% out of the total plastic waste. For disposal point; Cat-I is 1.09%, Cat-II is 5.79% and Cat-III is 3.87% out of the total plastic waste. Variation of quantities segregated w.r.t generation and disposal point is around 0.5%. Maximum quantity is for Category-II i.e. flexible plastics.

Details of characterization and assessment of plastic waste in the selected Wards of KMC are provided in Annexure - I.

Photographs taken on each day of the study are also attached as Annexure - II.

6. Annexure – I

6.1 Table 2A: Plastic Waste Characterization at Generation Point

Vehicle Load No.	Sorting Sample Size (Kg)	Total PW (kg)	Category 1 PW (Kg)	Category 2 PW (Kg)	Category 3 PW (Kg)	Category 4 PW (Kg)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	115	13.97	0.9	9.5	3.56	0.0
2	115	10.2	0.68	6.74	2.72	0.0
3	65	13.0	3.2	9.23	0.57	0.0
4	55	8.34	1.83	3.85	2.65	0.0
5	76	19.01	7.16	8.06	3.78	0.0
6	115	10.8	1.4	7.2	2.2	0.0
7	81	18.26	2.25	11.08	4.92	0.009
8	142	17.02	1.9	9.97	5.15	0.0
9	110	7.32	0.99	3.87	2.45	0.0
10	110	13.4	2.7	7.3	3.4	0.0
11	115	12.0	2.8	5.6	3.6	0.0
12	117	15.3	0.78	9.58	4.93	0.0
13	110	19.66	1.21	9.56	8.88	0.0
14	62	5.32	1.72	2.0	1.6	0.0
15	105	11.4	1.0	8.4	2.0	0.0
16	92	6.6	1.0	4.0	1.6	0.0
17	0.0	0.0	0.0	0.0	0.0	0.0
18	110	9.05	1.1	4.35	3.6	0.0
19	110	8.86	1.62	2.24	5.0	0.0
20	90	10.16	2.21	5.04	2.91	0.0
21	100	8.3	1.07	2.36	4.87	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0
24	120	10.8	2.0	5.6	3.2	0.0
Total	2115	248.77	39.52	135.53	73.59	0.009

6.2 Table 2B: Plastic Waste Characterization at Disposal Point

Vehicle Load No.	Sorting Sample Size (Kg)	Total PW (kg)	Category 1 PW (Kg)	Category 2 PW (Kg)	Category 3 PW (Kg)	Category 4 PW (Kg)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	122	14.27	1.59	8.92	3.74	0.0
2	145	14.37	1.47	8.56	4.45	0.0
3	135	10.05	0.69	5.89	3.46	0.0
4	108	10.68	0.0	6.52	4.15	0.0
5	105	16.27	2.0	8.43	5.84	0.0
6	85	11.5	1.56	6.22	3.72	0.0
7	137	10.77	0.23	5.79	4.74	0.0
8	71	13.56	1.23	7.86	4.46	0.0
9	76	15.3	1.82	7.06	6.4	0.0
10	74	6.3	1.0	3.0	2.3	0.0
11	125	10.16	0.5	5.0	4.66	0.0
12	86	14.24	1.1	9.14	4.0	0.0
13	132	14.61	0.31	8.83	5.47	0.0
14	135	11.65	0.8	5.5	5.35	0.0
15	132	15.86	1.4	7.96	6.5	0.0
16	105	8.23	0.87	4.17	3.19	0.0
17	85	5.2	1.2	2.5	1.5	0.0
18	78	11.4	1.3	5.6	4.5	0.0
19	90	7.95	1.02	4.2	2.7	0.02
20	120	12.88	2.78	5.2	4.9	0.0
21	78	3.28	0.58	1.5	1.2	0.0
22	68	5.3	0.5	3.3	1.5	0.0
23	72	7.4	1.05	3.87	2.47	0.0
24	70	10.6	1.6	5.8	3.2	0.0
Total	2434	261.83	26.60	140.82	94.27	0.02

6.3 Table 3A: Characterization of Single Use Plastics (SUPs) at Generation Point

			Vehicle Load No.	Vehicle Load No.1	Vehicle Load No.2	Vehicle Load No.3	Vehicle Load No.4	Vehicle Load No.5	Vehicle Load No.6	Vehicle Load No.7	Vehicle Load No.8	Vehicle Load No.9	Vehicle Load No.10	Vehicle Load No.11
1		a	Sorting sample size (Kg)	115	115	65	55	76	115	81	142	110	110	115
		b	Plastic waste (Kg)	13.97	10.2	13.0	8.34	19.01	10.8	18.26	17.02	7.32	13.4	12.0
			SUPs											
2	Plastic Stick	a	Ear buds (Kg)	0	0	0	0	0	0	0	0	0	0	0
		b	Balloons (Kg)	0	0	0	0	0	0	0	0	0	0	0
		c	Candy (kg)	0	0	0	0	0	0	0	0	0	0	0
		d	Ice Cream(kg)	0	0	0	0	0	0	0	0	0	0	0
		e	Straws (Kg)	0	0	0.44	0	0	0.008	0	0.004	0	0	0
3	Cutlery Item	a	Plates (Kg)	0	0	0	0.098	0.026	0.085	0	0	0.145	0.124	0.017
		b	Cups (Kg)	0.224	0.04	0	0.026	0	0.045	0.044	0.6	0.088	0.277	0.221
		c	Glass (Kg)	0.075	0	0.038	0	0.015	0.114	0.05	0.047	0.07	0.046	0.028
		d	Forks (Kg)	0	0	0	0	0	0	0	0	0	0.057	0
		e	Spoons (Kg)	0.004	0	0.025	0	0	0.025	0	0.01	0.018	0.067	0.002
		f	Knives (Kg)	0	0	0	0	0	0	0	0	0	0	0
		g	Trays (Kg)	0	0.29	0	0	0.01	0.098	0	2.2	0.042	0.151	0.339
4	Packaging / Wrapping Films	a	Sweet box (Kg)	0	0	0	0.092	0	0	0.272	0.8	0.059	0.105	0.135
		b	Invitation Cards(Kg)	0	0	0	0	0	0	0.272	0	0.059	0.105	0.135
		c	Cigarette Packets (Kg)	0	0.02	0	0	0.042	0	0	0.56	0.051	0.31	0.101

5	Carry bags	a	<120 microns (Kg)	9.0	6.74	9.23	3.55	8.06	7.2	11.08	9.97	3.87	7.3	5.6
6	Plastic sheets	a	<50 microns (Kg)	0	0	0	2	0	0	0	0.37	0	0	0
7	Other Items	a	Plastics flags (Kg)	0	0	0	0	0	0	0	0	0	0	0
		b	PVC banners <100µm (Kg)	0	0	0	0	0	0	0	0	0	0	0
		c	Polystyrene for decoration (Kg)	0	0	0	0	0.68	0	0	0.134	0.076	0.12	0
			Total	9.303	7.09	9.733	5.766	8.833	7.575	11.718	14.695	4.478	8.662	6.578

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Vehicle Load No.12	Vehicle Load No.13	Vehicle Load No.14	Vehicle Load No.15	Vehicle Load No.16	Vehicle Load No.17	Vehicle Load No18	Vehicle Load No.19	Vehicle Load No.20	Vehicle Load No.21	Vehicle Load No.22	Vehicle Load No.23	Vehicle Load No.24	Total	Average Kg/kg of Waste
117	110	62	105	92	0	110	110	90	100	0	0	120	2115	
15.3	19.66	5.32	11.4	6.6	0	9.05	8.86	10.16	8.3	0.0	0.0	10.8	248.77	0.1177
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00000
0	0.018	0	0	0.009	0	0.003	0.002	0.001	0.033	0	0	0.003	0.521	0.00025
0	0.39	0	0.004	0	0	0	0	0	0	0	0	0.094	0.983	0.00046
0.046	0.082	0.174	0.04	0.082	0	0.258	0.21	0.13	0.17	0	0	0.104	2.861	0.00135
0.061	1	0.006	0.07	0.036	0	0.06	0.15	0.06	0.16	0	0	0.061	2.147	0.00102
0	0	0	0	0	0	0.002	0	0	0.014	0	0	0.002	0.075	0.00004
0.01	0.035	0	0.003	0.014	0	0	0.02	0.002	0	0	0	0.009	0.244	0.00012
0	0	0	0	0	0	0.1	0.02	0	0	0	0	0	0.12	0.00006
0.018	0.206	0.134	0.339	0.208	0	0.5	0.072	0.03	0	0	0	0.208	4.845	0.00229
0.137	0.103	0.03	0.18	0.05	0	0.5	0.108	0	0	0	0	0.12	2.691	0.00127
0.137	0.4	0.03	0.165	0.05	0	0.148	0.106	0	0	0	0	0.15	1.757	0.00083
0.099	0.7	0.105	0.106	0.03	0	4.35	0.158	0.063	0.026	0	0	0.05	6.771	0.00320
9.58	9.66	2	8.4	4	0	0	2.24	5.04	2.36	0	0	5.6	130.48	0.06169

0	0	0	0	0	0	0	0	0	0	0	0	0	2.37	0.00112
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00000
0.307	0.035	0.039	0.006	0.204	0	0.081	0.37	0.01	0	0	0	0	2.062	0.00097
10.395	12.629	2.518	9.313	4.683	0	6.002	3.456	5.336	2.763	0	0	6.401	157.927	0.07467

6.4 Table 3B: Characterization of Single Use Plastics (SUPs) at Disposal Point

			Vehicle Load No.	Vehicle Load No.1	Vehicle Load No.2	Vehicle Load No.3	Vehicle Load No.4	Vehicle Load No.5	Vehicle Load No.6	Vehicle Load No.7	Vehicle Load No.8	Vehicle Load No.9	Vehicle Load No.10	Vehicle Load No.11
1		a	Sorting sample size (Kg)	122	145	135	108	105	85	137	71	76	74	125
		b	Plastic waste (Kg)	14.27	14.37	10.05	10.68	16.27	11.5	10.77	13.56	15.3	6.3	10.16
			SUPs											
2	Plastic Stick	a	Ear buds (Kg)	0	0	0	0	0	0	0	0	0	0	0
		b	Balloons (Kg)	0	0	0	0	0	0	0	0	0	0	0
		c	Candy (kg)	0	0	0	0	0	0	0	0	0	0	0
		d	Ice Cream(kg)	0	0	0	0	0	0	0	0	0	0	0.004
		e	Straws (Kg)	0	0	0.033	0	0.002	0	0	0.009	0.043	0	0
3	Cutlery Item	a	Plates (Kg)	0	0	0	0	0.059	0.102	0.488	0.012	0	0.2	0
		b	Cups (Kg)	0.03	0.106	0.236	0.099	0.04	0.068	0.079	0.006	0	0.114	0.019
		c	Glass (Kg)	0.333	0.15	0	0	0.17	0	0.067	0.008	0.1	0.137	0.011
		d	Forks (Kg)	0	0.01	0	0	0	0	0	0	0	0	0
		e	Spoons (Kg)	0.025	0.01	0.002	0	0.019	0.057	0.002	0	0.024	0.012	0
		f	Knives (Kg)	0	0	0	0	0	0	0	0	0	0	0
		g	Trays (Kg)	0.074	0	0	0.34	0.162	0.067	0	0.015	0.7	0.3	0.085
4	Packaging / Wrapping Films	a	Sweet box (Kg)	0	0.178	0	0.12	0	0	0.128	0	0.11		1.35
		b	Invitation Cards (Kg)	0	0	0	0	0	0	0.128	0	0.11	0	1.35
		c	Cigarette Packets (Kg)	0	0	0.052	0	0	0	0.133	0.012	0.049	0.092	0.134

5	Carry bags	a	<120 microns (Kg)	8.929	8.76	5.89	6.52	8.43	6.22	5.81	7.86	7.03	3	5
6	Plastic sheets	a	<50 microns (Kg)	0	0	0	0	0	0	0	0.12	0	0	0
			Total	9.391	9.214	6.213	7.079	8.882	6.514	6.835	8.042	8.166	3.855	7.953

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Vehicle Load No.12	Vehicle Load No.13	Vehicle Load No.14	Vehicle Load No.15	Vehicle Load No.16	Vehicle Load No.17	Vehicle Load No18	Vehicle Load No.19	Vehicle Load No.20	Vehicle Load No.21	Vehicle Load No.22	Vehicle Load No.23	Vehicle Load No.24	Total	Average Kg/kg of Waste
86	132	135	132	105	85	78	90	120	78	68	72	70	2434	
14.24	14.61	11.65	15.86	8.23	5.2	11.4	7.95	12.88	3.28	5.3	7.4	10.6	261.83	0.1076
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00000
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00000
0	0	0	0	0	0	0	0	0	0	0	0	0	0.004	0.00000
0	0	0.002	0	0.014	0.001	0	0.002	0.002	0.007	0	0	0	0.115	0.00005
0	0	0	0	0.015		0.005	0.071	0.141	0.095	0	0	0	1.188	0.00049
0.09	0	0.177	0.156	0.12	0	0	0	0.29	0.085	0.2	0.145	0.176	2.236	0.00092
0.03	1.001	0.15	0.18	0.05	0.6	0.1	0.037	0.032	0.02	0.01	0.02	0.04	3.246	0.00133
0	0	0	0	0	0	0.08	0	0	0	0	0	0	0.09	0.00004
0.014	0.035	0.02	0.002	0.007	0.002	0.085	0	0.004	0	0.037	0.01	0	0.367	0.00015
0	0	0	0	0	0	0	0.028	0	0	0	0	0	0.028	0.00001
0.094	0.211	0.018	0	0	0.2	0.44	0.141	0.02		0.064	0.09	0.211	3.232	0.00133
0.121	0	0.211	0.2	0.09	0.075	0.15	0.105	0.15	0.1	0.1	0.2	0.19	3.578	0.00147
0.121	0	0.211	0.25	0	0.075	0.15	0.12	0.15	0.1	0.12	0.3	1.1	4.285	0.00176
0.065	0.018	0.192	0.118	0.122	0.1	0.091	0.07	0.038	0.01	0.014	0.03	0.07	1.41	0.00058
9.14	8.83	5.5	7.96	4.17	2.5	5.6	4.2	5.2	1.5	3.3	3.87	5.8	141.02	0.05794

0	0	0	0	0.042	0	0	0.5	0	0	0	0	0	0.662	0.00027
9.675	10.1	6.481	8.866	4.63	3.553	6.701	5.274	6.027	1.917	3.845	4.665	7.587	161.46	0.06634

6.5 Assessment of Plastic Waste

I. Quantity of Plastic Waste Generation

• Average quantity of plastic waste generated (kg of plastic waste/ kg of mixed waste)
Q1= (ΣColumn 3) / (ΣColumn 2) = (249 / 2115) = 0.1177

• Considering Quantity of Mixed Waste generated in the town (TPA) (Q) = 1,95,030.85 Tons per Annum

• Quantity of Plastic Waste Generated (TPA) (Q_T) = Q1*Q
= 1,95,030.85 x (249 / 2115)
= 22,961.08 Tons per Annum

II. Quantity of Plastic Packaging Waste Generation

• Average quantity of plastic packaging waste generated (kg of plastic packaging waste / kg of mixed waste)
Q2 = (Σ (Column 4) +Σ (Column 5) +Σ (Column 6) + Σ (Column 7)) / (Σ (Column 2))
= (39.52 + 135.53 + 73.59 + 0.009) / 2115 = 248.65 / 2115
= 0.1175

• Quantity of Mixed Waste generated (TPA) = 1,95,030.85 Tons per Annum

• Quantity of Plastic Packaging Waste Generated (Q_{pack}) (TPA)
= (0.1175 x 1,95,030.85)
= 22,928.71 Tons per Annum

III. Quantity of SUP Waste Generation

• Average quantity of SUP waste generated (SUP in kg / kg of mixed waste)
Q3 = (Σ (Row 2a… 7c) / (Σ (Row 1a)
Q3 =157.93/2115 = 0.0746

• Quantity of Mixed Waste generated (TPA) = 1,95,030.85 Tons per Annum

• Quantity of Plastic Packaging Waste Generated (TPA) (Q_{SUP}) = Q3*Q
= 14,563.23 Tons per Annum

IV. Quantity of Other (Non-packaging waste)

$Q_{other} = Q_T - Q_{pack}$ = 22,961.08 – 22,928.71
= 32.37 Tons per Annum

V. Quantity of Plastic Waste Disposed

• Average quantity of plastic waste generated (kg of plastic waste/ kg of mixed waste)

$Q1_d$ = (Σ Column 3) / (Σ Column 2)

OR

$Q1_d$ = (Σ Row 1b) / (Σ Row 1a) = (261.83 / 2434) = 0.1076

• Considering Quantity of Mixed Waste Disposed (TPA) (Q_D)= 1,95,030.85 Tons per Annum

• Quantity of Plastic Waste Disposed (TPA) (Q_{TD}) = $Q1_d$*Q_D
= 1,95,030.85 x (261.83 / 2434)
= 20,979.84 Tons per Annum

VI. Quantity of Plastic Packaging Waste Disposed

• Average quantity of plastic packaging waste Disposed (kg of plastic packaging waste / kg of mixed waste)

$Q2_d$ = (Σ (Column 4) +Σ (Column 5) +Σ (Column 6) + Σ (Column 7)) / (Σ (Column 2))
= (26.60 + 140.82 + 94.27 + 0.02) / 2434
= 261.71 / 2434
= 0.1075

• Quantity of Mixed Waste Disposed (TPA) Q_D = 1,95,030.85

• Quantity of Plastic Packaging Waste Disposed ($Q_{pack\ D}$) (TPA) = $Q2_d$*Q_D
= 20,970.22 Tonnes per Annum

VII. Quantity of SUP Waste at Disposal

• Average quantity of SUP waste at Disposal (SUP in kg / kg of mixed waste)

$Q3_d$ = (Σ (Row 2a… 7c) / (Σ (Row 1a) = 161.46/2434 = 0.0663

• Quantity of Mixed Waste Disposed (TPA) = 1,95,030.85 Tons per Annum

• Quantity of SUP Waste Disposed (TPA) (Q_{SUP}) D = $Q3_d$*Q_D
= 0.0663 x 1,95,030.85 = 12,937.42 Tons per Annum

VIII. Quantity of Other (Non-packaging waste) Disposed

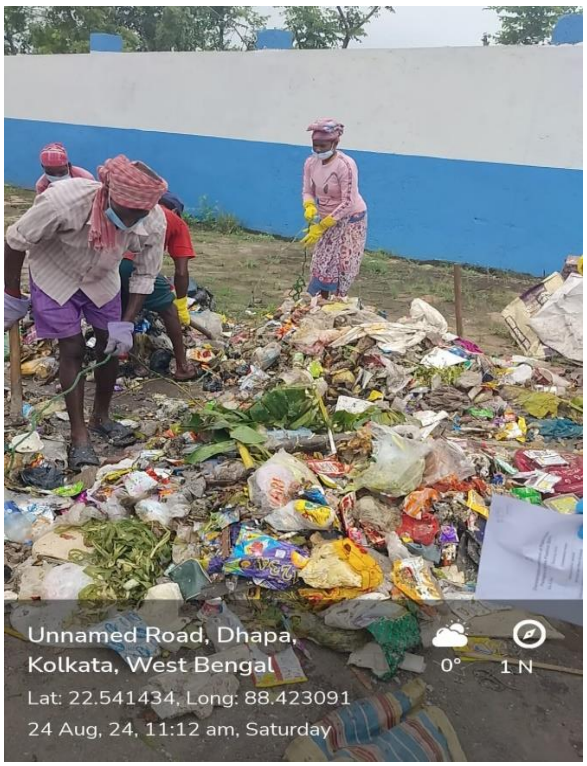
$Q_{other\ D}$ = Q_{TD} - $Q_{pack\ D}$ = 20,979.84 – 20,970.22 = 9.62 Tons per Annum

7. Annexure – II

Day-1 at Generation Point

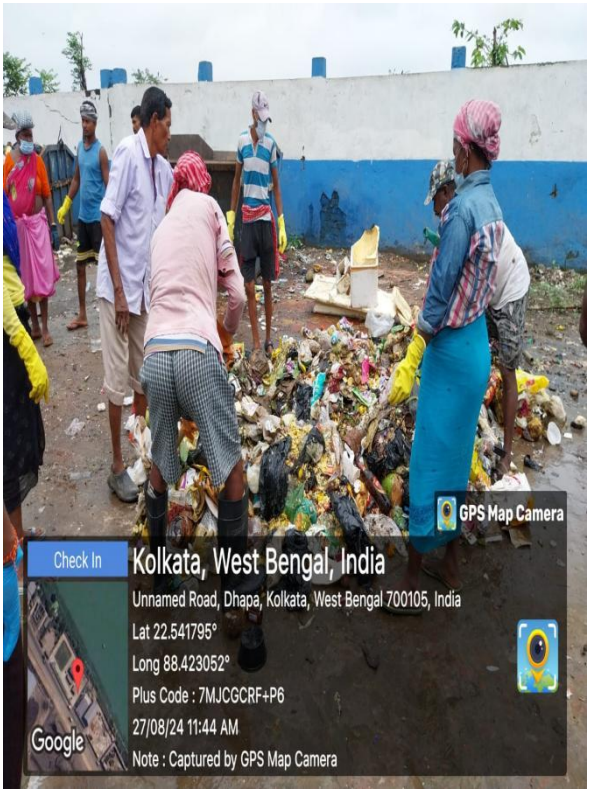
Day-1 at Disposal Point

Day-2 at Generation Point



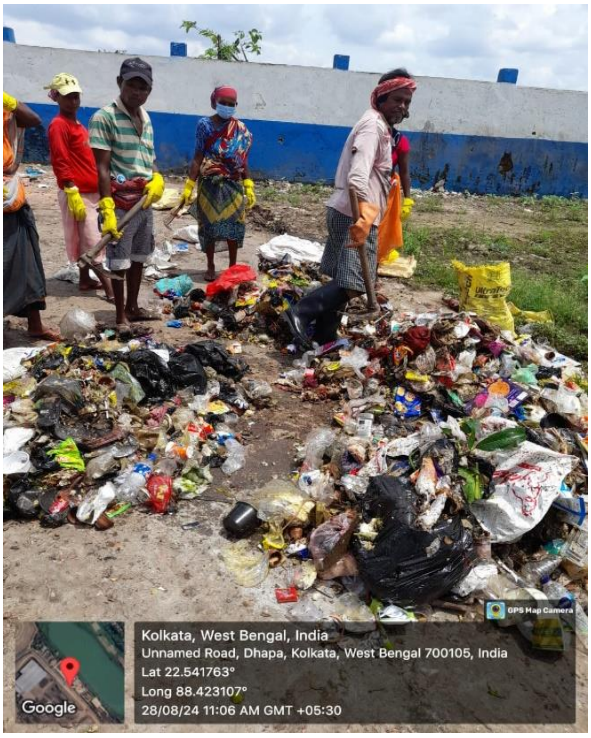
Day-2 at Disposal Point

Day-3 at Generation Point



Day-3 at Disposal Point

Day-4 at Generation Point



Day-4 at Disposal Point

Day-5 at Generation Point

Day-5 at Disposal Point

Day-6 at Generation Point

Day-6 at Disposal Point

CPCB Officials with waste segregation personnel of KMC

Waste segregation personnel of KMC

Dhapa Landfill site office

REPORT ON ASSESSMENT & CHARACTERIZATION OF PLASTIC WASTE AT SHILLONG MUNICIPALITY

REGIONAL DIRECTORATE (NORTH-EAST)

CENTRAL POLLUTION CONTROL BOARD

CTO BUILDING, SHILLONG-793004

CONTRIBUTIONS

Overall Coordination & Implementation
M.K. Choudhury, Regional Director Anil C. Ranveer, Additional Director
Team Members
Arnab Mandal, Scientist-B Rakesh Basumatary, SSA Ananda Kumar Ngangom, SSA Rajesh Kumar Barik, SSA Mangal Murmu, FA Dr. W.J. Kharbhih, SRF Humbleman L. Mawphlang, OA(S)

Introduction:

The Plastic Waste Management (PWM) Rules of 2016 along with subsequent amendments, laid out a statutory framework for effective plastic waste management in the country. As per the provision of PWM Rules, the local bodies are required to assess the quantum of plastic waste generated in their jurisdiction and report the same in the Annual Report to be submitted to the concerned State Pollution Control Boards (SPCBs)/ Pollution Control Committees (PCCs), which in turn compiles the same and submits it to Central Pollution Control Board (CPCB). In this regard, CPCB has prepared Standard Operating Procedure (SOP) for the characterisation & assessment of Plastic Waste incorporating the provision of PWM Rules.

Further, as per the action plan for Plastic Waste Management prepared in accordance with the directions given during the PAC meeting at CPCB Delhi, Regional Directorates of CPCB are required to carry out the characterization and assessment of plastic packaging waste and SUPs in one city as per the procedure delineated in the SOP. In this Regard, Regional Directorate (North-East), CPCB, Shillong has conducted the characterisation and assessment of plastic packaging waste and Single Use Plastic (SUP) waste in the Shillong Municipal Area from 09.09.2024 to 14.09.2024.

Sample Planning & Study Area:

Shillong is the capital city in the state of Meghalaya with more than 1 lakh population (with a population of 1,43,229 according to the 2011 census). This study focuses on the Shillong municipal area governed by the Shillong Municipal Board (SMB). The Shillong Municipality is divided into 27 wards, as illustrated in **Figure 1**.

Since, medium or heavy vehicles being utilized to collect municipal waste, 480 kgs per vehicle is considered as vehicle load size applicable to all the selected areas. Moreover, the sample collection from the generation points is equally divided across all the 27 wards that were divided into four zones as per the details shown in **Table 1**. Since, Shillong has only one dumping site, selected vehicles from each 4 zones are assessed at that dumping/disposal site as per the methodology prescribed in the SOP. A total of 21 vehicles from the generation points and 24 vehicles at the disposal site are assessed and characterised for plastic packaging and Single Use Plastic (SUP) waste during the sampling period using *Cone & Quarter method* as per SOP.

Table 1: Sample Location Distribution

	Zone-1		Zone-2		Zone-3		Zone-4		
Day	Ward 1-6		Ward 7-13		Ward 14-21		Ward 22-27		Total Vehicle Samples
	Generation Points	Disposal Site	Generation Points	Disposal Site	Generation Points	Disposal Site	Generation Points	Disposal Site	
1	Laitumkhrah residential	Laitumkhrah Residential	Civil Secretariate	Civil Secretariate	Mawprem	Mawprem	Lumparing	Lumparing	8
2	-	Lachumiere	Polo	Polo	2 X Bara bazar market, Motphran	Bara Bazar market Motphran	Laban	Laban	8
3	Laitumkhrah market	Laitumkhrah market	Barik	Barik	Gari-Khana	Gari-Khana	Bishnupur	Bishnupur	8
4	Malki	Malki	Jail Road	Keating Road, PB	Jaiaw	Jaiaw	Rilbong	Rilbong	8
5	Lachumiere	Lachumiere	-	Civil Secretariate	-	Mawprem	Oxford Hills	Oxford Hills	6
6	Malki	Malki	Civil Secretariate	Civil Secretariate	Mawkhar	Mawkhar	-	Bishnupur	7

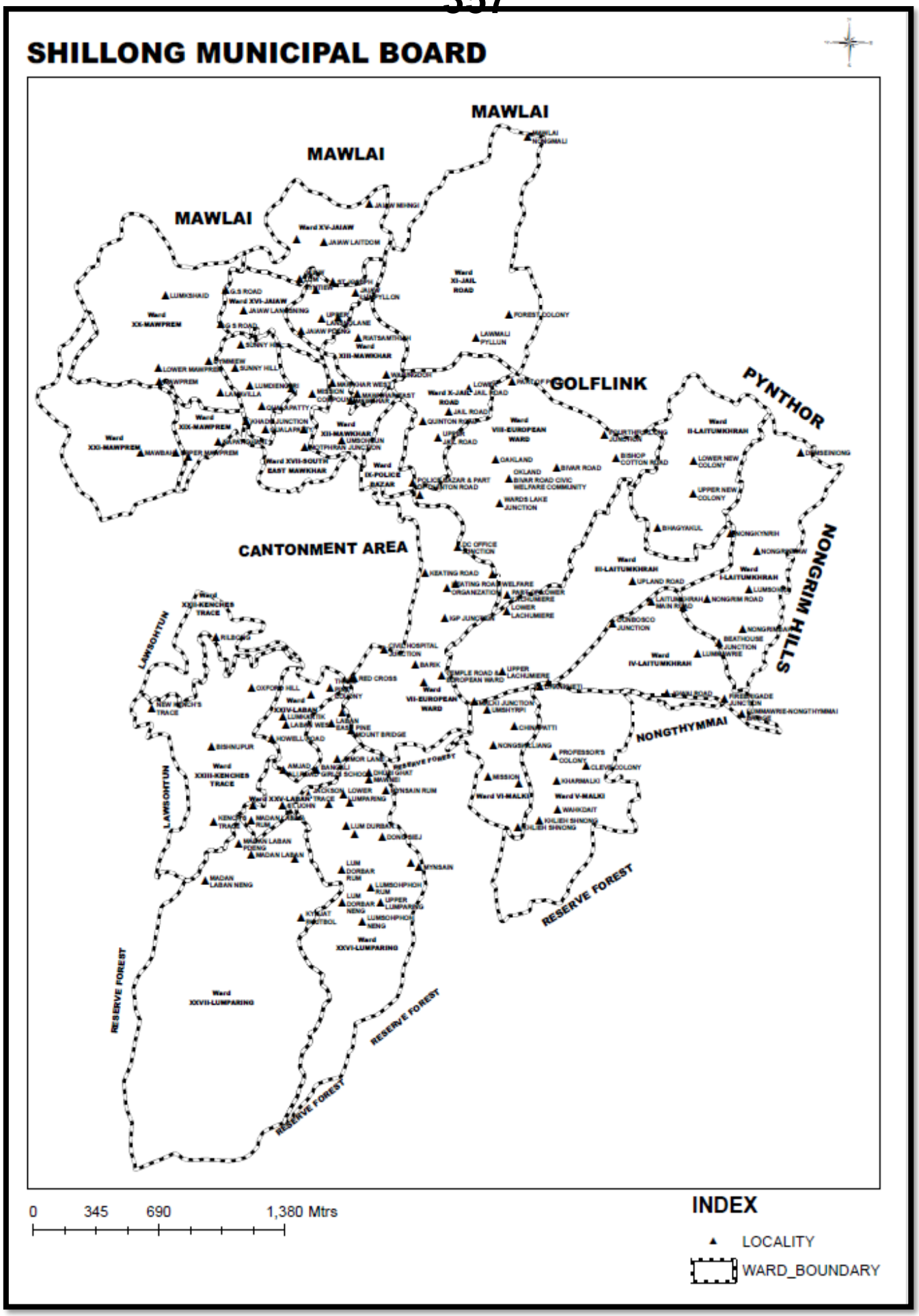


Figure 1: Study Area (Shillong Municipality)

Waste characterisation:

First, waste was characterised into two categories plastic waste and others. Subsequently, the total plastic waste was sorted and weighed into 4 categories, as per the EPR guidelines. Each sub-category was weighed and registered in the data sheet as given below in the Table 2(A & B).

Table 2 (A & B): Plastic Waste (PW) characterization (Plastic Packaging category wise)

A. Generation Point

Vehicle Load No.	Sorting Sample Size (Kg)	Total PW (kg)	Category1 PW (Kg)	Category2 PW (Kg)	Category3 PW (Kg)	Category 4 PW (Kg)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	120	19.6	7.0	4.2	1.0	-
2	120	21.5	8.0	4.5	2.0	-
3	120	19.55	7.62	4.78	2.8	-
4	120	16.25	6.80	3.75	1.32	-
5	120	18.19	2.79	1.56	0.93	-
6	120	16.47	0.61	5.65	-	-
7	120	25.59	1.6	14.13	3.5	-
8	120	14.595	5.165	4.4	0.2	-
9	120	18.00	0.810	8.840	3.89	-
10	120	16.95	7.58	3.5	1.2	-
11	120	17.73	0.93	5.35	4.9	-
12	120	16.742	4.107	4.45	1.425	-
13	120	18.49	8.1	2.79	0.8	-
14	120	19.57	3.55	7.89	2.35	-
15	120	17.73	1.23	6.79	2.43	-
16	120	15.88	3.23	3.99	1.5	-
17	120	19.08	8.4	3.95	1.2	-
18	120	16.55	4.87	3.38	1.9	-
19	120	18.93	6.86	5.71	0.35	-
20	120	20.5	6.8	4.75	1.63	-
21	120	17.89	6.70	6.75	0.67	-
	∑ (2) =	∑ (3) =	∑ (4) =	∑ (5) =	∑ (6) =	∑ (7) =
Total	**2520**	**385.787**	**102.752**	**111.110**	**35.995**	**0**

B. Disposal Point

Vehicle Load No.	Sorting Sample Size (Kg)	Total PW (kg)	Category1 PW (Kg)	Category2 PW (Kg)	Category3 PW (Kg)	Category4 PW (Kg)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	120	18.58	6.2	3.95	1.2	-
2	120	18.15	5.78	4.85	1.7	-
3	120	18.45	7.22	5.1	1.9	-
4	120	17.5	7.50	3.5	1.05	-
5	120	16.35	5.56	4.1	2.2	-
6	120	17.55	2.9	1.8	1.5	-
7	120	24.88	1.1	14.75	-	-
8	120	15.3	5.65	3.98	0.8	-
9	120	16.78	0.59	9.840	2.99	-
10	120	18.15	8.5	3.9	1.0	-
11	120	16.45	0.71	6.34	4.63	-
12	120	17.43	4.321	5.02	1.315	-
13	120	17.37	7.22	2.56	0.55	-
14	120	17.83	3.1	8.12	2.22	-
15	120	17.53	1.18	6.94	2.19	-
16	120	16.37	2.84	4.79	1.39	-
17	120	17.35	4.86	3.59	2.7	-
18	120	17.05	4.98	5.77	1.35	-
19	120	16.88	6.92	5.34	1.36	-
20	120	16.13	5.07	3.43	1.58	-
21	120	17.73	6.35	4.91	0.55	-
22	120	18.95	3.78	6.85	1.2	-
23	120	18.13	6.40	5.95	1.17	-
24	120	16.23	4.321	6.02	0.615	-
	∑ (2) =	**∑ (3) =**	**∑ (4) =**	**∑ (5) =**	**∑ (6) =**	**∑ (7) =**
Total	**2880**	**423.12**	**113.05**	**131.4**	**37.16**	**0**

Banned SUPs waste sorting:

Table 3 (A&B): Plastic waste characterization (Single Use Plastic)

A. Generation point

			Vehicle Load No.	Vehicle Load No. 1	Vehicle Load No. 2	Vehicle Load No. 3	Vehicle Load No. 4	Vehicle Load No. 5	Vehicle Load No. 6	Vehicle Load No. 7	Vehicle Load No. 8	Vehicle Load No. 9	Vehicle Load No. 10	Vehicle Load No. 11	Vehicle Load No. 12	Vehicle Load No. 13	Vehicle Load No. 14	Vehicle Load No.15	Vehicle Load No. 16	Vehicle Load No. 17	Vehicle Load No. 18	Vehicle Load No. 19	Vehicle Load No. 20	Vehicle Load No. 21	Avg kg/Kg of waste
1		a	Sorting sample size (Kg)	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	
		b	Plastic waste (Kg)	19.6	21.5	19.55	16.25	18.19	16.47	25.59	14.595	18	16.95	17.73	16.742	18.49	19.57	17.73	15.88	19.08	16.55	18.93	20.5	17.89	0.1530
			SUPs																						
2	Plastic Sticks	a	Earbuds (Kg)			0.002																			0.0000
		b	Balloons (Kg)																						-
		c	Candy (kg)																						-
		d	Ice Cream (Kg)			0.005																			0.0000
		e	Straws (Kg)		0.01							0.003											0.078	0.03	0.0000
3	Cutlery Items	a	Plates (Kg)			0.14						0.05						0.1							0.0000
		b	Cups (Kg)	0.151		0.18			0.13			0.1				0.06		0.35			0.209				0.00047
		c	Glass (Kg)		0.04				0.05	0.05	0.1					0.03									0.0001
		d	Forks (Kg)		0.01		0.009	0.02		0.07	0.04	0.03		0.02	0.02	0.04	0.010	0.05		0.028			0.03	0.04	0.00017
		e	Spoons (Kg)	0.05	0.02	0.015	0.02	0.02	0.04	0.05	0.04			0.08	0.07	0.05	0.052	0.05	0.027	0.066	0.02	0.02	0.07	0.03	0.0003
		f	Knives (Kg)				0.008	0.03	0.05	0.03	0.02		0.005												0.0001
		g	Trays (Kg)																						
4	Packaging/ Wrapping Films	a	Sweet box (Kg)													0.024		0.086							0.0000
		b	Invitation Cards (Kg)																						
		c	Cigarette Packets (Kg)	0.025	0.01		0.063			0.085		0.035	0.02	0.039		0.036			0.023			0.049			0.00015
5	Carry bags	a	<120 microns (Kg)	5.324	4.90	3.252	4.10	9.38	8.79	3.315	2.118	3.721	3.595	4.361	3.62	4.961	2.618	4.718	4.222	4.315	3.118	4.221	3.595	2.361	0.0359
6	Plastic sheets	b	<50 microns (Kg)	1.85	2.01	0.756	0.18	2.94	1.05	2.76	2.512	0.521	1.05	2.05	3.05	1.599	2.89	1.926	2.538	1.121	2.421	1.54	3.547	1.309	0.0157
7	Other Items	a	Plastics flags (Kg)																						
		b	PVC banners <100 um.(Kg)																						
		c	Polystyrene for decoration (Kg)					0.51	0.1								0.21		0.35		0.632				0.0007
			Total	7.4	7	4.35	4.38	12.91	10.21	6.36	4.83	4.46	4.67	6.55	6.76	6.8	5.78	7.28	7.16	5.53	6.4	6.01	7.32	3.77	0.0539

B. Disposal Point

			Vehicle Load No.	Vehicle Load No. 1	Vehicle Load No. 2	Vehicle Load No. 3	Vehicle Load No. 4	Vehicle Load No. 5	Vehicle Load No. 6	Vehicle Load No. 7	Vehicle Load No. 8	Vehicle Load No. 9	Vehicle Load No. 10	Vehicle Load No. 11	Vehicle Load No. 12	Vehicle Load No. 13	Vehicle Load No. 14	Vehicle Load No.15	Vehicle Load No. 16	Vehicle Load No. 17	Vehicle Load No. 18	Vehicle Load No. 19	Vehicle Load No. 20	Vehicle Load No. 21	Vehicle Load No. 22	Vehicle Load No. 23	Vehicle Load No. 24	Avg kg/Kg of waste
1		a	Sorting sample size (Kg)	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	
		b	Plastic waste (Kg)	18.58	18.15	18.45	17.5	16.35	17.55	24.88	15.3	16.78	18.15	16.45	17.43	17.37	17.83	17.53	16.37	17.35	17.05	16.88	16.13	17.73	18.95	18.13	16.23	0.1469
			SUPs																									
2	Plastic Sticks	a	Earbuds (Kg)	0.005		0.003																						0.0000
		b	Balloons (Kg)																									-
		c	Candy (kg)																									-
		d	Ice Cream (Kg)																									-
		e	Straws (Kg)									0.003											0.012	0.03		0.02		0.0000
3	Cutlery Items	a	Plates (Kg)			0.08					0.2	0.05							0.08								0.25	0.0002
		b	Cups (Kg)	0.11		0.10		0.11	0.08			0.212	0.091				0.08				0.20							0.0003
		c	Glass (Kg)		0.03					0.06	0.1						0.12		0.03						0.13		0.11	0.0002
		d	Forks (Kg)				0.01	0.07		0.07	0.08	0.03		0.02	0.02		0.010		0.07	0.028		0.04		0.04		0.03		0.0002
		e	Spoons (Kg)	0.05	0.02	0.012	0.03	0.05	0.04	0.055	0.04		0.07	0.08	0.07	0.05	0.052	0.05	0.027	0.066	0.02	0.02	0.07	0.03	0.07	0.05		0.00035
		f	Knives (Kg)				0.01	0.02		0.03	0.02		0.005															0.0000
		g	Trays (Kg)																									
4	Packaging/ Wrapping Films	a	Sweet box (Kg)													0.024											0.035	0.0000
		b	Invitation Cards (Kg)																									
		c	Cigarette Packets (Kg)	0.035	0.01		0.075			0.085		0.035	0.02	0.039	0.044	0.036			0.023			0.049				0.065		0.0002
5	Carry bags	a	<120 microns (Kg)	4.93	3.90	3.32	4.54	2.87	8.83	7.39	2.67	2.118	3.721	3.595	4.15	3.92	3.78	5.327	4.973	4.18	3.222	2.15	4.315	3.118	4.915	3.05	3.57	0.0342
6	Plastic sheets	b	<50 microns (Kg)	2.1	1.86	0.715	0.785	1.37	2.30	1.34	1.76	0.912	0.843	1.036	2.49	3.01	0.348	1.77	2.07	1.576	1.528	1.00	1.121	2.702	2.005	1.395	1.309	0.0129
7	Other Items	a	Plastics flags (Kg)																									
		b	PVC banners <100 um.(Kg)																									
		c	Polystyrene for decoration (Kg)						0.10									0.08	0.077	0.35			0.532					0.0004
				7.23	5.82	4.23	5.45	4.49	11.35	9.03	4.87	3.36	4.75	4.77	6.774	7.04	4.39	7.22	7.35	6.2	4.95	3.26	6.05	5.92	7.12	4.61	5.274	0.0491

Assessment of Plastic Waste:

1. Quantity of Plastic Waste Generation

Average quantity of plastic waste generated (kg of plastic waste/ kg of mixed waste) (data sheet at Table 2A & Table 3A)

Q1= (Σ Row 1b) / (Σ Row 1a)

OR

Q1= (Σ Column 3) / (Σ Column 2)

= (385.787 kg/2520 kg)

= 0.153

Considering Quantity of Mixed Waste generated in the town (TPA) (Q)

= 32,850 Tons per annum

(considering 90 Tons per day as per the data submitted in the annual report of 2023 by Shillong Municipal Board)

Quantity of Plastic Waste Generated (TPA) (Q_T)

= Q1*Q = 0.153 x 32,850

= 5026.05 Tons per Annum

2. Quantity of Plastic Packaging Waste Generation

Average quantity of plastic packaging waste generated (kg of plastic packaging waste / kg of mixed waste)

(Q2) = (Σ (Column 4) +Σ (Column 5) +Σ (Column 6) + Σ (Column 7))/ (Σ (Column 2)

(data sheet at Table 2A)

= (102.752 + 111.110 + 35.995 + 0)/ 1890

= 249.857/2520

= 0.099

Quantity of Mixed Waste generated (TPA) = 32,850 Tons per annum

Quantity of Plastic Packaging Waste Generated (Q_{pack})(TPA)

= 0.099 x 32,850

= 3252.15 Tons per Annum

3. Quantity of SUP Waste Generation

Average quantity of SUP waste generated (SUP in kg / kg of mixed waste)

(Q3) = (Σ (Row 2a… 7c) / (Σ (Row 1a) (data sheet Table 3A)

Q3 = 135.93/2520

= 0.0539

Quantity of Mixed Waste generated (TPA) = 32,850 tons per annum

Quantity of Plastic Packaging Waste Generated (TPA) (Q_{SUP}) = Q3*Q

= 1771.9 tons per annum

4. **Quantity of Other (Non-packaging waste)**

$Q_{other} = Q_T - Q_{pack}$

= 32,850 - 3252.15

=29,597.85 tons per annum

5. Quantity of Plastic Waste Disposed

Average quantity of plastic waste generated (kg of plastic waste/ kg of mixed waste)

Q1d= (Σ Column 3) / (Σ Column 2) – *refer Table 2B*

OR

Q1d= (Σ Row 1b) / (Σ Row 1a) – *refer Table 3B*

= (423.12/2880)

Considering Quantity of Mixed Waste Disposed (TPA) (Q_D)= 27,010 Tons per annum

(considering 74 Tons per day collection as per the data submitted in the annual report of 2023 by Shillong Municipal Board)

Quantity of Plastic Waste Disposed (TPA) (QTD) = $Q1d*Q_D$

= 27,010 x (423.12/2880)

= 3968.22 Ton per Annum

6. Quantity of Plastic Packaging Waste Disposed

Average quantity of plastic packaging waste Disposed (kg of plastic packaging waste / kg of mixed waste)

(Q2d) = (Σ (Column 4) +Σ (Column 5) +Σ (Column 6) + Σ (Column 7)) / (Σ (Column 2) ----(*refer Table 2B*)

= (113.05+131.4 + 37.16)/ 2880

= 281.61/2880

= 0.097

Quantity of Mixed Waste Disposed (TPA) Q_D= 27,010 Ton per Annum

Quantity of Plastic Packaging Waste Disposed (Qpack D)(TPA) = $Q2d*Q_D$

=2641.07 Tonnes per Annum

7. Quantity of SUP Waste at Disposal

Average quantity of SUP waste at Disposal (SUP in kg / kg of mixed waste)

(Q3d) = (Σ (Row 2a… 7c) / (Σ (Row 1a) ---(*refer Table 3B*)

= 141.508/2880

= 0.0491

Quantity of Mixed Waste Disposed (TPA) = 27,010 Tons per Annum

Quantity of SUP Waste Disposed (TPA) (QSUP)D = $Q3d*Q_D$

=0.0491 x 27,010= 1327.128 Tons per Annum

8. **Quantity of Other (Non-packaging waste) Disposed**

Qother D = QT (D)-Qpack D

= 27,010 - 2641.07

= 24,368.93 tons per Annum

9. **Quantity of Plastic waste Utilized/Processed**

Q utilised/processed = QT-QTD

= 5026.05 - 3968.22

= 1058.28 Tons per Annum

Conclusion:

A comprehensive characterization and assessment of plastic waste in the Shillong municipal area, governed by the Shillong Municipal Board (SMB), was conducted from September 9 to September 14, 2024. During this period, 21 vehicles were evaluated at waste generation points, and 24 vehicles were assessed at the disposal site, focusing on plastic packaging and banned single-use plastic (SUP) waste. The sampling followed the Cone & Quarter method as outlined in the standard operating procedures (SOP) prescribed by CPCB.

The analysis at the generation sites revealed that plastic waste (including both plastic packing wastes and banned single-use plastic (SUP) items) constitutes approximately 15% of the total municipal solid waste (MSW) generated in the Shillong Municipality, with SUPs alone accounting for around 5.3%. With an estimated mixed waste generation of 90 tons per day (TPD), or 32,850 tons annually, the total plastic waste generation was calculated to be about 5,026.05 tons annually. Among this, approximately 1,771.9 tons are attributed to banned SUPs, predominantly consisting of plastic carry bags with thicknesses of less than 50 and 120 microns.

In terms of waste collection, the SMB processes about 74 TPD, equating to 27,010 tons annually. At the disposal site, plastic waste accounted for approximately 14.69% of the collected MSW, totaling an estimated 3,968.22 tons per year. This indicates a significant shortfall of over 1,000 tons of uncollected plastic waste. Similar to the findings at generation points, banned SUP items also contributed close to 5% of the MSW at the disposal site, again dominated by thin plastic carry bags.

While collected plastic packaging waste is processed for recycling with the assistance of local self-help groups, a majority of SUP items end up in landfill sites. These findings highlight an urgent need for enhanced waste management practices, increased public awareness, and potential policy interventions to mitigate plastic waste generation and improve recycling efforts in the Shillong Municipality. This data serves as a vital baseline for future research and initiatives aimed at addressing the environmental challenges posed by plastic waste in hilly-urban settings.

Recommendations:

1. The ULB must rigorously enforce the PWM Rules, 2016, as amended, within the city to ban the use of prohibited single-use plastic items.

2. A huge dump of multilayer plastic packaging waste and Single use plastic carry bags were seen in the dump/processing site. Appropriate actions should be taken to handle these wastes in accordance with the regulations. The Shillong Municipal Board (SMB) has recently begun sending these wastes to nearby cement plants for co-processing, as reported by their representatives.

Photographs taken during the Assessment


SHILLONG MUNICIPAL BOARD
TATA
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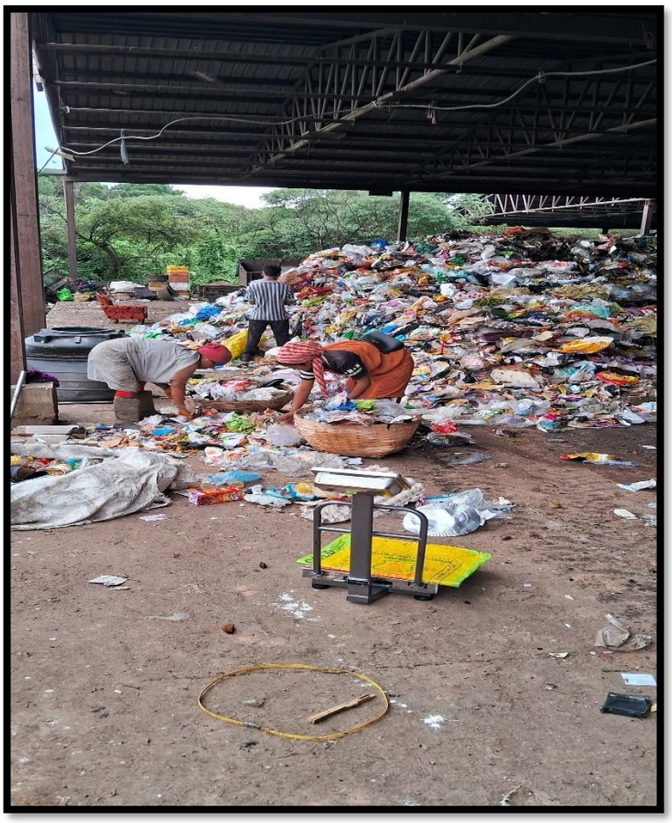

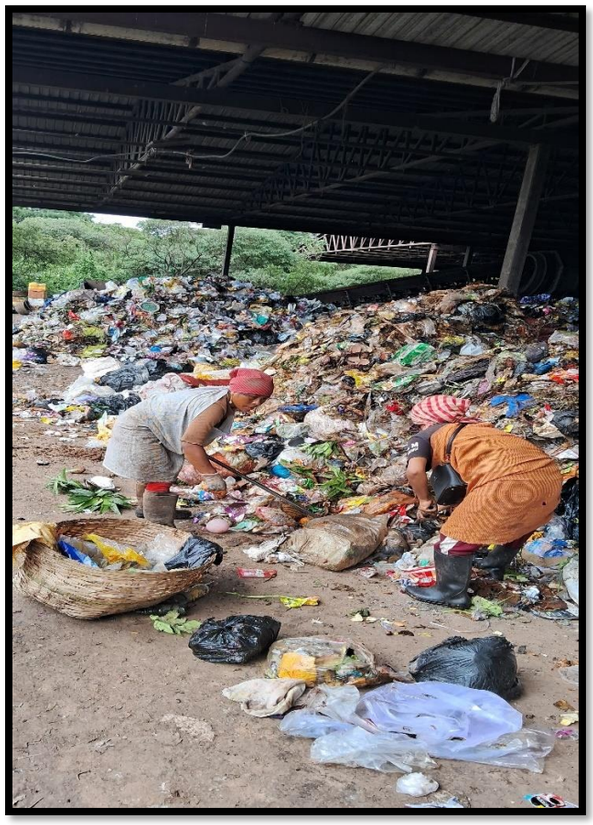


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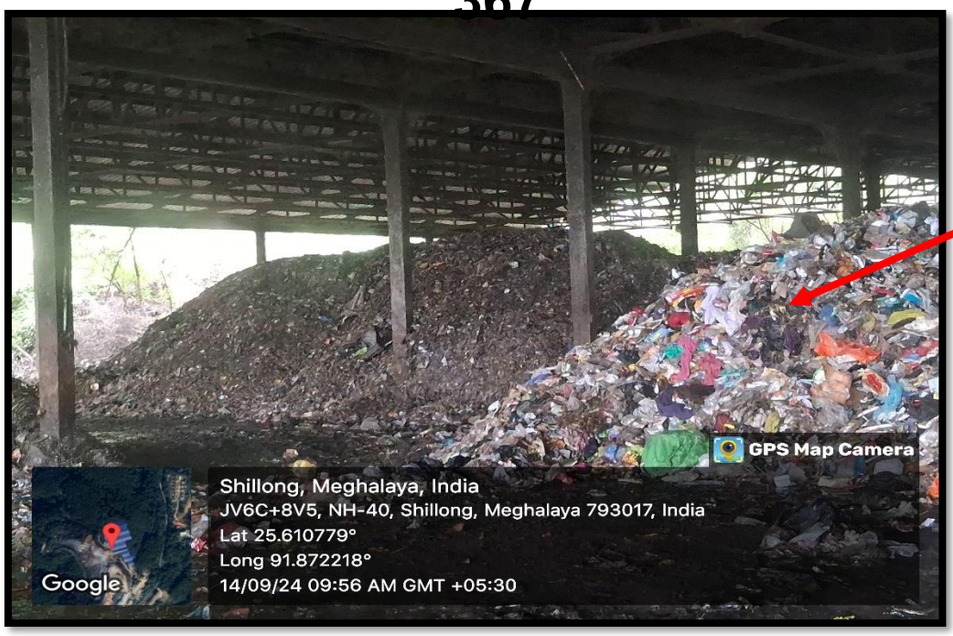
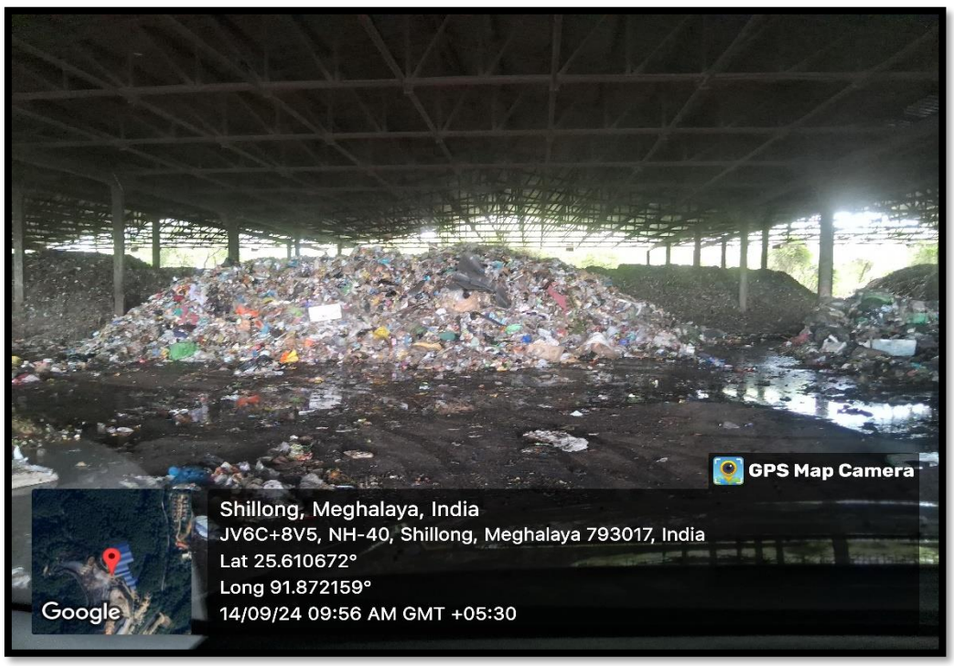
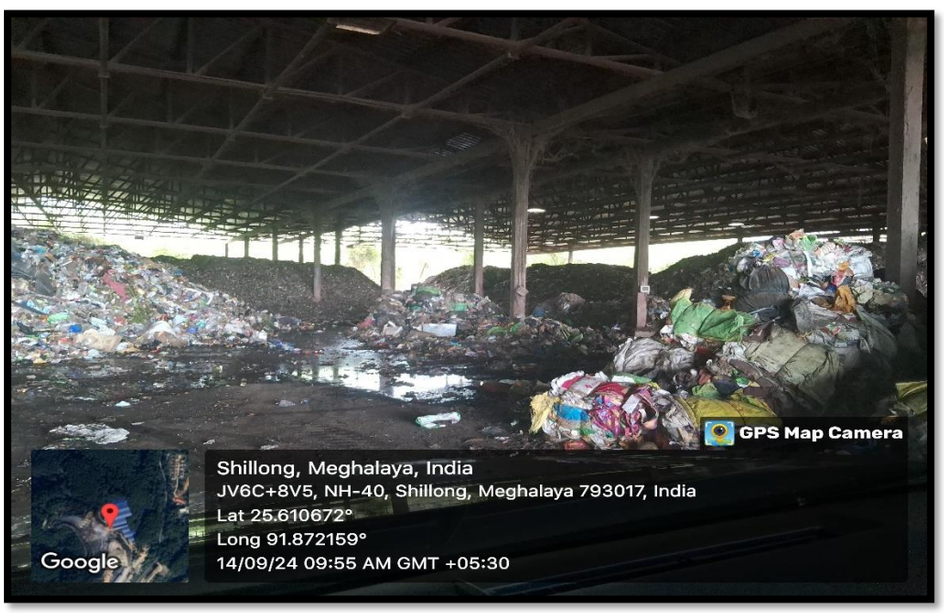


Dump of plastic waste after separation





REPORT ON CHARACTERIZATION & ASSESSMENT OF PLASTIC WASTE IN VADODARA, GUJARAT

Background

Regional Directorate, Vadodara received a communication from UPC-II Division to carry out characterization and assessment of plastic waste in one city of RD Vadodara jurisdiction. Accordingly, Vadodara city of Gujarat was selected to carry out the said activity. Following officials of RD Vadodara carried out the activity during 7th and 8th August 2024.

1. Smt. Kavitha B.V., Sc. E
2. Dr. N. Semwal, Sc. C
3. Shri Goipidesi Srinu, Sr. Technician
4. Shri Mayank Nimbark, JLA

The details of activities carried out, observations and findings of the study are given in the subsequent paragraph, tables and photographs.

Methodology / Approach

The above mentioned team of RD Vadodara first convened a formal meeting with concerned officials of Vadodara Municipal Corporation (VMC) on 06th August, 2024 to apprise them about the objective of the study (in accordance with the SOP for characterization and assessment of plastic waste developed by CPCB) and to understand their routine of Municipal Solid Waste (MSW) management practices and related infrastructure facilities provided in Vadodara city. After discussions on the said issues and considering the availability of required infrastructure, manpower availability, solid waste transfer routine etc., it was decided to carry out the activity at Atladara waste transfer station of VMC.

In accordance of provisions of SOP, it was decided to collect total six samples from following zones of the city for sample sorting and characterization of plastic waste.

I. High income group residential zone
II. Mid income group residential zone
III. Low income group residential zone
IV. Mix of residential and commercial zone
V. Pure commercial zone
VI. MSW Disposal site

The sample sorting size, segregation and categorization of plastic waste was carried out as outlined in the SOP. The findings of the study are summarized in the tables below.

Table-1: Plastic Waste Assessment & Characterization (packaging category wise)

	Residential			**Residential + Commercial**	**Commercial**	**MSW Disposal Site**
Name of the area	Alkapuri , Ward No. 08, Vadodara **(High Income)**	Bhayali, Ward No. 11, Vadodara **(Middle Income)**	Akota Slum Vistar, Ward No. 12, **(Low Income)**	Majhalpur, Ward 18	Sayajiganj, Kala Ghoda, Ward No.	Jambua
Vehicle load no.	990 Kg (GJ06BT6008)	820 Kg (GJ06BT 2213)	1060 Kg (Newly registered vehicle)	1530 Kg GJ06JT-0659	670 Kg (GJ06BT9084)	1220 kg (J06AZ7400)
Sorting sample size	130 Kg	120 Kg	123 Kg	121 Kg	129 Kg	121 kg
Total plastic waste (PW)	19 .0 Kg	12. 8 Kg	8.7 Kg	15.85 Kg	10.72 Kg	5.3 Kg
Cat. I PW	2.80 Kg	2.60 Kg	1.25 Kg	1.60 Kg	2.82 Kg	0.4 kg
Cat. II PW	13.80 Kg	7.40 Kg	5.05 Kg	12 .0 Kg	6.80 Kg	4.15 Kg
Cat. III PW	2.40 Kg	2.8 Kg	2.40 Kg	2.25 Kg	1.10 Kg	0.75 Kg
Cat. IV PW	0	0	0	0	0	0

Table-2: Plastic Waste Characterization for Single Use Plastic (SUP)

Name of area	Alkapuri, Ward No. 08, Vadodara **(High Income)**	Bhayali , Ward No. 11, Vadodara **(Middle Income)**	Akota Slum Vistar, Ward No. 12, (**Low Income)**	Majhalpur, Ward 18 **(Res. + Comm.)**	Sayajiganj , Kala Ghoda, Ward No. **(Commercial)**	MSW Disposal site, Jambua
	Vehicle Load No. 1	Vehicle Load No. 2	Vehicle Load No. 3	Vehicle Load No. 4	Vehicle Load No. 5	Vehicle Load No. 6
Sorting Sample Size	130 (kg)	120 (kg)	123 (kg)	121 (kg)	129 (kg)	121 (kg)

Total Plastic Waste	19.0 (kg)	12.8 (kg)	8.70 (kg)	15.85 (kg)	10.72 (kg)	5.3 (kg)
Composition of SUPs in Plastic Waste	**SUPs were segregated from Cat. I and Cat. II Plastic Waste**					
Plastic sticks (earbuds, balloons, candy, ice cream)	0	0	0	0	0	0
Cutlery items (plates, cups, glasses, forks, spoons, knives, trays, straw)	< 50 (gm)	< 50 (gm)	< 50 (gm)	< 50 (gm)	70 (gm)	< 50 (gm)
Packaging/ wrapping films(sweet box, invitation cards, cigarette packets)	0	0	0	0	0	0
Carry bags (<120 micron)	12.4 (Kg)	6.30 (Kg)	4.4 (Kg)	10.7 (Kg)	6.1 (Kg)	3.5 (Kg)
Other items (Plastic Flags, PVC banners < 100 micron, Polyestyrene for decoration)	0	0	0	0	0	0

Table 3: Composition of Plastic Waste in MSW

	Quantity of MSW	Quantity of Plastic Waste	Percentage composition of Plastic Waste
City Waste	623 (Kg)	67.07 (Kg)	10.76 (%)
Disposal Site	121 (Kg)	5.3 (Kg)	4.38 (%)

Table 4: Composition of Different Category of Plastic Packaging Waste in Total Plastic Waste

	Quantity of Plastic Waste	Percentage composition of Cat-I	Percentage composition of Cat-II (%)	Percentage composition of Cat-III (%)	Percentage composition of Cat-IV (%)

City Waste	67.07 (Kg)	16.50 (%)	67.17 (%)	16.33 (%)	0 (%)
Disposal Site	5.3 (Kg)	7.55 (%)	78.30 (%)	14.15 (%)	0 (%)

Table 5: Composition of SUPs in Plastic Waste

	Quantity of Plastic Waste	Quantity of SUPs	Percentage composition of SUPs
City Waste	67.07 (Kg)	40.17 (Kg)	59.89 (%)
Disposal Site	5.3 (Kg)	3.55 (Kg)	66.98 (%)

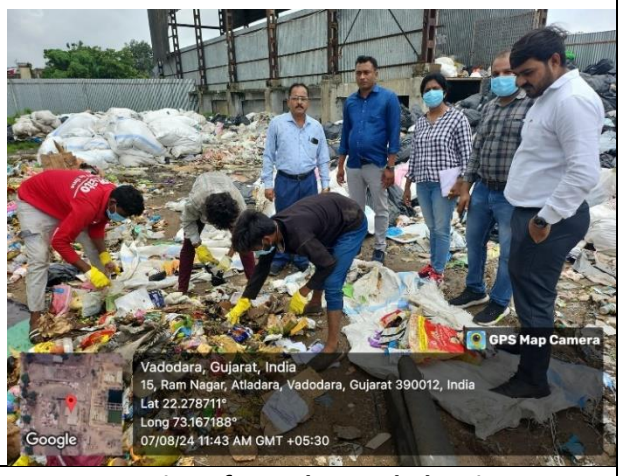
Highlights of the Findings

- Plastic waste content found high in waste from high income group residential areas and lowest in waste from low income group residential areas.
- Category-II of plastic waste is dominant among all four categories.
- Carry bags are predominantly present among waste falling under SUPs.
- Percentage of plastic waste in city waste is more than waste at disposal site.
- Percentage of Category-II is highest followed by Category-III in the total plastic waste of city as well as found at dump site.
- Percentage of SUPs in total plastic waste from city is close to 60% and about 67% in dump site.

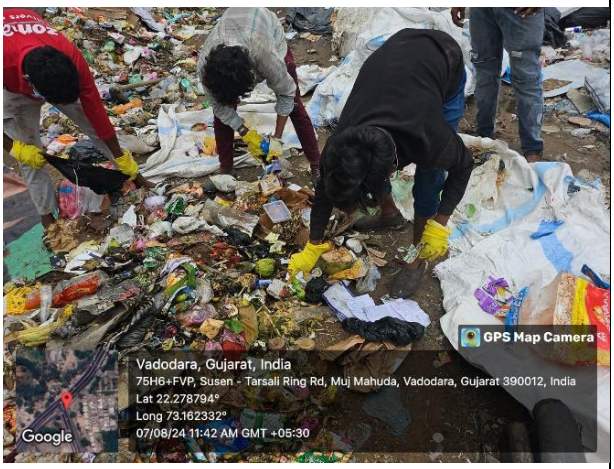
Photographs taken during the study

Waste carrying vehicle stationed at Weigh Bridge and digital display of weight

MSW sample unloaded at site

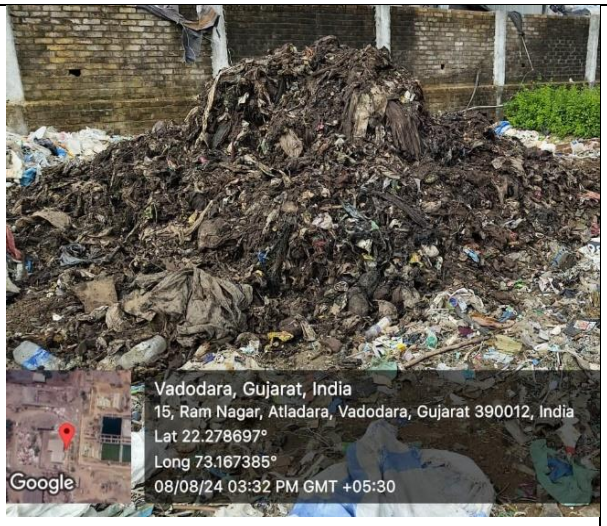


Sorting of sample at Atladra site



Plastic waste segregation

Segegation of Category I PW



Solid waste sample of disposal site

Segregation of PW from sample of disposal site

Weighing of segregated PW componenent at site

Annexure- IV

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT FOREST & CLIMATE CHANGE GOVT OF INDIA

F-No. CP-20/37/2023-UPC-II-HO-CPCB-HO 4400-4431 **September 21, 2023**

To,

The Chairman
SPCB/PCC
(As per list)

Sub: Direction Under Section 5 of the Environment (Protection) Act, 1986 to SPCBs/PCCs for submission of incomplete/no information for Annual Report (2022-23) on Implementation of Plastic Waste Management Rules, 2016 (as amended)

WHEREAS, the Ministry of Environment, Forest and Climate Change (MoEF&CC) notified the Plastic Waste Management Rules, 2016 in exercise of the powers conferred under sections 3,6 and 25 of the Environment (Protection) Act, 1986 vide Notification No. G.S.R 320 (E) dated March 18, 2016; and

WHEREAS, Ministry of Environment, Forest and Climate Change amended PWM Rules 2016 vide Notification No. G.S.R. 285(E) dated March 27, 2018; and

WHEREAS, as per rule 17(2) of the PWM Rules, 2016, as amended, "*Every local body shall prepare and submit an annual report in Form –V to the concerned Secretary-in-charge of the Urban Development Department under intimation to the concerned State Pollution Control Board or Pollution Control Committee by the 30th June, every year*"; and

WHEREAS, as per rule 17(3) of the PWM Rules, 2016, as amended, *"Each State Pollution Control Board or Pollution Control Committee shall prepare and submit an annual report in Form VI to the CPCB on the implementation of these rules by the 31st July, of every year";* and

WHEREAS, *as per rule 17(4) of PWM Rules, 2016 as amended, The CPCB shall prepare a consolidated annual report on the use and management of plastic waste and forward it to the Central Government along with its recommendations before the 31st August of every year"; and*

WHEREAS, honourable NGT in the matter of O.A No. 247/2017 had directed that "*all the States and Union Territories to ensure that reports in terms of Rule 13 are furnished to the CPCB positively within one month or 30th April, 2019, for the period the reports are due as per rules and not filed so far. CPCB may prepare Action plan for submission of compliance state of PWM Rules by states/UTs".* CPCB had prepared a comprehensive format for the action plan for submission of compliance status of PWM Rules by states/UTs and obtained detailed information from the States/UT during the period 2019-21; and

'परिवेश भवन' पर्वी अर्जुन नगर, दिल्ली-110032
Parivesh Bhawan, East Arjun Nagar, Delhi-110032
दूरभाष/Tel : 43102030, 22305792, वेबसाईट/Website : www.cpcb.nic.in

WHEREAS, CPCB, subsequently, had directed SPCBs/PCCs to file Action Plan (Form VI) in the prescribed format **(Annexure I)** in the Annual Report submitted to CPCB which included data related to plastic waste generated, collected and processed (recycled, co-processing, road making, waste to oil); and

WHEREAS, incomplete/no information regarding Annual Report and Action plan for year 2022-23 has been received from your office; and

NOW, THEREFORE, in view of above and in exercise of powers vested under Section 5 of Environment (Protection) Act, 1986 to the Chairman, CPCB, it is directed to submit complete information for Annual Report for Financial Year 2022-23 on Implementation of Plastic Waste Management Rules, 2016, as amended along with the Action Plan as per prescribed format.

You are requested to take necessary action to ensure compliance of above direction within 15 days of issue this direction.

25/9/23

(Tanmay Kumar)
Chairman

Copy to:

1. **Additional Secretary (CP Division)**
   Ministry of Environment, Forests & Climate Change
   Indira Paryavaran Bhawan, Jor Bagh Road,New Delhi,110003 : For kind information please

2. **Incharge, IT Division**
   CPCB : For uploading on CPCB website

(Bharat Kumar Sharma)
Member Secretary

By Registered Post

F. No. B-31011/BMW (14499)/2023/WMD-I 4685

27th September, 2023

To,

M/s Belgaum Green Environment Management Pvt. Ltd.,
Sy No 29/2, Harugoppa Village,
Saundatti Taluk, Belagavi District,
Belagavi, Karnataka

DIRECTION UNDER SECTION 5 OF THE ENVIRONMENT (PROTECTION) ACT, 1986 AND SHOW CAUSE NOTICE - THEREOF FOR IMPOSITION OF ENVIRONMENTAL COMPENSATION

WHEREAS the Central Government has notified the Bio-Medical Waste Management Rules, 2016 and amendments thereof (herein after referred as BMWM Rules, 2016) in suppression of the Bio-Medical Waste (Management & Handling) Rules, 1998, and amendments thereof, under the Environment (Protection) Act, 1986, to improve the collection, segregation, processing, treatment and disposal of the Bio-Medical wastes in an environmentally sound management thereby, reducing the biomedical waste generation and its impact on the environment; and

WHEREAS Rule 5 of BMWM Rules, 2016 stipulate duties of the operator of Common Bio-Medical Waste Treatment Facility (CBWTF) to ensure treatment and disposal of biomedical waste in line with provisions of said Rules; and

WHEREAS as per Rule 7 (1) of BMWM Rules, 2016, the bio-medical waste is required to be treated and disposed off in accordance with Schedule I and in compliance with the standards prescribed in Schedule II of the BMWM Rules, 2016; and

WHEREAS Rule 14 (1) of BMWM Rules, 2016 stipulate that every authorized person is required to maintain records related to generation, collection, segregation, storage, transportation, treatment, disposal and or any form of handling of Bio-Medical waste in accordance with these Rules and guidelines issued by CPCB"; and

WHEREAS the Hon'ble National Green Tribunal, in the matter of O.A. No. 710 of 2017 filed by Shailesh Singh vide order dated 12.03.2019 directed "CPCB to undertake study and prepare a scale of compensation to be recovered from violators of Bio-Medical Waste Management Rules, 2016. Hon'ble NGT also directed that scale of compensation must be deterrent, rendering violation of Rules to be non-profitable which should be adequate to remedy the situation"; and

WHEREAS Hon'ble National Green Tribunal in its order dated 15.07.2019 in the matter of O.A. No. 710 of 2017, accepted Guidelines for "Imposition of Environmental Compensation Charges (ECC) against Healthcare Facilities (HCFs) and Common Biomedical Waste Treatment Facilities (CBWTFs)"; and

WHEREAS the CBWTF namely M/s Belgaum Green Environment Management Pvt. Ltd., Sy. No. 29/2, Harugoppa Village, Saundatti Taluk, Belagavi District, Belagavi, Karnataka (the Unit) was inspected by Central Pollution Control Board (CPCB) on 19.07.2023 wherein following non-compliances were observed:

2. The Member Secretary
Karnataka State Pollution Control Board,
Parisara Bhavana,1st to 5thFloor
49, Church Street,
Bengaluru – 560 001. : For kind information

3. The Regional Director,
The Regional Directorate
Central Pollution Control Board
1st & 2nd Floors, Nisarga Bhavan
A-Block, Thimmaiah Main Road
7th D Cross, Shivanagar, Opp. Pushpanjali Theatre,
Bangalore –560 010. : For kind information

4. I/c IT Division : For information and necessary action

5. I/c Accounts Division : For information & for further necessary action

(Bharat Sharma)

Reminder Add task Snooze

Reminder: Submission of information for Annual Report (AR) on Plastic Waste Management Rules, 2018 for the year 2022-23 in compliance with Rule 17(3) of PWM Rules - reg

ME Me <pwm.cpcb@gov.in>

Mon, 19 Feb 2024 11:18:17 AM +0530 SENT

To "ms" <ms@uppcb.in>

Cc "DIVYA SINHA" <divyasinha.cpcb@nic.in>, "YOGESH CHANDRA" <yogesh.cpcb@gov.in>, "Divya Gupta" <divyag9.cpcb@gov.in>

Tags

Sir/Madam,

It is to inform you that Annual Report (AR) for Plastic Waste Management (PWM) of the year 2022-23 has not been received from your office till date. It is requested to provide the Annual Report in Form-VI format along with Action Plan as per the attached format within 7 days for timely completion of the Annual Report by CPCB.

.....

Regards,
Divya Sinha
Director & I/c, UPC-II
CPCB, Delhi

1 Attachment(s) Download as Zip

Annexure-I to VIII.xlsx
25.6 KB

Reply Reply All Forward Edit as new

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA

File No. CP-20/117/2021-UPC-II-HO-CPCB-HO-Part(7) Date: 04 -07-2024

To,

The Chairman
All SPCBs/PCCs

Sub: - Direction under Section 5 of the EPA, 1986 regarding Characterization & Assessment of Plastic Waste by Local Bodies, District Panchayats, SPCBs & PCCs as per methodology developed by CPCB

Whereas, the Ministry of Environment, Forest & Climate Change (MoEF&CC) notified the PWM Rules, 2016, in exercise of the powers conferred under section 3,6, & 25 of the Environmental (Protection) Act, 1986 Vide Notification No. G.S.R. 320 (E) dated March 27, 2016; and

Whereas, MoEF&CC, vide Notification dated August 12, 2021 banned identified SUP items and prescribed minimum thickness of carry bag with effect from July 01, 2022; and

Whereas, as per Rule 4(2) of PWM Rules, 2016 (as amended), *"The manufacture, import, **stocking, distribution, sale and use** of following single use plastic (SUP), including polystyrene and expanded polystyrene, commodities shall be prohibited with effect from the 1st July, 2022:*

(a) *Ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene [Thermocol] for decoration.*

(b) *Plates, cups, glasses, cutlery such as forks, spoons, knives, straw, trays, wrapping or packing films around sweet boxes, invitation cards, and cigarette packets, plastic or PVC banners less than 100 micron, stirrers*; and

Whereas, as per Rules 4(1)(c) of PWM Rules, 2016 (as amended), *"Carry bag made of virgin or recycled plastic, shall not be less seventy-five microns in thickness with effect from the 30th September,2021 and one hundred and twenty (120) microns in thickness with effect from 31st December, 2022"*; and

Whereas, as per Rule 4(1)(d) of the PWM Rules, *"plastic sheet or like, which is not an integral part of multi-layered packaging and cover made of plastic sheet used for packaging, wrapping the commodity shall not be less than fifty microns in thickness except where the thickness of such plastic sheets impairs the functionality of the product"*; and

Whereas, Guidelines on Extended Producer Responsibility for Plastic Packaging and commodities made from compostable plastics or biodegradable plastics were notified by MoEF&CC on February 16, 2022 in Schedule – II of 4th amendment of Plastic Waste Management Rules, 2018 (as amended); and

Whereas, as per Provision 5.1 of the Schedule-II of PWM Rules (as amended), "*The following plastic packaging categories are covered under Extended Producer Responsibility:*

i. *Category I: Rigid plastic packaging;*
ii. *Category II: Flexible plastic packaging of single layer or multilayer (more than one layer with different types of plastic), plastic sheets or like and covers made of plastic sheet, carry bags, plastic sachet or pouches;*
iii. *Category III: Multi-layered plastic packaging (at least one layer of plastic and at least one layer of material other than plastic);*
iv. *Category IV: Plastic sheet or like used for packaging as well as carry bags & commodities made of compostable plastics;*
v. *Category V: Plastic sheet or like used for packaging as well as carry bags and commodities made of biodegradable plastics*"; and

Whereas, as per Rule 6(5) of PWM Rules, 2018 (as amended), *"The local body shall undertake assessment of plastic waste generated, including plastic waste existing in dump sites, by the 30th June of every year and also estimate the quantity of plastic waste to be generated in following five-year period"*; and

Whereas, as per Rule 6(8) of PWM Rules, 2018 (as amended), *"The local body shall include in the annual report the following details on plastic waste management, namely: -*

i. *Plastic waste generated, including plastic waste existing in dump sites, in a year;*
ii. *Plastic waste management infrastructure available for collection, segregation, processing;*
iii. *Projection of plastic waste to be generated;*
iv. *Status on framing and implementation on byelaws;*
v. *Actions taken action to prevent stocking, distribution, sale and usage of prohibited Single Use Plastic items"*; and

Whereas, as per Rule 7A(1) of PWM Rules, 2018 (as amended), "*The Panchayat at District level shall undertake assessment of plastic waste generated, including plastic waste existing at dump sites, by the 30th June of every year for rural areas of the district and also estimate the quantity of plastic waste to be generated in following five-year period*"; and

Whereas, as per Rule 7A(3) of PWM Rules, 2018 (as amended), "*The Panchayat at District Level shall include in the annual report the following details on plastic waste management, namely: -*

i. *Plastic waste generated, including plastic waste existing at dump sites, in a year;*

ii. *Plastic waste management infrastructure available for collection, segregation, processing;*
iii. *Projection of plastic waste to be generated;*
iv. *Status on framing and implementation on byelaws;*
v. *Actions taken action to prevent stocking, distribution, sale and usage of banned Single Use Plastic items*"; and

Whereas, as per Rule 17 (4) of PWM Rules, 2018 (as amended), "*Every urban local body and Panchayat at District Level shall prepare and submit online an annual report in Form –V (A& B) to the Urban Development Department and to Rural Development Department, respectively, and also to the State Pollution Control Board or Pollution Control Committee concerned by the 30th June every year*"; and

Whereas, as per Rule 17 (6) of PWM Rules, 2018 (as amended), "The *State Pollution Control Board or Pollution Control Committee shall prepare and submit online an annual report in Form VI to the Central Pollution Control Board on the implementation of these rules by the 31st July of every year"; and*

Whereas, as per the aforementioned formats for filing Annual Reports, Assessment & Characterization of plastic waste by the Local Bodies, District level Panchayats, SPCBs & PCCs, is to be carried out as per methodology developed by CPCB; and

Whereas, CPCB had prepared draft Standing Operating Procedure (SOP) for assessment of quantity of plastic waste generated and its characterization, with a focus on Single Use Plastic and Categories of Plastic Packaging as per the PWM Rules; and

Whereas, the draft Standard Operating Procedure (SOP) prepared by the Central Pollution Control Board (CPCB) was circulated during the period February 11, 2024 to March 12, 2024 for comments; and

Whereas, the SOP has been finalised incorporating the comments and suggestions from various stakeholders. The same is enclosed at **Annexure-I** and is also available at CPCB's website (https://cpcb.nic.in/uploads/plasticwaste/SOP_PWM_24062024.pdf); and

Now, therefore, in view of the above direction and in exercise of powers vested under Section 5 of Environment (Protection) Act, 1986 to the Chairman CPCB, following directions are issued for compliance:

1. To direct the Local Bodies and District Panchayats in your jurisdiction to carry out Assessment & Characterization of plastic waste for the purpose of reporting in the Annual Report, as per provision of PWM Rules, in accordance with the SOP for Assessment & Characterization of Plastic Waste developed by CPCB.

2. To provide necessary assistance & impart training to the Local Bodies and District Panchayats for implementation of Point (1) above.
3. To carry out assessment & characterization of plastic waste in at least two Local Bodies and District Panchayat in association with the concerned Authorities.
4. To monitor the implementation of this SOP by the concerned stakeholders in your jurisdiction.
5. To validate the data submitted by the Local Bodies and District Panchayats as per the methodology stipulated in the SOP.
6. To carry out Assessment & Characterization of plastic waste in your jurisdiction for the purpose of reporting in the Annual Report, as per provision of PWM Rules, in accordance with the methodology stipulated in the SOP.

You are hereby directed to take necessary action for compliance of aforesaid Directions and submit Action Taken Report to this office within 15 days of issuance of the Direction.

(Tanmay Kumar)
Chairman

Copy to:

1.	Shri Naresh Pal Gangwar Additional Secretary, Ministry of Environment, Forest and Climate Change, Indira Paryavaran Bhawan, Jorbagh Road, New Delhi – 110 003	:	For kind information, please
2.	The Regional Director All CPCB Regional Directorates	:	For follow up with concerned SPCB/PCCs in your jurisdiction, please
3.	DH-IT, CPCB	:	For uploading a copy of these directions on CPCB website, please

Bharat Kumar Sharma
Member Secretary

O/C

Annexure V-B

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT FOREST & CLIMATE CHANGE GOVT OF INDIA

F.No.CP-20/8/2024-UPC-II-HO-CPCB-HO

March 14, 2024

To,

The Chairman
SPCBs/PCCs - All States/UTs

Sub: - Directions under Section 5 of the EPA, 1986 regarding compliance of various provisions under Schedule-II of Plastic Waste Management Rules, 2016, i.e., Guidelines on Extended Producer Responsibility (EPR)

WHEREAS, the Ministry of Environment, Forest & Climate Change (MoEF&CC) has notified Plastic Waste Management Rules, 2016, in exercise of the powers conferred under sections 3, 6 & 25 of the Environment (Protection) Act, 1986 vide Notification No. G.S.R 320 (E) dated March 18, 2016; and

WHEREAS, Guidelines for Extended Producers Responsibility for Plastic packaging were notified by MoEF&CC on February 16, 2022 as Schedule-II of the Plastic Waste Management Rules, 2016; and

WHEREAS, as per Section 6.1(a) of the EPR Guidelines, *"The following entities shall register on the centralized portal developed by Central Pollution Control Board namely: - (i) Producer (P); (ii) Importer (1); (iii) Brand owner (BO), (iv) Plastic Waste Processor engaged in (a) recycling, (b) co-processing (c) waste to energy, (d) waste to oil, and (e) industrial composting;* and

WHEREAS, as per section 6.2 of the above Guidelines, "*The entities covered under clause 6.1 shall not carry any business without registration obtained through online Centralized Portal developed by Central Pollution Control Board";* and

WHEREAS, as per section 10.1 of the above Guidelines, "*The Producers, Importers & Brand Owners shall have to register through the online centralized portal developed by Central Pollution Control Board. The certificate of registration shall be issued using the portal*; and

WHEREAS, as per section 10.6 of the above Guidelines, *"The Producers, Importers & Brand-Owners shall file annual returns on the plastic packaging waste collected and processed towards fulfilling obligations under Extended Producer Responsibility with the Central Pollution Control Board or concerned State Pollution Control Board or Pollution Control Committee as per pro forma prescribed by Central Pollution Control Board by the 30th June of the next financial year. Information on the reuse and/or recycled content used for packaging purposes will also be provided. The details of the*

registered recyclers from whom the recycled plastic has been procured will also be provided"; and

WHEREAS, as per Section 11.1 of the EPR Guidelines, *"All plastic waste processors shall have to register with concerned State Pollution Control Board or Pollution Control Committee in accordance with provisions of 13(3) of Plastic Waste Management Rules, 2016 on the centralized portal developed by Central Pollution Control Board. Central Pollution Control Board shall lay down uniform procedure for registration within three months of the publication of these guidelines";* and

WHEREAS, as per Section 11.2 of EPR Guidelines, *"The Plastic waste processors shall submit annual returns after end of every financial year by 30th April of the next financial year on the quantity of plastic waste processed category-wise as per prescribed pro forma on the centralized portal developed by Central Pollution Control Board";* and

WHEREAS, CPCB has developed the Centralized EPR portal for registration of Producers, Importers and Brand-owners (PIBOs) & Plastic Waste Processors (PWPs) that has been formally launched on April 05, 2022; and

WHEREAS, 36228 PIBOs (Producers: 3988, Importer: 29807 and Brand Owners: 2433) and 2351 Plastic Waste Processors (PWPs) have already been registered on the EPR portal; and

WHEREAS, it has been observed that several PIBOs/PWPs are continuing with their operations without obtaining registration on the Centralized EPR Portal, which is in violation of Plastic Waste Management Rules, 2016, as amended; and

WHEREAS, in the matter of CWP No. 2369 of 2018 titled 'Suleman and others vs. Union of India', vide order dated 01.03.2024 (**Annexure I**), the Hon'ble High court of Himachal Pradesh has made the following observations:

> *"However, we find that very few industries have been registered and, therefore, have impressed upon her to collect the relevant data of the industries registered in the various States and U.T.s from the relevant authorities, so that industries falling under the PWM Rules essentially get registered under the PWM Rules, 2016, be it with the Central Pollution Control Board or else the respective State Pollution Control Boards, as the case may be. The Officer has assured us that the needful shall be done before the next date of hearing."*

WHEREAS, CPCB has issued letters to department of Industries/State Authorities dated 06.03.2024 **(Annexure - II)** to provide the list of industries involved in introducing/processing of plastic packaging under their jurisdiction and to further ensure that all such entities register themselves on the centralized EPR portal in compliance of the PWM Rules, 2016, as amended; and

WHEREAS, CPCB has issued a public notice dated 14/03/2024 **(Annexure III)** informing all PIBOs & PWPs to register on the centralized EPR portal on or before 31.03.24; and

NOW THEREFORE, in compliance of above and in exercise of powers vested under Section 5 of Environment (Protection) Act, 1986 to the Chairman, CPCB, the following directions are hereby issued to all SPCBs/PCCs for compliance:

a. To issue a public notice on the SPCBs/PCCs website informing all PIBOs & PWPs in your jurisdiction to register on the centralized EPR portal on or before 31.03.24.

b. To publish the aforesaid notice in the regional newspaper in English as well as in local languages.

c. To follow-up with the department of Industries / State authorities to provide necessary information as per letter dated 06.03.2024 **(Annexure II)** to CPCB.

You are hereby directed to take necessary action for compliance of aforesaid directions and submit the action taken report to this office within 10 days of receipt of this direction.

18/3/24

(Tanmay Kumar)
Chairman

Copy to:

1. Additional Secretary, HSMD, Ministry of Environment, Forest and Climate Change, Indira Paryavaran Bhawan Jorbagh Road, New Delhi – 110 003 : for kind information, please

2. Regional Directors, All CPCB Regional Directorates : for kind information and follow up with SPCBs/PCCs in your jurisdiction

3. DH (IT) : for uploading on CPCB website, please

(Bharat Kumar Sharma)
Member Secretary

O/C

Annexure I

Suleman vs. Union of India and others a/w connected matters.
CWP No. 2369 of 2018 a/w CWPIL No. 269 of 2017, CWP Nos. 1074 of 2019, 3334 of 2021, CWPIL Nos. 32, 42, 56 of 2021, CWP No. 3511 of 2022 and CWPIL No. 4 of 2022.

01.03.2024. Present: Mr. Deven Khanna, Advocate, (through video-conferencing) for the petitioners, in CWP No.2369 of 2018.

Mr. Shekhar Badola, Advocate vice Mr. Parav Sharma, Advocate, for the petitioner, in CWP No. 1074 of 2019.

None for the petitioner in CWP No. 3334 of 2021.

Mr. Suneet Goel, Advocate, as Amicus Curiae, for the petitioner, in CWPIL No. 269 of 2017.

Mr. K.B. Khajuria, Advocate, for the petitioner, in CWP No. 3511 of 2022 and for respondent No.6-Central Pollution Control Board, in CWP No.2369 of 2018.

Court on its own motion in CWPIL Nos. 32, 42 and 56 of 2021.

Mr. Anup Rattan, Advocate General with Mr. I.N. Mehta, Senior Additional Advocate General, Mr. Ramakant Sharma, Mr. Navlesh Verma, Ms. Sharmila Patial, Additional Advocate Generals and Mr. J.S.Guleria, Deputy Advocate General, for the respondents-State.

Mr. Balram Sharma, DSGI, for Union of India and for respondent No.4-Central Pollution Control Board in CWP No. 3511 of 2022.

Mr. Pranjal Munjal, Advocate, for respondent No.8, in CWP No. 2369 of 2018 and CWP No. 1074 of 2019.

Mr. Lovneesh Kanwar, Senior Advocate with Mr. Tek Chand, Advocate, for M.C. Sarkaghat.

Mr. Tara Singh Chauhan and Mr. Maan Singh, Advocates, for respondent-H.P. Pollution Control Board, in CWP No. 2369 of 2018 and CWP No.1074 of 2019.

Mr. Lalit K. Sharma, Advocate, for respondent No. 4, in CWPIL No. 32 of 2021.

Mr. Mukesh Sharma, Advocate vice Mr. Virbahadur Verma, Advocate, for respondent No.2, in CWPIL No. 32 of 2021, for respondent No.1, in CWPIL No.42 of 2021 and for respondent No.3 in CWP No. 3511 of 2022.

Mr. Naveen K. Bhardwaj, Advocate, for M.Cs. Kullu, Manali and Nagar Panchayat, Bhuntar, Distt. Kullu, H.P., in CWP No. 2369 of 2018.

Mr. H.S.Rangra, Advocate, for M.C., Mandi, in CWP No. 2369 of 2018.

Mr. Ajay K. Chauhan, Advocate, for M.C. Palampur, in CWP No. 2369 of 2018.

Mr. Adarsh K. Vashista, Advocate, for M.Cs. Chamba, Nalagarh, Nagrota Bagwan, Nurpur, Shahpur, Jawalamukhi and N.P., Jawali.

Mr. Mukul Sood, Advocate, for M.Cs Shimla and Dharamshala.

Mr. Ajay Kumar Dhiman, Advocate, for M.C., Paonta Sahib, District Sirmaur, H.P.

Mr. Janmajai Chauhan, Advocate vice Mr. Sunil Mohan Goel, Advocate, for respondent No.5 in CWPIL No. 4 of 2022.

Ms. Divya Sinha, Director & Head UPC II Div., Central Pollution Control Board, in person.

Mr. Balram Sharma, learned Deputy Solicitor General of India, states that necessary affidavit in terms of order dated 12.01.2024 has been filed in the Registry on 29.02.2024, however, the same is not on record. Be traced and placed on record.

2. In compliance to our order dated 12.01.2024, Ms. Divya Sinha, Director & Head UPC II Div., Central Pollution Control Board, is present in person. We have interacted with the Officer, who has informed us about the steps taken with regard to registration and implementation of the PWM Rules,

2016. However, we find that very few industries have been registered and, therefore, have impressed upon her to collect the relevant data of the industries registered in the various States and U.T.s from the relevant authorities, so that industries falling under the PWM Rules essentially get registered under the PWM Rules, 2016, be it with the Central Pollution Control Board or else the respective State Pollution Control Boards, as the case may be. The Officer has assured us that the needful shall be done before the next date of hearing.

3. On 11.01.2024, the Court passed the following order:

> "Central Pollution Control Board has filed certain instructions. The counsel for the petitioner prays for to go through the said instructions.
>
> Learned Advocate General has placed on record instructions which goes to indicate that two sites have been proposed for exchange to the petitioner in CWP No. 2369 of 2018. Let petitioner examine the aforesaid sites and accordingly apprise this Court by tomorrow.
>
> For these limited purpose(s), list the matter on **12th January, 2024.**
>
> We find from the affidavit filed by the various Urban Local Bodies that they have been facing certain difficulties in implementing the environmental laws more particularly with regard to the solid waste management. More than five years have passed, but not much progress has been made in this regard despite the majority of petitions have been clubbed together.
>
> In such circumstances, we direct the respondents-State to constitute a Multi Member Committee which will look into the grievances and difficulties pointed out by

executive officers and Secretaries of the various Local Urban Bodies in implementing the environmental laws. Such committee shall comprise of Director Urban (Head), one member of Pollution Control Board, one member of Environmental Department, one member of the Revenue Department and One member of the Forest Department along with concerned Secretary of the District Legal Services Authority. In addition to the aforesaid members, the counsel for the petitioner in CWP No. 2369 of 2018 and any other Advocate(s), who is/are willing to participate in the meeting, is/are also permitted to participate and the Committee is directed to give advance notice of at least 24 hours of the meeting to the counsel(s).

This Multi Member Committee shall meet at least once a week and it shall be open to the Committee to hold meetings either online or off line or hybrid mode. After examining the various affidavits filed by the various authorities, meaningful suggestions shall be carved out by the Committee within a period of four weeks and thereafter these shall be referred to the Chief Secretary to the Government of Himachal Pradesh, who shall then take a call and issue necessary directions to the authorities concerned and file a status report before this Court. For this purpose, the case be listed on **1st March, 2024.** In addition, the Committee shall also consider the recommendations and the reports submitted by the Advocate Committee along with affidavits submitted by the Pollution Control Board as also the suggestions made by the petitioner in CWP No.2369 of 2018."

4. The State is directed to place on record the minutes of the meeting as also the proposed action which they intend to take pursuant to the deliberations held in the meeting(s) before the next date of hearing.

5. List on **21.03.2024**. In the meanwhile, all the

U.L.Bs of the State Government are directed to get themselves registered with the Centralized EPR portal for Plastic Packaging and compliance affidavit to this effect be filed by the Director (Urban).

6. We are informed by the learned Advocate General that the petitioner has rejected both the sites shown to him pursuant to the directions of this Court. This aspect shall be considered on the next date of hearing.

7. The Officer present is exempted from physical appearance before this Court. However, she henceforth is permitted to appear through video-conferencing as and when required by this Court.

(Tarlok Singh Chauhan)
Judge

(Satyen Vaidya)
Judge

March 01, 2024.
(krt)

Annexure II

SPEED-POST / E-MAIL केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA

File No. CP-20/139/2021-UPC-II-HO-CPCB-HO Date: 06.03.2024

To,

Director/ Commissioner,
Department of Industries / State Authorities
(All States/UTs – As per list)

Sub: - Registration of Producers, Importers, Brand owners & Plastic Waste Processors as per Plastic Waste Management Rules, 2016, as amended - reg

Sir/Madam,

Central Pollution Control Board (CPCB) has developed the Centralized EPR Portal for Plastic Packaging for implementation of Extended Producer Responsibility (EPR) in accordance with the Guidelines on Plastic Packaging issued vide MoEFCC's Fourth Amendment to PWM Rules, 2016 dated February 16, 2022 (Annexure I).

As per the clause 6.1 of the EPR guidelines Producers, Importers, Brand owners (PIBOs) who introduce plastic packaging in the market and Plastic waste processors (PWPs) (recycling, co-processing, waste to energy, waste to oil, and industrial composting) have to register on the EPR portal.

Till date, 36228 PIBOs (Producers: 3988, Importer: 29807 and Brand Owner: 2433) and 2351 PWPs have been registered on the centralized EPR portal. Further, it has been observed that several such PIBOs/PWPs are continuing with their operations without obtaining registration on the Centralized EPR Portal, which is in violation of Plastic Waste Management Rules, 2016, as amended.

Further, vide order dated 01.03.2024 **in the matter of CWP No. 2369 of 2018 titled 'Suleman and others vs. Union of India'**, the Hon'ble High Court of Himachal Pradesh made the following observations **(Annexure II).**

"However, we find that very few industries have been registered and, therefore, have impressed upon her to collect the relevant data of the industries registered in the various States and U.T.s from the relevant authorities, so that industries falling under the PWM Rules essentially get registered under the PWM Rules, 2016, be it with the Central Pollution Control Board or else the respective State Pollution Control Boards, as the case may be. The Officer has assured us that the needful shall be done before the next date of hearing"

Contd.

In view of the above, it is requested a list of all such entities involved in introducing/processing of plastic packaging into the market may be provided to CPCB along with their address and email. It is further requested to ensure that all such entities register themselves on the centralized EPR portal in compliance of the PWM Rules, 2016, as amended. The aforementioned information be provided to CPCB within 10 days, to enable us to take further necessary action.

The matter be taken on priority being compliance of the Hon'ble High Court order.

This issues with approval of Competent Authority.

Yours sincerely,

(Divya Sinha)
Director & In charge, UPC-II

Copy for Information to: -

1. PS to CCB
2. AO to MS

(Divya Sinha)

o/c

State/UT	Address of Department of Industries/State Authorities
Andhra Pradesh	Commissioner of Industries, Government of Andhra Pradesh, 8th Floor, APIIC Towers, Auto Nagar, Mangalagiri, Guntur District Andhra Pradesh, Pin code: - 522503 Email:- apmsefcinds@gmail.com
Arunachal Pradesh	Director of Industries, Government of Arunachal Pradesh, Udyog Sadan, Itanagar Arunachal Pradesh Pin code: - 791111
Assam	Commissioner of Industries, Government of Assam, Udyog Bhawan, Bamuni Maidan, Industrial Estate, Guwahati, Assam, Pin Code: - 781021
Bihar	Director of Industries, Department of Industries, Govt of Bihar, 2Nd Floor, Vikas Bhawan, Bailey Road, Jawaharlal Nehru Marg, Patna, Bihar, 800015 Email:- Dir.Ind-Bih@Nic.In
Delhi	Commissioner of Industries, Government of Nct of Delhi, Plot No. 419, Patparganj Industrial Area, Delhi - 110092 Email:- delhiold@test.com
Himachal Pradesh	Director of Industries, Government of Himachal Pradesh, Udyog Bhavan, Bemloe, Shimla Himachal Pradesh Pincode:- 171001
Jammu & Kashmir	Director, Industries & Commerce, Government of Jammu & Kashmir, Civil Secretariat, Jammu - 180001 Email: Jkindcom@Gmail.Com

State/UT	Address of Department of Industries/State Authorities
Jharkhand	Director of Industries, Government of Jharkhand, 3Rd Floor, Nepal House, Doranda, Ranchi-834002, Jharkhand Email:- jhr-doi@nic.in
Karnataka	Director of Industries & Commerce, Department of Industries and Commerce, Government of Karnataka, 49, Khanija Bhavan, South Block, First Floor, Race Course Road, Bengaluru - 560001 Karnataka Email:- msefcblr22@gmail.Com
Kerala	Director of Industries & Commerce, Government of Kerala, Vikas Bhavan P.O, Thiruvananthapuram, Kerala - 695033
Madhya Pradesh	Commissioner of Industries, Government of Madhya Pradesh, 4Th Floor, Directorate of Industries, Vindhyachal Bhawan, Bhopal, Madhya Pradesh Pincode:- 462004 Email:- mp-msefc@mp.gov.In
Manipur	Director of Industries & Commerce, Government of Manipur Head office of Directorate of Trade, Commerce & Industries, Lamphelapt, Imphal West State:- Manipur Pincode:- 795001 Email:- dcimanipur@gmail.com
Mizoram	Director of Industries & Commerce, Government of Mizoram Department of Industries Government of Mizoram, Aizawl - 796190, Mizoram

State/UT	Address of Department of Industries/State Authorities
Punjab	Director of Industries Commerce, Government of Punjab, O/O General Manager, District Industries Centre, Mission Road, Malikpur, Pathankot State:- Punjab Pincode:- 145001 Email:- pathankot.msefc@gmail.Com
Tamil Nadu	Industries Commissioner and Director of Industries and Commerce, Department of Industries and Commerce, Government of Tamil Nadu, Sidco Corporate office Building, 3Rd Floor, Thiru-Vi-Ka Industrial Estate, Guindy, Chennai 600 032, Tamil Nadu
Tripura	Director of Industries & Commerce, Government of Tripura, Shilpa Udyog Bhawan, Directorate of Industries & Commerce, Khejurbagan, Agartala, Tripura (W) State:- Tripura Pincode:- 799006 Email:- industrytripura@gmail.com
Uttar Prdesh	Chairman, Uttar Pradesh Micro Small and Medium Enterprises, Facilitation Council, Sarvodaya Nagar, G.T. Road, Kanpur - 208005 Uttar Pradesh Email:- facilitation.council@gmail.Com
Pondicherry	Chairman-Cum-Director, Directorate of Industries & Commerce, Thattanchavady, Puducherry State:- Puducherry Pincode:- 605009 Email:- ind.pon@nic.In
Goa	Deputy Director (Industries), Industry Directorate, Trade and Commerce, Government of Goa, Udyog Bhawan, Panaji, Goa - 403 001. E-Mail: Dir-Indu.Goa@Nic.In

State/UT	Address of Department of Industries/State Authorities
A&N	Director Directorate of Industries, Udhyog Parishar, Middle Point, Port Blair State:- andaman and Nicobar Islands Pincode:- 744101 Email:- dirind.and@nic.In
odisha	Director Directorate of Industries, Killa Maidan, Buxi Bazar-753001 Cuttack, Odisha
daman & Diu	Director Department of Industries, District Industries Centre, Udyog Bhawan, 1St Floor, Bhenslore, Nani Daman State:- Daman and Diu Pincode:- 396210 Email:- dic-dd@nic.In
chandigarh	Director of Industries, Chandigarh Administration, 39- Industrial Area, Phase-II, Ram Darbar State:- Chandigarh Pincode:- 160001
Chhattisgarh	Director Directorate of Industries, Udyog Bhawan, Ring Road No.1.Telibandha Raipur, C.G. State:- Chhattisgarh Pincode:- 492001 Email:- dtic-directorate.cg@gov.In
Gujarat	Commissioner Office of MSME Commissionerate Block No. 1, 4Th Floor, Udyog Bhavan, Gandhinagar 382 010, Gujarat Pincode:- 382010 Email:- comm-msefc-gnr@gujarat.gov.in

State/UT	Address of Department of Industries/State Authorities
haryana	Director Directorate of Industries & Commerce, 1St Floor, 30 Bays Building, Sector17, Chandigarh Haryana - 134114 Email: Ipcharyana@Yahoo.Com Help@Hryindustries@Gmail.Com
LAKSHADWEEP	Director of Industries, Ut Administration of Lakshadweep, Kavaratti, Lakshadweep Pincode:- 682555
Maharashtra	Development Commissioner (Industries) Government of Maharashtra Directorate of Industries, New Administrative Building, 2Nd Floor, Madame Cama Road, Opp. Mantralaya, Mumbai – 400032 Email: didci@maharashtra.gov.In
Meghalaya	Director Commerce and Industries Department, Meghalaya 2Nd Floor, Administrative Building, Lower Lachumiere, Shillong-793001, Meghalaya Email:- industries-meg@gov.In
Nagaland	Director Directorate of Industries & Commerce, Kohima Nagaland Nagaland- 797001 Email:- industrynaga@gmail.com

State/UT	Address of Department of Industries/State Authorities
Rajashthan	Director Industries & Commerce Department Udhyog Bhawan Tilak Marg Jaipuir Rajasthan, Pincode:- 302001 Email:- indrajfc@rajasthan.gov.In
Sikkim	Director of Industries, Government of Sikkim, Gangtok Secretariat Annexe-1, S. T. Marg, Gangtok, Sikkim Pincode:- 737001
Telangana	Commissioner, Commissionerate of Industries Government of Telangana Chirag Ali Lane, Abids, Hyderabad, Telangana 500001
UTTARAKHAND	Director, Directorate of Industries, Uttarakhand Industrial Area, Patel Nagar, Dehradun, Uttarakhand Email:- mpr@doiuk.org
West Bengal	Director of Industries, West Bengal 4, Abanindranath Tagore Sarani, Kolkata-700016 Email:-adiat.di-wb@bangla.gov.in

Annexure III

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA

F. No. CP-20/8/2024-UPC-II-HO-CPCB-HO

March 14, 2024

Notice

Sub: - Registration of Producers, Importers & Brand-Owners (PIBOs) and Plastic Waste Processors (PWPs) on Centralized Extended Producer Responsibility (EPR) Portal for Plastic Packaging

Ministry of Environment, Forest & Climate Change (MoEFCC), Govt. of India, notified guidelines on Extended Producer Responsibility (EPR) for Plastic Packaging vide fourth amendment to Plastic Waste Management (PWM) Rules on February 16, 2022. Producers, Importers & Brand-Owners (PIBOs) and Plastic Waste Processors (PWPs) are required to register on centralized EPR Portal developed by Central Pollution Control Board (CPCB) to fulfil their EPR liability as per the notified EPR Guidelines.

The PIBOs are required to obtain registration from CPCB if operating in more than two States/UTs and from concerned State Pollution Control Board (SPCB) / Pollution Control Committee (PCC) if operating in one or two States/UTs only. Also, PWPs are required to obtain registration from the concerned SPCBs/PCCs.

The EPR Portal (https://eprplastic.cpcb.gov.in/#/plastic/home) was launched on April 05, 2022 and 36,230 PIBOs and 2351 PWPs have been registered on the Portal on date. However, it is observed that several PIBOs & PWPs are still operating their business without obtaining registration from CPCB/SPCB/PCC (as applicable) which is in violation of provisions of PWM Rules 2016 (as amended).

This notice is being issued to inform all the PIBOs & PWPs to obtain registration from CPCB/SPCB/PCC (as applicable) in accordance with provisions of PWM Rules, 2016. PIBOs & PWPs, who have not yet applied for registration are required to submit registration application complete in all respects on the EPR Portal by March 31, 2024. Guidance Manual and the Standard Operating Procedure (SOP) for registration of PIBOs/PWPs, uploaded on EPR Portal, may be referred to for the purpose.

Necessary action, as deemed appropriate under the Environment (Protection Act), 1986, including levying of Environmental Compensation and closure of operations, shall be taken against defaulters.

(Bharat Kumar Sharma)
Member Secretary

'परिवेश भवन' पूर्वी अर्जुन नगर, दिल्ली-110032
Parivesh Bhawan, East Arjun Nagar, New Delhi - 110032
दूरभाष/Tel: 43102030, 22305792, वेबसाईट/Website : www.cpbc.nic.in

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF NDIA

F. No. CP-20/35/2023-UPC-II-HO-CPCB-HO Date: 16-02-2024

To,

The Principal Secretary
All States/UTs UDDs

Sub: - Directions Under Section 5 of the Environment (Protection) Act, 1986 for Implementation of ban on Single Use Plastic (SUP)-Reg.

Whereas, the Ministry of Environment, Forest & Climate Change (MoEF&CC) notified the PWM Rules, 2016, in exercise of the powers conferred under section 3,6, & 25 of the Environmental (Protection) Act, 1986 Vide Notification No. G.S.R. 320 (E) dated March 27, 2016; and

Whereas, Hon'ble Prime Minister of India announced India's pledge to phase out SUP by 2022 on World Environment Day June 05, 2022 and also pitched for freedom for Single Use Plastic while delivering the Independence Day speech on August 15, 2019; and

Whereas, MoEF&CC, vide Notification dated August 12, 2021 banned identified SUP items and prescribed minimum thickness of carry bag with effect from July 01, 2022; and

Whereas, as per Rule 4(2) of PWM Rules, 2016 (as amended), *"The manufacture, import, **stocking, distribution, sale and use** of following single use plastic (SUP), including polystyrene and expanded polystyrene, commodities shall be prohibited with effect from the 1st July, 2022:*

a. *Ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene [Thermocol] for decoration.*

b. *Plates, cups, glasses, cutlery such as forks, spoons, knives, straw, trays, wrapping or packing films around sweet boxes, invitation cards, and cigarette packets, plastic or PVC banners less than 100 micron, stirrers"*; and

Whereas, as per Rules 4(1)(c) of PWM Rules, 2016 (as amended), *"Carry bag made of virgin or recycled plastic, shall not be less seventy five microns in thickness with effect from the 30th September 2021 and one hundred and twenty (120) microns in thickness with effect from 31st December, 2022"; and*

Whereas, as per Rule 4 (d) of the PWM Rules, "*plastic sheet or like, which is not an integral part of multilayered packaging and cover made of plastic sheet used for packaging, wrapping the commodity shall not be less than fifty microns in thickness except where the thickness of such plastic sheets impair the functionality of the product*"; and

Whereas, as per Rule 12 (2) of PWM Rules, *"The concerned Additional Chief Secretary / Principal Secretary /Secretary-in-charge of the Department of the State or a Union Territory responsible for municipal administration shall be the authority for enforcement of*

the provisions of these rules relating to waste management by waste generator, restriction or prohibition on use of plastic carry bags, plastic sheets or like, covers made of plastic sheets and multi-layered plastic packaging and items prohibited under these rules in the urban areas of the State or a Union Territory"; and

Whereas, as per Rule 12 (3) of PWM Rules, *"The concerned Gram Panchayat Additional Chief Secretary / Principal Secretary / Secretary-in-charge of the Department of the State or a Union Territory responsible for Panchayati Raj Institution shall be the authority for enforcement of the provisions of these rules relating to waste management by the waste generator, restriction or prohibition on use of plastic carry bags, plastic sheets or like, covers made of plastic sheets and multilayered plastic packaging and items prohibited under these rules in the rural area of the State or a Union Territory"; and*

Whereas, CPCB prepared a Comprehensive Action Plan for implementation of SUP ban as per which SPCBs/PCCs have a key role to play for elimination of SUP; and

Whereas, CPCB issued Direction dated 01-2-2022 to all SPCBs/PCCs to ensure compliance of notification published by MoEF&CC dated 12-08-2021 in line with comprehensive action plan; and

Whereas, for effective monitoring of ban on identified single use plastic items and plastic waste management in the country, CPCB developed SUP Compliance Monitoring portal and SUP field inspection app to facilitate the structured inspection and monitoring by state boards and local bodies, and SUP Public Grievance App to ensure citizen participation for effective enforcement of ban; and

Whereas, CPCB issued Directions dated 30-06-2022 to all SPCBs/PCCs and UDDs to monitor compliance through SUP Compliance Monitoring App; and

Whereas, special inspection drive was conducted from October to December 2022 with focus on enforcement on street vendors, local shops, wholesale markets etc. by CPCB/SPCB/PCC with State UDD; and

Whereas, CPCB had prepared Standard Operating Procedure (SOP) with the prime objective to break the supply chain of SUP items and also issued directions dated 01-03-2023 to all SPCBs/PCCs for joint inspections with State UDD as per SOP through Field inspection app and file the inspection report on the SUP compliance monitoring portal till August 2023.

Whereas, CPCB further issued Directions dated 17.05.2023 & 20.11.2023 to all SPCBs/PCCs and UDDs for conduction of exhaustive inspection drives at regular intervals in the area under your jurisdiction along with State UDDs to identify manufacturers and suppliers of banned SUP items and take strict action against the violating entities.

Whereas continual use and sale of Single Use Plastic Items is being observed specially in informal sector including local shops/ street vendors; and

Now, therefore, in view of above and in exercise of powers vested under Section 5 of Environment (Protection) Act, 1986 to the Chairman, CPCB following directions in

continuation of Directions dated 1.2.2022, 30.6.2022, 01.03.2023, 17.05.2023 & 20.11.2023 are issued for compliance:

1. To conduct SUP ban enforcement drive jointly with State PCB/CPCB as per the SOP prepared by CPCB for four days a month during the period February- June 2024. The schedule of inspection is to be finalized by the concerned SPCB/PCC in consultation with State UDD and is to be completed by 25th of every month. The Police force may be deployed during the inspection drive as per requirement.

2. To conduct the inspections with focus on street vendors, local shops, wholesale markets, interstate borders, industries, bus depots, railway stations, airports etc.

3. To register all the concerned field officers (SPCB/PCC/State UDD) on SUP Compliance monitoring portal.

4. To conduct the inspections through Field inspection app and file the inspection report on the SUP compliance monitoring portal. Violations & details of action taken w.r.t Commercial establishment shall be reported by State UDD and violation & details of action taken w.r.t industries shall be reported by the SPCB/PCC.

5. To include information w.r.t supplier of SUP items (for commercial users), plastic raw material suppliers (for banned SUP producers) and SUP producers (for plastic waste recyclers making granules) in the inspection report.

6. To provide details w.r.t action taken against the defaulters (Seizure/ challan/ fine levied/ cancellation of permission granted for Commercial entities & Seizure/ Show Cause Notice/ Closure/ environmental compensation levied in case of banned SUP producers).

You are requested to take necessary action to ensure compliance of above directions and submit action taken report before the of every month till **June, 2024** to this office.

Yours faithfully,

16/2

(Tanmay Kumar)
Chairman

Copy to:

1. Additional Secretary, : for kind information, please
   HSMD,
   Ministry of Environment, Forest and Climate Change
   Indira Paryavaran Bhawan Jorbagh Road,
   New Delhi – 110 003

2. Regional Directors,
   All CPCB Regional Directorates : for information and necessary action, please

3. DH (IT) : for uploading on CPCB website, please

(Bharat Kumar Sharma)
Member Secretary

Annexure V-C

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA

F. No. CP-20/35/2023-UPC-II-HO-CPCB-HO Date: 16-02-2024

To,

The Chairman
All SPCBs/PCCs

Sub: - Directions Under Section 5 of the Environment (Protection) Act, 1986 for Implementation of ban on Single Use Plastic (SUP)-Reg.

Whereas, the Ministry of Environment, Forest & Climate Change (MoEF&CC) notified the PWM Rules, 2016, in exercise of the powers conferred under section 3,6, & 25 of the Environmental (Protection) Act, 1986 Vide Notification No. G.S.R. 320 (E) dated March 27, 2016; and

Whereas, MoEF&CC, vide Notification dated August 12, 2021 banned identified SUP items and prescribed minimum thickness of carry bag with effect from July 01, 2022; and

Whereas, as per Rule 4(2) of PWM Rules, 2016 (as amended), *"The manufacture, import, **stocking, distribution, sale and use** of following single use plastic (SUP), including polystyrene and expanded polystyrene, commodities shall be prohibited with effect from the 1st July, 2022:*

a. *Ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene [Thermocol] for decoration.*

b. *Plates, cups, glasses, cutlery such as forks, spoons, knives, straw, trays, wrapping or packing films around sweet boxes, invitation cards, and cigarette packets, plastic or PVC banners less than 100 micron, stirrers"*; and

Whereas, as per Rules 4(1)(c) of PWM Rules, 2016 (as amended), *"Carry bag made of virgin or recycled plastic, shall not be less seventy five microns in thickness with effect from the 30th September 2021 and one hundred and twenty (120) microns in thickness with effect from 31st December, 2022"; and*

Whereas, as per Rule 4 (d) of the PWM Rules, "*plastic sheet or like, which is not an integral part of multilayered packaging and cover made of plastic sheet used for packaging, wrapping the commodity shall not be less than fifty microns in thickness except where the thickness of such plastic sheets impair the functionality of the product*"; and

Whereas, as per Rule 12 (1) of PWM Rules, *"The Central Pollution Control Board, State Pollution Control Board and Pollution Control Committee in respect of a Union territory shall be the authority for enforcement of the provisions of these rules relating*

to registration, manufacture of plastic products and multilayered plastic packaging, processing and disposal of plastic wastes and items prohibited under these rules"; and

Whereas, as per Rule 12 (2) of PWM Rules, *"The concerned Additional Chief Secretary / Principal Secretary /Secretary-in-charge of the Department of the State or a Union Territory responsible for municipal administration shall be the authority for enforcement of the provisions of these rules relating to waste management by waste generator, restriction or prohibition on use of plastic carry bags, plastic sheets or like, covers made of plastic sheets and multi-layered plastic packaging and items prohibited under these rules in the urban areas of the State or a Union Territory"; and*

Whereas, as per Rule 12 (3) of PWM Rules, *"The concerned Gram Panchayat Additional Chief Secretary / Principal Secretary / Secretary-in-charge of the Department of the State or a Union Territory responsible for Panchayati Raj Institution shall be the authority for enforcement of the provisions of these rules relating to waste management by the waste generator, restriction or prohibition on use of plastic carry bags, plastic sheets or like, covers made of plastic sheets and multilayered plastic packaging and items prohibited under these rules in the rural area of the State or a Union Territory"; and*

Whereas, CPCB prepared a Comprehensive Action Plan for implementation of SUP ban as per which SPCBs/PCCs have a key role to play for elimination of SUP; and

Whereas, CPCB issued Direction dated 01-2-2022 to all SPCBs/PCCs to ensure compliance of notification published by MoEF&CC dated 12-08-2021 in line with comprehensive action plan; and

Whereas, for effective monitoring of ban on identified single use plastic items and plastic waste management in the country, CPCB developed SUP Compliance Monitoring portal and SUP field inspection app to facilitate the structured inspection and monitoring by state boards and local bodies, and SUP Public Grievance App to ensure citizen participation for effective enforcement of ban; and

Whereas, CPCB issued Directions dated 30-06-2022 to all SPCBs/PCCs to monitor compliance through SUP Compliance Monitoring App; and

Whereas, special inspection drive was conducted from October to December, 2022 with focus on enforcement on street vendors, local shops, wholesale markets etc. by CPCB/SPCB/PCC with State UDD; and

Whereas, CPCB had prepared Standard Operating Procedure (SOP) with the prime objective to break the supply chain of SUP items and also issued directions dated 01-03-2023 to all SPCBs/PCCs for joint inspections with State UDD as per SOP through Field inspection app and file the inspection report on the SUP compliance monitoring portal till August 2023; and

Whereas, CPCB further issued Directions dated 17.05.2023 & 20.11.2023 to all SPCBs/PCCs and UDDs for conduction of exhaustive inspection drives at regular intervals in the area under your jurisdiction along with State UDDs to identify

manufacturers and suppliers of banned SUP items and take strict action against the violating entities; and

Whereas, continual use and sale of Single Use Plastic Items is being observed specially in informal sector including the local shops/ street vendors; and

Now therefore, in view of above and in exercise of powers vested under Section 5 of the Environment (Protection) Act, 1986 to the Chairman, CPCB following directions in continuation of Directions dated 1.2.2022, 30.6.2022, 01.03.2023, 17.05.2023 & 20.11.2023 are issued for compliance:

1. To conduct SUP ban enforcement drive jointly with State UDD as per the SOP prepared by CPCB for four days a month during the period **February- June 30, 2024**. The schedule of inspection is to be finalized by the concerned SPCB/PCC in consultation with State UDD and is to be completed by 25th of every month. The Police force may be deployed during the inspection drive as per requirement.

2. To conduct the inspections with focus on street vendors, local shops, wholesale markets, interstate borders, industries, bus depots, railway stations, airports and such other crowded locations.

3. To register all the concerned field officers (SPCB/PCC/State UDD) on SUP Compliance monitoring portal.

4. To conduct the inspections through Field inspection app and file the inspection report on the SUP compliance monitoring portal. Violations & details of action taken w.r.t Commercial establishment shall be reported by State UDD and violation & details of action taken w.r.t industries shall be reported by the SPCB/PCC.

5. To include information w.r.t. supplier of SUP items (for commercial users), plastic raw material suppliers (for banned SUP producers) and SUP producers (for plastic waste recyclers making granules) in the inspection report.

6. To provide details w.r.t. the action taken against the defaulters (Seizure/ challan/ fine levied/ cancellation of permission granted for Commercial entities & Seizure/ Show Cause Notice/ Closure/ environmental compensation levied in case of banned SUP producers) through SUP field inspection App.

You are requested to take necessary action to ensure compliance of above Directions and submit action taken report before the 10th of every month till **June, 2024** to this office.

Yours faithfully,

(Tanmay Kumar)
Chairman

407

Copy to:

1. Additional Secretary, HSMD, Ministry of Environment, Forest and Climate Change Indira Paryavaran Bhawan Jorbagh Road, New Delhi – 110 003 : for kind information, please

2. Regional Directors, All CPCB Regional Directorates :

3. DH (IT) : for uploading on CPCB website, please

(Bharat Kumar Sharma)
Member Secretary

Annexure V-D

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT FOREST & CLIMATE CHANGE GOVT OF INDIA

F.No.CP-20/80/2021-UPC-II-HO-CPCB-HO-Part(2) Date: 20.11.2023

To,

The Chairman
All SPCBs/PCCs (as per list)

Sub: Directions under Section 5 of the EPA, 1986 regarding compliance of various provisions under Schedule – II of Plastic Waste Management Rules, 2016, *i.e.,* Guidelines on Extended Producer Responsibility (EPR); and

WHEREAS, the Ministry of Environment, Forest & Climate Change (MoEF&CC) has notified Plastic Waste Management Rules, 2016, in exercise of the powers conferred under sections 3, 6 & 25 of the Environment (Protection) Act, 1986 vide Notification No. G.S.R 320 (E) dated March 18, 2016; and

WHEREAS, Plastic Waste Management Rules, 2016 was amended and notified by Ministry of Environment, Forest & Climate Change (MoEF&CC) on 16 February, 2022 to insert Schedule – II, *i.e.,* Guidelines on Extended Producer Responsibility for Plastic Packaging (hereinafter referred as "EPR Guidelines"); and

WHEREAS, as per Section 6.1(a) of the EPR Guidelines, "*The following entities shall register on the centralized portal developed by Central Pollution Control Board namely: - (i) Producer (P); (ii) Importer (I); (iii) Brand owner (BO), (iv) Plastic Waste Processor engaged in (a) recycling, (b) waste to energy, (c) waste to oil, and (iv) industrial composting;"* and

WHEREAS, as per Section 11.1 of the EPR Guidelines, "*All plastic waste processors shall have to register with concerned State Pollution Control Board or Pollution Control Committee in accordance with provisions of 13(3) of Plastic Waste Management Rules, 2016 on the centralized portal developed by Central Pollution Control Board. Central Pollution Control Board shall lay down uniform procedure for registration within three months of the publication of these guidelines"* and

WHEREAS, CPCB developed the Standard Operating Procedure (SOP) for registration of PWPs on March 15, 2023 and uploaded the same on CPCB website in accordance with EPR guidelines; and

WHEREAS, as per Section 11.2 of EPR Guidelines, "*The Plastic waste processors shall submit annual returns after end of every financial year by 30th April of the next financial year on the quantity of plastic waste processed category-wise as per prescribed pro forma on the centralized portal developed by Central Pollution Control Board"; and.*

WHEREAS, as per Section 11.5 of the EPR Guidelines, "*Only plastic waste processors registered under Plastic Waste Management Rules, 2016, as amended, shall provide certificates for plastic waste processing, except in case of use of plastic waste in road construction. In case where plastic waste is used in road construction the Producers, Importers & Brand-Owners shall provide a self-declaration certificate in pro forma developed by Central Pollution Control Board. The certificate provided by only registered plastic waste processors shall be considered for fulfilment of Extended Producer Responsibility obligations by Producers, Importers & Brand-Owners"*; and

WHEREAS, as per Section 11.7 of the EPR Guidelines, "*The certificate for plastic packaging waste provided by registered plastic waste processors shall be in the name of registered Producers, Importers & Brand-Owners or Local authorities, as applicable, based upon agreed modalities. Central Pollution Control Board will develop mechanism for issuance of such certificate on the centralized portal "*; and

WHEREAS, as per the EPR Guidelines, CPCB has developed the Centralized portal for registration of Producers, Importers and Brand-owners (PIBOs) & Plastic Waste Processors (PWPs) that has been formally launched on April 05, 2022; and

WHEREAS, CPCB has developed the mechanism for Generation & Transfer of EPR Certificates (as given in the Guidance Manual developed by CPCB) by PWPs on the EPR Portal and the corresponding online module of the EPR Portal was launched on November 19, 2022; and

WHEREAS, Registration of PWPs by SPCBs/PCCs is on the basis of information provided online by PWPs on the EPR Portal which includes details of plant and machinery (processing capacity, production capacity, power rating, etc.), geotagged photograph of the plant & machinery, raw material, production and sales section of the Units, short video of the Unit etc.; and

WHEREAS, as per clause 4(iv) of SOP "*Physical Audit of the PWP to be completed by SPCB/PCC within 30 days of grant of Registration. The PWP shall be able to issue certificates to PIBOs post conduction of Audit and validation of its facilities by the SPCB/PCC*"; and

WHEREAS, in accordance with aforesaid clause of SOP, upon grant of registration to PWP, SPCB/PCC are required to physically verify details of plant and machinery (processing capacity, production capacity, power rating etc.), geotagged photograph of the plant & machinery, raw material, production and sales section of the Units, short video of the Unit etc. as per the checklist provided on EPR portal for the purpose; and

WHEREAS, CPCB has developed the Guidance manual for operating Centralized EPR Portal which includes details of procedure for Registration of PIBOs/PWPs, Generation & Transfer of EPR certificates etc., which was made available on EPR portal. Several training sessions/meetings were also conducted with SPCBs/PCCs/Industrial Associations/PWPs and other stakeholders in which inspection requirements/procedures for grant of approval of physical verification of PWPs to be followed by SPCBs/PCCs were covered. SPCBs/PCCs were required to upload approval status of Physical verification of PWPs on the EPR portal following these procedures; and

WHEREAS, CPCB vide directions dated 10.03.2023 and 04.07.2023 reiterated that all SPCBs/PCCs to complete physical verification of all registered PWPs in their jurisdiction within the stipulated time frame to enable the PWPs to generate EPR certificates within the timelines stipulated in EPR guidelines; and

WHEREAS, CPCB vide directions dated 21.12.2022 had directed all PWPs to upload GST E-invoice of all transactions (sales/ purchase) related to processing of plastic packaging & plastic waste on the EPR Portal; and

WHEREAS, viewing rights of the PWP dashboard have been provided to the officials of SPCBs/PCCs to monitor the PWP operations including procurement, production, sale and Certificate generation & transfer by PWP Units registered in their jurisdiction and the same was communicated during the training sessions for SPCBs/PCCs conducted by CPCB for the purpose; and

WHEREAS, Section 12.4 of the EPR Guidelines provides that "*Central Pollution Control Board by itself or through a designated agency shall verify compliance of Producers, Importers & Brand-Owners through inspection and periodic audit, as deemed appropriate. Central Pollution Control Board, as required, can also verify compliance of Plastic Waste Processors through inspection and periodic audit. In case of plastic waste processors and Producers, Importers & Brand-Owners operating in a State or Union Territory, Central Pollution Control Board may, if required, direct State Pollution Control Board or Pollution Control Committee to take action*"; and

WHEREAS, audit of random five Plastic Waste Processors (Recyclers) was conducted during Aug-Sept 2023 by CPCB in accordance with Clause 12.4 of the EPR

Guidelines. These units are registered on EPR Portal and Physical Verification of these units has been approved by concerned SPCBs/PCCs; and

WHEREAS, following one or more non-compliances / irregularities w.r.t implementation of EPR Guidelines were observed by the CPCB officials during the aforesaid audit in some of the aforesaid five units:

a. The plastic waste processing capacity of the units as registered by the SPCB/PCC is much higher than the actual installed/commissioned plant & machinery processing capacity in the unit. In few cases, plant & machinery are installed in the premises, but yet not commissioned.

b. Electricity and water connection has not been provided to the plant machinery; electrical and civil works were not in place and work on the same found to be still in progress during the Audit. The unit could not even perform trial run to assess the processing capacity.

c. The geotagged photographs /video of the plant uploaded with the application were not found to be in conformity with the actual observations on the field, indicating that fabricated photographs had been uploaded with the application. That the same has also not been checked during the Physical verification by the concerned SPCB/PCC.

d. The plant & machinery corresponding to the registered processing capacity granted by SPCB/PCC was neither found declared on the EPR portal nor found to be installed and commissioned in the unit by the Audit team.

e. As a result of (a) to (d) above, the unit has generated EPR Certificates of excess values for which which the actual production capacity does not exist with the unit.

f. As per the information on the EPR Portal, invoices were randomly verified and it has been observed that such verified invoices have been generated for Services provided towards collection and recycling and not for requisite actual sales of recycled plastic.

g. No relevant information was made available by the unit to the audit team to verify processing of plastic waste and sale of proportionate quantity of finished product corresponding to the value of EPR certificates generated, which included the following:

   i. Procurement of Plastic waste (Procurement invoices, Supplier details, etc.)
   ii. Electricity consumption (Electricity bill)
   iii. Procurement of additives required for processing plastic waste
   iv. Sale of recycled plastic (GST Statement, Sales invoices, etc.)

h. No worker was available in the unit or number of workers were found much less than that reported in the application form.

i. The Consent to Establish and Consent to Operate have been granted in quick succession within a gap of few days (less than a week). It is not clear as to how the unit of such scale (in this case- a large scale unit) , was established in such a short time.

j. Plot area as observed by the Audit team was not in conformity with the Plot area reported in the application form. Further, the area available for production, raw material & product storage was not found to be adequate.

k. No plastic waste was found in the premises in few cases.

l. ETP of the plant found to be under construction, in few cases, despite the fact that CTO has been granted to the unit by SPCB/PCC.

In view of the above, it is observed that EPR Certificates of the very high values have been generated by some of the units whereas such units neither have processing capacity for the said quantity nor relevant prescribed supporting documents/information. The units have obtained registration and generated the said EPR certificates of very high values without any actual processing of plastic at the units and by submitting false documents/information, which is in gross violation of provisions of EPR Guidelines as notified under Schedule II of the PWM Rules by MoEFCC, CPCB's Guidance manual for operating Centralized EPR Portal and other directions/communications issued by CPCB from time to time. The process of generation of EPR Certificates by the unit has not been monitored by the concerned SPCB/PCC despite being the enforcing agency notified under the PWM Rules and having viewing provision of the PWP dashboard of the EPR portal.

WHEREAS, as per Section 11.4 of the EPR Guidelines "*In case, at any stage it is found that the information provided by the plastic waste processor is false, the plastic waste processor shall be debarred by State Pollution Control Board, as per procedure laid down by Central Pollution Control Board, from operating under the Extended Producer Responsibility framework for a period of one year*"; and

WHEREAS, as per Section 11.6 of the EPR Guidelines "*The pro forma for the certificate shall be developed by Central Pollution Control Board. In no case, the amount of plastic packaging waste recycled by the enterprise shall be more than installed capacity of the enterprise. The certificates will be for plastic packaging category-wise and shall include GST data of the enterprise*"; and

WHEREAS, as per Section 13.1 of the EPR Guidelines "*The concerned State Pollution Control Board or Pollution Control Committee shall register Producers, Importers & Brand-Owners (operating in one or two states) and plastic waste processors, through*

the online portal developed by Central Pollution Control Board. Provision for registration shall be made on the Extended Producer Responsibility portal. State Pollution Control Board or Pollution Control Committee by itself or through a designated agency shall verify compliance of Producers, Importers & Brand-Owners through inspection and periodic audit, as deemed appropriate, of Producers, Importers & Brand-Owners as well as plastic waste processors in their jurisdiction as per the Plastic Waste Management Rule, 2016"; and

WHEREAS, as per Rule 18 of PWM Rules " *The Environmental Compensation shall be levied based upon polluter pays principle, on persons who are not complying with the provisions of these rules, as per guidelines notified by the Central Pollution Control Board*"; and

WHEREAS, as per the EC Regime framed by CPCB in 2022, Environmental Compensation is to be levied on PWP @ Rs. 5000/- per ton of plastic waste misreported for quantity of plastic procured and EPR certificate generated after following due legal procedure*";* and

NOW, THEREFORE, in view of above and in exercise of the powers vested to Chairman, Central Pollution Control Board (CPCB) vide Notification No. S.O.730 (E) dated July 10, 2002 notified as per provisions of Section 5 of the Environment (Protection) Act, 1986, following directions are issued for compliance:

1. To take immediate necessary actions to improve upon the system of grant of registration within SPCB/PCC, monitoring and enforcement ensuring enforcement of the PWM Rules, EPR guidelines and directions/guidelines issued by CPCB, including the following:

    a. To re-check processing facilities of Registered PWPs in your state and to confirm that the Processing capacity as per the Registration granted to them is in conformity with the actual facilities available in the unit. All other details provided in the online application form are also to be revalidated by SPCB/PCC.
    b. To regularly monitor EPR Certificate generation process of the Registered PWPs ensuring that EPR Certificates generated by PWPs are in accordance with requirements prescribed in CPCB guidance manual such as uploading of GST E-invoice corresponding to the sales of finished on the EPR Portal.
    c. If violations are observed as per (a) & (b) above, to conduct detailed enquiry into the issue of CTE and CTO and also as to how physical verification of the Unit was approved by SPCB/PCC, in view of the gross violations observed also as to why the process of generation of EPR Certificates was not monitored by SPCB/PCC.

d. To fix the liability on erring official/s and take disciplinary action against erring officials, if any, as per the findings of the enquiry set up, as at (c) above.

2. To take the following actions against the defaulting PWPs, if any , identified as per (1) above

   i. To suspend the consent/authorization/registration issued to the defaulting PWPs, with immediate effect and issue show cause notice to debar such PWPs from operating under the Extended Producer Responsibility framework for a period of one year as per Clause 11.4 of the EPR Guidelines or/ and for revocation of the consent/authorization/registration issued to the Unit;

   ii. To levy Environmental Compensation (EC), corresponding to the quantum of EPR certificates generated not in conformity with requirement prescribed in CPCB Guidance manual for operating Centralized EPR Portal. The EC is to be levied as per "Guidelines for Assessment of Environmental Compensation to be levied for violation of PWP Rules"(https://cpcb.nic.in/uploads/plasticwaste/EC_Regime_PWM.pdf) and Unit be directed to deposit the same in the designated Escrow Account, created by the SPCB/PCC for the purpose.

   iii. To take necessary action as per applicable law against violating PWPs which have submitted false documents for obtaining registration as well as for generating EPR certificates. It may further be ensured that action taken by SPCB/PCC regarding these units should act as a deterrent for other Units in committing such violations.

3. To take all necessary steps to ensure that PWPs henceforth complies with all conditions including generating GST E-invoice for all sales of only finished products and uploads the same on the EPR Portal, failing which necessary action be immediately taken including levying of EC against each non-complying Unit.

You are, hereby, directed to take necessary action immediately for ensuring compliance of the aforesaid directions and submit action taken report to this office within 10 days from the date of issuance of this direction.

(Tanmay Kumar)
Chairman

Annexure V-E

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT FOREST & CLIMATE CHANGE GOVT OF INDIA

F-No. CP-20/37/2023-UPC-II-HO-CPCB-HO 4400-4431 **September 21, 2023**

To,

The Chairman
SPCB/PCC
(As per list)

Sub: Direction Under Section 5 of the Environment (Protection) Act, 1986 to SPCBs/PCCs for submission of incomplete/no information for Annual Report (2022-23) on Implementation of Plastic Waste Management Rules, 2016 (as amended)

WHEREAS, the Ministry of Environment, Forest and Climate Change (MoEF&CC) notified the Plastic Waste Management Rules, 2016 in exercise of the powers conferred under sections 3,6 and 25 of the Environment (Protection) Act, 1986 vide Notification No. G.S.R 320 (E) dated March 18, 2016; and

WHEREAS, Ministry of Environment, Forest and Climate Change amended PWM Rules 2016 vide Notification No. G.S.R. 285(E) dated March 27, 2018; and

WHEREAS, as per rule 17(2) of the PWM Rules, 2016, as amended, "*Every local body shall prepare and submit an annual report in Form –V to the concerned Secretary-in-charge of the Urban Development Department under intimation to the concerned State Pollution Control Board or Pollution Control Committee by the 30th June, every year*"; and

WHEREAS, as per rule 17(3) of the PWM Rules, 2016, as amended, *"Each State Pollution Control Board or Pollution Control Committee shall prepare and submit an annual report in Form VI to the CPCB on the implementation of these rules by the 31st July, of every year";* and

WHEREAS, *as per rule 17(4) of PWM Rules, 2016 as amended, The CPCB shall prepare a consolidated annual report on the use and management of plastic waste and forward it to the Central Government along with its recommendations before the 31st August of every year"; and*

WHEREAS, honourable NGT in the matter of O.A No. 247/2017 had directed that "*all the States and Union Territories to ensure that reports in terms of Rule 13 are furnished to the CPCB positively within one month or 30th April, 2019, for the period the reports are due as per rules and not filed so far. CPCB may prepare Action plan for submission of compliance state of PWM Rules by states/UTs".* CPCB had prepared a comprehensive format for the action plan for submission of compliance status of PWM Rules by states/UTs and obtained detailed information from the States/UT during the period 2019-21; and

'परिवेश भवन' पर्वी अर्जुन नगर, दिल्ली-110032
Parivesh Bhawan, East Arjun Nagar, Delhi-110032
दूरभाष/Tel : 43102030, 22305792, वेबसाईट/Website : www.cpcb.nic.in

WHEREAS, CPCB, subsequently, had directed SPCBs/PCCs to file Action Plan (Form VI) in the prescribed format **(Annexure I)** in the Annual Report submitted to CPCB which included data related to plastic waste generated, collected and processed (recycled, co-processing, road making, waste to oil); and

WHEREAS, incomplete/no information regarding Annual Report and Action plan for year 2022-23 has been received from your office; and

NOW, THEREFORE, in view of above and in exercise of powers vested under Section 5 of Environment (Protection) Act, 1986 to the Chairman, CPCB, it is directed to submit complete information for Annual Report for Financial Year 2022-23 on Implementation of Plastic Waste Management Rules, 2016, as amended along with the Action Plan as per prescribed format.

You are requested to take necessary action to ensure compliance of above direction within 15 days of issue this direction.

25/9/23

(Tanmay Kumar)
Chairman

Copy to:

1. **Additional Secretary (CP Division)**
   Ministry of Environment, Forests & Climate Change
   Indira Paryavaran Bhawan, Jor Bagh Road,New Delhi,110003 : For kind information please

2. **Incharge, IT Division**
   CPCB : For uploading on CPCB website

(Bharat Kumar Sharma)
Member Secretary

By Registered Post

F. No. B-31011/BMW (14499)/2023/WMD-I 4685

27th September, 2023

To,

M/s Belgaum Green Environment Management Pvt. Ltd.,
Sy No 29/2, Harugoppa Village,
Saundatti Taluk, Belagavi District,
Belagavi, Karnataka

DIRECTION UNDER SECTION 5 OF THE ENVIRONMENT (PROTECTION) ACT, 1986 AND SHOW CAUSE NOTICE - THEREOF FOR IMPOSITION OF ENVIRONMENTAL COMPENSATION

WHEREAS the Central Government has notified the Bio-Medical Waste Management Rules, 2016 and amendments thereof (herein after referred as BMWM Rules, 2016) in suppression of the Bio-Medical Waste (Management & Handling) Rules, 1998, and amendments thereof, under the Environment (Protection) Act, 1986, to improve the collection, segregation, processing, treatment and disposal of the Bio-Medical wastes in an environmentally sound management thereby, reducing the biomedical waste generation and its impact on the environment; and

WHEREAS Rule 5 of BMWM Rules, 2016 stipulate duties of the operator of Common Bio-Medical Waste Treatment Facility (CBWTF) to ensure treatment and disposal of biomedical waste in line with provisions of said Rules; and

WHEREAS as per Rule 7 (1) of BMWM Rules, 2016, the bio-medical waste is required to be treated and disposed off in accordance with Schedule I and in compliance with the standards prescribed in Schedule II of the BMWM Rules, 2016; and

WHEREAS Rule 14 (1) of BMWM Rules, 2016 stipulate that every authorized person is required to maintain records related to generation, collection, segregation, storage, transportation, treatment, disposal and or any form of handling of Bio-Medical waste in accordance with these Rules and guidelines issued by CPCB"; and

WHEREAS the Hon'ble National Green Tribunal, in the matter of O.A. No. 710 of 2017 filed by Shailesh Singh vide order dated 12.03.2019 directed "CPCB to undertake study and prepare a scale of compensation to be recovered from violators of Bio-Medical Waste Management Rules, 2016. Hon'ble NGT also directed that scale of compensation must be deterrent, rendering violation of Rules to be non-profitable which should be adequate to remedy the situation"; and

WHEREAS Hon'ble National Green Tribunal in its order dated 15.07.2019 in the matter of O.A. No. 710 of 2017, accepted Guidelines for "Imposition of Environmental Compensation Charges (ECC) against Healthcare Facilities (HCFs) and Common Biomedical Waste Treatment Facilities (CBWTFs)"; and

WHEREAS the CBWTF namely M/s Belgaum Green Environment Management Pvt. Ltd., Sy. No. 29/2, Harugoppa Village, Saundatti Taluk, Belagavi District, Belagavi, Karnataka (the Unit) was inspected by Central Pollution Control Board (CPCB) on 19.07.2023 wherein following non-compliances were observed:

2. The Member Secretary
Karnataka State Pollution Control Board,
Parisara Bhavana,1st to 5thFloor
49, Church Street,
Bengaluru – 560 001. : For kind information

3. The Regional Director,
The Regional Directorate
Central Pollution Control Board
1st & 2nd Floors, Nisarga Bhavan
A-Block, Thimmaiah Main Road
7th D Cross, Shivanagar, Opp. Pushpanjali Theatre,
Bangalore –560 010. : For kind information

4. I/c IT Division : For information and necessary action

5. I/c Accounts Division : For information & for further necessary action

(Bharat Sharma)

Annexure V-F

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE GOVT. OF INDIA

F. No. CP-20/117/2021-UPC-II-HO-CPCB-HO-Part(10) Date: 17-02-2023

To,

Airline Operators
(As per list)

Sub: - Direction under Section 5 of the Environment (Protection) Act, 1986 to Airlines operators for phasing out of Single Use Plastic (SUP) & obtaining Registration as per EPR Guidelines -Reg.

Whereas, the Ministry of Environment, Forest & Climate Change (MoEF&CC) notified the Plastic Waste Management (PWM) Rules, 2016, in exercise of the powers conferred under section 3, 6 & 25 of the Environmental (Protection) Act, 1986 vide Notification No. G.S.R. 320 (E) dated March 27, 2016; and

Whereas, MoEF&CC issued Notification, dated August 12, 2021 which mandated banning of identified Single Use Plastic (SUP) items with effect from July 01, 2022; and

Whereas, as per Rule 4(2) of PWM Rules, 2016 (as amended), *"The manufacture, import, stocking, distribution, sale and use of following single use plastic (SUP), including polystyrene and expanded polystyrene, commodities shall be prohibited with effect from the 1st July, 2022:*

(a) ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene [Thermocol] for decoration.

(b) Plates, cups, glasses, cutlery such as forks, spoons, knives, straw, trays, wrapping or packing films around sweet boxes, invitation cards, and cigarette packets, plastic or PVC banners less than 100 micron, stirrers; and

Whereas, as per Rules 4(1)(c) of PWM Rules, 2016 (as amended) *"Carry bag made of virgin or recycled plastic shall not be less than seventy five microns in thickness with effect from the 30th September,2021 and one hundred and twenty (120) microns in thickness with effect from 31st December, 2022"*; and

Whereas, as per Rules 4(d) of PWM Rules, 2016 (as amended*), "plastic sheet or like, which is not an integral part of multilayered packaging and cover made of plastic sheet used for packaging, wrapping the commodity shall not be less than fifty microns in thickness except* ***as specified by Central Government*** *where the thickness of such plastic sheets impair the functionality of the product"*;

Whereas, as per Rules 4(1)(j) of PWM Rules, 2016 (as amended) *"Non-woven plastic carry bag shall not be less than 60 Gram Per Square Meter (GSM) with effect from the 30th September, 2021";*

Whereas, MoEF&CC notified Extended Producer Responsibility (EPR) Guidelines for Plastic Packaging in Schedule II of Fourth Amendment to PWM Rules on February 16, 2022; and

Whereas, as per Section 4 of the notified EPR Guidelines, brandowners , producers and importers (PIBOs) of plastic packaging are covered under the Extended Producer Responsibility obligations and provisions of the EPR guidelines; and

Whereas, as per Section 10.1 of the EPR guidelines, brandowners, producers and importers of plastic packaging have to register on the Centralized EPR Portal developed by CPCB; and

Whereas, CPCB has developed online portal https://eprplastic.cpcb.gov.in for registration of PIBOs which was launched by Hon'ble MEF on April 05, 2022; and

Whereas, it has been observed that banned SUP items (as per MoEF&CC notification dated August 12, 2021), thin plastic sheets (less than 50 microns thickness), thin plastic bags (less than 120 microns thickness) are continued to be used by various operators in the Airlines sector which is in violation of PWM Rules 2016 (as amended); and

Whereas, it has been observed that plastic packaging (more than 50 micron), without obtaining Registration as per notified EPR Guidelines, is used by various operators in the Airlines sector which is in violation of PWM Rules 2016 (as amended);

Now, **therefore,** in compliance of above and in exercise of powers vested under Section 5 of Environment (Protection) Act, 1986 to the Chairman, CPCB, following Directions are being issued for compliance:

i. To ensure that banned SUP items (as per MoEF&CC notification dated August 12, 2021), thin plastic sheets (less than 50 microns thickness), thin plastic bags (less than 120 microns thickness) are not sold/ stocked/ used in any form by your Airline.

ii. To obtain Registration as a Brand-owner/Producer/Importer (as applicable) under PWM Rules, 2016 (as amended) on Centralized EPR portal, if using plastic packaging more than 50 micron thickness in any form.

Necessary action for compliance of aforesaid directions shall be taken and Action Taken Report to be submitted to this office within 15 days of issue of these directions, failing which appropriate action including levying of Environmental Compensation will be taken under the provision of Environmental (Protection) Act, 1986.

Yours faithfully,

17/2

(Tanmay Kumar)
Chairman

Copy to:

1. Sh. Naresh Pal Gangwar, Additional Secretary, Ministry of Environment, Forests & Climate Change Indira ParyavaranBhawan Jorbagh Road, New Delhi – 110003 : for kind information please

2. DH (IT) : for uploading on CPCB website

(Prashant Gargava)
Member Secretary

O/C

LIST OF AIRLINES

S.No.	Name	Address
1.	Air India	M/s. Air India Limited Airlines House, 113 Gurudwara Rakabganj Road, New Delhi, Delhi, 110001
2.	Air India Express	M/s. Air India Express Ltd. Door No. 54/4042 A&B, 5th Floor, Aryabhangy Pinnacle, Sahodaran Ayyappan Road, Elamkulam, Kochi, Kerala 682020
3.	AIX Connect	M/s. AIX Connect Private Limited Ground Floor, Alpha 3 Building Kempegowda International Airport, Devenahalli, Bangalore, Bangalore, Karnataka
4.	Akasa Air	M/s. Akasa Air Urmi Estate, Tower A, 12th Floor 95, Ganpatrao Kadam Marg, Lower Parel (W), Mumbai 400013
5.	Go First	M/s. Go Airlines (India) Ltd Terminal 2, Indira Gandhi International Airport New Delhi -110037
6.	IndiGo	M/s. IndiGo Level 1, Tower C, Global Business Park, Mehrauli-Gurgaon Road, Gurgaon – 122 002, Haryana
7.	SpiceJet	M/s. SpiceJet Ltd. 319, Udyog Vihar, Phase IV, Gurgaon – 122016 Haryana
8.	Vistara	M/s. Tata SIA Airlines Limited Intellion Edge, Tower A, 9th and 10th Floor, South Peripheral Road, Sector – 72, Gurugram, Haryana - 122101
9.	Alliance Air	M/s. Alliance Air Aviation Limited Alliance Bhawan, Domestic Terminal-1, I.G.I. Airport, New Delhi 110037
10.	FlyBig	M/s. FlyBig Killa No. 13, 3rd Floor, Begumpur, Khatola, Gurugram - 122001, Haryana
11.	Star Air	M/s. StarAir 2nd Floor, Block 3 Sindhu Logistic Park, No. 34, Nellakunte, Bettahalasuru, Hunsemaranahalli (P), Bangalore - 562 157,

Annexure V-G

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE GOVT. OF INDIA

F. No. CP-20/117/2021-UPC-II-HO-CPCB-HO-Part(10) Dated: 25 -01-2023

To,

M/s. E-commerce Company
(As per list)

Sub: - Closure Directions under Section 5 of the Environment (Protection) Act, 1986 for Non-compliance of PWM Rules, 2016 (as amended) - Reg.

Whereas, the Ministry of Environment, Forest & Climate Change (MoEF&CC) notified the Plastic Waste Management (PWM) Rules, 2016, in exercise of the powers conferred under section 3, 6 & 25 of the Environmental (Protection) Act, 1986 vide Notification No. G.S.R. 320 (E) dated March 27, 2016; and

Whereas, MoEF&CC issued Notification, dated August 12, 2021 which mandated banning of identified Single Use Plastic (SUP) items and prescribed minimum thickness of carry bag with effect from July 01, 2022; and

Whereas, as per Rule 4(2) of PWM Rules, 2016 (as amended), *"The manufacture, import, stocking, distribution, sale and use of following single use plastic (SUP), including polystyrene and expanded polystyrene, commodities shall be prohibited with effect from the 1st July, 2022:*

(a) ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene [Thermocol] for decoration.

(b) Plates, cups, glasses, cutlery such as forks, spoons, knives, straw, trays, wrapping or packing films around sweet boxes, invitation cards, and cigarette packets, plastic or PVC banners less than 100 micron, stirrers; and

Whereas, as per Rules 4(1)(c) of PWM Rules, 2016 (as amended) *"Carry bag made of virgin or recycled plastic shall not be less than seventy five microns in thickness with effect from the 30th September,2021 and one hundred and twenty (120) microns in thickness with effect from 31st December, 2022";* and

Wheras, as per Rule 4(1)(d) of PWM Rules (as amended) *"Plastic sheet or like, which is not an integral part of multilayered packaging and cover made of plastic sheet used for packaging, wrapping the commodity shall not be less than fifty microns in thickness except as specified by the Central Government where the thickness of such plastic sheets impair the functionality of the product"*; and

Whereas, as per Rule 4(1)(j) "*non-woven plastic carry bag shall not be less than 60 Gram Per Square Meter (GSM) with effect from the 30th September, 2021.*"; and

Whereas, M/s. Unit Name Limited is engaged in selling / using banned SUP items as per the said Notification; and

Whereas, vide letter No. B.17011/7/UPC-II-PWM(SUP)/2022 dated 01/02/2022, CPCB issued following Directions to your unit to stop selling / usage of banned SUP items through the online platform provided by your organization with effect from July 01, 2022.

Whereas, vide letter dated 03-6-2022, a reminder letter was sent for compliance of the above said direction issued to your unit; and

Whereas, report on compliance of aforementioned Directions has not been received from your organization, although six months have lapsed since the ban on SUP items has been in force, as per MoEF&CC Notification dated 12.08.22.; and

Whereas, CPCB issued Show Cause Notice dated December 13, 2022 under Sec 5 of the Environment (Protection) Act, 1986 (notice thereof) to your unit for i) Closure of operations of the unit ii) Levying of Environment Compensation for non-compliance of provisions of PWM Rules, 2018 and given an opportunity to submit its reply within 10 days from issuance of these directions; and

Whereas, M/s. Unit name has not submitted any response to CPCB so far;

Whereas, as per the EC Regime prepared by CPCB, Environmental Compensation is to be levied @Rs.5000/- per ton of SUP items sold in marketplace through your platform.

NOW THEREFORE, in view of above and in exercise of the powers vested to Chairman, Central Pollution Control Board (CPCB) under Section 5 of the Environment (Protection) Act, 1986, the following directions are issued to your unit:

1. The industry shall close down its operations with immediate effect and not resume its operations till it complies with provision of the PWM Rules, 2016 (as amended) related to SUP ban.

2. The unit shall pay **Rs. 25,00,000/-** (Twenty Five lakhs only) as interim Environmental Compensation charge for violation of Plastic Waste Management Rules, 2016 (as amended) to CPCB (A/c No. 532702050000164, Bank Name: Union Bank Of India, IP Extension Branch, Vikash marg Ext, Delhi, IFSC: UBIN0553271). In case of delay, simple interest @12% shall be levied for the delay period (delay period shall be calculated after 15 days of issue of this direction till the date of EC deposited by the unit).

You are required to take necessary action to comply with the above Directions and submit the Compliance report within 15 days of issue of these Directions, failing which CPCB shall be constrained to take action as deemed fit under Section 5 of EPA.

Yours faithfully,

25/1/23

(Tanmay Kumar)
Chairman

Copy to:

1. The Secretary,
   Ministry of Electronics and Information Technology
   (Government of India)
   Electronics Niketan, 6, CGO Complex,
   Lodhi Road, New Delhi – 110003
   : For information & necessary action please

2. Sh. Naresh Pal Gangwar,
   Additional Secretary,
   Ministry of Environment, Forests & Climate Change
   Indira Paryavaran Bhawan, Jorbagh Road,
   New Delhi – 110003

3. DH (IT)

(Prashant Gargava)
Member Secretary

O/c

E commerce companies (Non-complying)

Sl. No.	Name	Address
1.	MS Movers and Packers	M/s. MS Movers and Packers 8A/ 174/2740 Sai Co-operative Housing Society, Hariyali Village, Tagore Nagar, Vikroli East Mumbai, Maharashtra 400083
2.	Limeroad	M/s. A. M. Marketplaces Pvt Ltd (Lime Road) 4th & 5th Floor, Plot No. 48, Sector 44, Near HUDA City Center Metro Station, Gurgaon, Haryana – 122001
3.	Yepme	M/s. Yepme Limited 312 F, 3rd Floor, Centrum Plaza, Golf Course Road, Sector 53, Gurgaon 122001
4.	Netmeds	M/s. Netmeds 5th Floor, EA Chambers (Express Avenue) No 49 & 50 L, Whites Road, Royapettah, Chennai – 600014
5.	Zivame	M/s. Reliance Retail Limited (Zivame) 3rd Floor, Court House, Lokmanya Tilak Marg, Dhobi Talao, Mumbai, Maharashtra - 400 002
6.	Clovia	M/s. Purple Panda Fashions Private Limited (Clovia) 109 B -plot No. 18, Rajendra Jaina Tower, Wazirpur Commercial Complex, Wpia, New Delhi -110052
7.	Quikr	M/s. Quikr India Pvt. Ltd. 1st Floor, Raghuvanshi Mansion, Senapati Bapat Marg, Lower Parel, Mumbai, Maharashtra – 400013
8.	Sulekha	M/s. Sulekha.com New Media Pvt. Ltd. RMZ Millenia Business Park, 2nd Floor of, Campus 1A, No 143, Dr. MGR Road, Kandanchavadi, Perungudi, Chennai - 600 096
9.	Hopscotch	M/s. Hopscotch 1st Floor DGP House, Behind Bengal Chemical, Old Prabhadevi Road, Mumbai, Maharashtra 400025
10.	FreshMenu	M/s. FreshMenu No 1229, 4th Main Cross, Sector 7, HSR Layout, Bengaluru, Karnataka 560034

Annexure V-H

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE GOVT. OF INDIA

F. No. B.17011/7/UPC-II-PWM(SUP)/2022 Dated: 13-12-2022

To,

The Manufacturers,
(As per list)

Sub: Comprehensive Directions under Section 5 of the Environment (Protection) Act, 1986 to Plastic Raw Material Manufacturers for effective implementation of ban on identified Single-use plastic (SUP) items and implementation of Guidelines for Extended Producer Responsibility (EPR) on plastic packaging-Reg.

Whereas, the Ministry of Environment, Forest & Climate Change (MoEF&CC) notified the Plastic Waste Management (PWM) Rules, 2016, in exercise of the powers conferred under sections 3,6, & 25 of the Environmental (Protection) Act, 1986 vide Notification No. G.S.R. 320 (E) dated March 27, 2016; and

Whereas, MoEF&CC issued Notification, dated August 12, 2021 which mandated banning of following Single Use Plastic (SUP) items with effect from July 01, 2022; and

a. ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene [Thermocol] for decoration;

b. plates, cups, glasses, cutlery such as forks, spoons, knives, straw, trays, wrapping or packing films around sweet boxes, invitation cards, and cigarette packets, plastic or PVC banners less than 100 micron, stirrers.

Whereas, as per provision 4(1)(c) of PWM Rules 2018, (as amended), "*carry bags made of virgin or recycled plastic shall not be less than seventy five microns in thickness with effect from the 30th September, 2021and one hundred and twenty (120) microns in thickness with effect from the 31st December, 2022*"

Whereas, as per provision 4(d) of PWM Rules 2018, (as amended), *Plastic sheet or like, which is not an integral part of multilayered packaging and cover made of plastic sheet used for packaging, wrapping the commodity shall not be <50 microns in thickness except* ***as specified by Central Government*** *where the thickness of such plastic sheets impair the functionality of the product*";

Whereas, as per Rules 4(1)(j) of PWM Rules, 2016 (as amended) *"Non-woven plastic carry bag shall not be less than 60 Gram Per Square Meter (GSM) with effect from the 30th September, 2021"; and*

Whereas, As per provision 4(1-e) of the PWM Rules, as amended, "*The manufacturer shall not sell or provide or arrange plastic to be used as raw material to a producer, not having valid registration from the concerned State Pollution*

Control Boards or Pollution Control Committee or the Central Pollution Control Board; and

Whereas, MoEF&CC notified Guidelines for Extended Producer Responsibility for Plastic Packaging in Schedule II of Fourth Amendment to PWM Rules on February 16, 2022; and

Whereas, as per Section 10.1 of the EPR guidelines: "*The Producers, Importers & Brand-Owners (PIBOs) shall have to register through the online centralized portal developed by CPCB. The certificate of registration shall be issued using the portal*"; and.

Whereas, CPCB has developed online portal https://eprplastic.cpcb.gov.in/plastic/ for registration of PIBOs & PWPs which was launched on April 05, 2022; and

Whereas, M/s. Name of Industry is engaged in manufacturing plastic raw material which can be used for production of plastic items including plastic packaging as enumerated above; and

Whereas, vide letters dated 10-06-2022, CPCB issued following modified Directions to your unit for phasing out Single Use plastic; and

1. The manufacturers shall not directly supply plastic raw materials to producers (in formal/informal sector) engaged in production of banned SUP items.

2. Manufacturers shall inform its plastic raw material buyers that they shall not be supplying plastic raw material for production of banned SUP items w.e.f. July 01, 2022:

3. The manufacturers shall print the following advisory on their invoices raised for sale of plastic raw material w.e.f. July 01, 2022:
   "*Not to be used in the manufacture of SUP items prohibited under PWM Rules*"

4. The manufacturers shall print the following on all Packaging Bags of plastic raw material w.e.f July 01, 2022:
   "*Not to be used in the manufacture of SUP items prohibited under PWM Rules, 2016.*"

5. The following shall be incorporated in all MoU/ Sale Contracts/Price Lists pertaining to sales of plastic raw materials w.e.f July 01, 2022:
   "*Buyer hereby undertakes and warrants to comply, at all times, with the applicable laws including but not limited to the Plastic Waste Management Rules 2016 as amended from time to time and notifications and directives issued thereunder ("PWM Rules"), in relation to the use of the Goods. Buyer expressly undertakes and warrants that the plastic raw material purchased shall not be used, directly or indirectly, in production of banned Single Use Plastic (SUP) items, listed in PWM Rules.*"

6. The plastic raw material manufacturers shall provide sales details of plastic raw materials on quarterly basis to CPCB w.e.f. July 01, 2022 in the prescribed format.

Whereas, vide letters dated 17-08-2022 & 18-09-2022, CPCB issued following Directions to your unit:

1. Not to supply plastic raw materials directly to producers engaged in manufacture of plastic packaging not having valid registration certificate from the concerned State Pollution Control Boards or Pollution Control Committee or CPCB through the centralized EPR Portal.

2. Manufacturers shall send a communication to its plastic raw material customers that they, henceforth, shall not be supplying plastic raw material for production of banned SUP items to producers of plastic packaging not registered on CPCB portal.

3. The plastic raw material manufacturers shall submit quarterly sales details of plastic raw materials to CPCB.

4. To ensure that Registration No., as issued on the centralized EPR Portal to the plastic packaging producer, is henceforth incorporated in all invoices issued for sale of plastic raw material to such producers.

Whereas, production, sale and usage of banned SUP items and improper management of plastic packaging waste still continues in various sections of the Indian economy;and

Now, therefore, in exercise of powers vested under Section 5 of Environment (Protection) Act, 1986 to the Chairman CPCB, following comprehensive directions are issued to your industry:

1. Not to supply plastic raw materials directly to producers engaged in manufacture of plastic packaging not having valid registration certificate from the concerned State Pollution Control Boards or Pollution Control Committee or CPCB through the centralized EPR Portal.

2. Not to supply plastic raw materials directly to banned SUP producers. The list of banned items to include items listed in MoEF&CC Notification dated August 12, 2021, plastic sheets less than 50 micron thickness, plastic carry bags less than 75 micron thickness w.e.f 30.9.21 and & 120 micron w.e.f 31.12.22 and non-woven bags less than 60 GSM

3. To ensure that Registration No., as issued on the centralized EPR Portal to the plastic packaging producer, is henceforth incorporated in all invoices issued for sale of plastic raw material to such producers

4. To ensure that first buyer and every subsequent buyer of plastic raw materials shall maintain record of transactions of plastic raw material in electronic from, till such time the raw material is sold for making products.

5. To print the following advisory on their invoices raised for sale of plastic raw material w.e.f. July 01, 2022*"Not to be used in the manufacture of SUP items prohibited under PWM Rules including plastic sheets < 50 micron thickness, non-woven carry bags < 60 GSM, Carry bags < 75 micron thickness w.e.f 30.9.21 and 120 micron thickness w.e.f 31.12.22"*

6. To print the following on all Packaging Bags of plastic raw material w.e.f July 01, 2022:*"Not to be used in the manufacture of SUP items prohibited under PWM Rules, 2016. including plastic sheets < 50 micron thickness, non-woven carry bags < 60 GSM, Carry bags < 75 micron thickness w.e.f 30.9.21 and 120 micron thickness w.e.f 31.12.22*

7. To incorporate the following in all MoU/ Sale Contracts/Price Lists pertaining to sales of plastic raw materials w.e.f July 01, 2022:
"Buyer hereby undertakes and warrants to comply, at all times, with the applicable laws including but not limited to the Plastic Waste Management Rules 2016 as amended from time to time and notifications and directives issued thereunder ("PWM Rules"), in relation to the use of the Goods. Buyer expressly undertakes and warrants that the plastic raw material purchased shall not be used, directly or indirectly, in production of banned Single Use Plastic (SUP) items, listed in PWM Rules."

8. To provide sales details of plastic raw materials on quarterly basis to CPCB w.e.f. July 01, 2022 in the prescribed format (annexed).

Necessary action shall be taken to ensure compliance of aforesaid directions and Action Taken Report submitted to this office on quarterly basis, failing which appropriate action including levying of Environmental Compensation will be taken against your industry in accordance with the provisions under Environmental (Protection) Act, 1986.

Yours faithfully,

(Tanmay Kumar)
Chairman

Copy to:

1. Sh. Naresh Pal Gangwar,
   Additional Secretary,
   Ministry of Environment, Forests & Climate Change
   Indira ParyavaranBhawan
   Jorbagh Road,
   New Delhi – 110003

2. DH (IT)

(Prashant Gargava)

O/C

Monthly report of Plastic Raw Material Manufacturers								
Duration			Month		Year			
Sl. No.	Name & Contact details (Address, E-mail ID & Phone No.)	Category (Supplier/Producer/Stockist/ Retail)	GST No. of the entity supplied to	Product manufactured (in case of producer)	Type of plastic raw material supplied	Qty of raw material supplied	Date of supply	GST paid

LIST OF LEADING MANUFACTURERS OF PLASTIC RAW MATERIAL

S.No.	Company	Registered Address
1	Reliance Industries Limited	Reliance Industries Limited 3rd Floor, Maker Chambers IV,,222, Nariman Point, Mumbai Maharashtra - 400021
2	Indian Oil Corporation Limited	Indian Oil Corporation Limited Indian Oil Bhavan G-9, Ali Yavar Jung Marg, Bandra (East), Mumbai -400051
3	Haldia Petrochemicals Ltd.	Haldia Petrochemicals Ltd. Tower 1, Bengal Eco Intelligent Park (Techna) Block EM, Plot No 3, Sector V, Salt Lake PO: Bidhan Nagar, District: North 24 Paraganas Kolkata 700091
4	GAIL (INDIA) Limited	GAIL (INDIA) Limited GAIL Bhawan, 16 BhikajiCama Place, R K Puram, New Delhi - 110066
5	HPCL–Mittal Energy Limited	HPCL–Mittal Energy Limited Phullokari Village, TalwandiSaboo Taluka, District Bathinda - 151301, Punjab
6	IVL Dhunseri Petrochem Industries Limited	IVL Dhunseri Petrochem Industries Limited 'Dhunseri House', 4A, Woodburn Park, Kolkata 700020
7	Supreme Petrochem Ltd.	Supreme Petrochem Ltd. Solitaire Corporate Park, Building No. 11, 5th Floor, 167, Guru Hargovindji Marg, Chakala, Andheri (East), Mumbai - 400093,
8	Finolex Industries Limited	Finolex Industries Limited Gat No. 399, Village Urse,,Taluka Maval, Pune District Maharashtra-410506
9	Chemplast Sanmar Limited	Chemplast Sanmar Limited 9 Cathedral Rd Madras Tamil Nadu 600086

10	LG Polymers India Pvt., Ltd.	LG Polymers India Pvt., Ltd. Quality Innovation & Solutions RR Venkatapuram, Visakhapatnam-530029. Andhra Pradesh, India.
11	INEOS Styrolution India Limited	INEOS Styrolution India Limited 5th Floor, OHM House-2, OHM Business Park, Near Balaji Hospital Subhanpura, Vadodara - 390007, Gujarat India
12	ONGC Petro additions Limited	ONGC Petro additions Limited 35, Nutan Bharat Co-operative Housing Society Limited, R.C. Dutt Road, Alkapuri, Vadodara-390007, Gujarat,
13	Mangalore Refinery and Petrochemicals Limited	Mangalore Refinery and Petrochemicals Limited Kuthethoor P.O., Via Katipalla, Mangalore, 575 030
14	Brahmaputra Cracker & Polymer Ltd.	Brahmaputra Cracker and Polymer Limited 1st Floor, House No 6 Bhuban Road, Uzanbazar Guwahati, Assam Pin - 781001
15	DCW Limited	DCW Limited Nirmal 3rd Floor, Nariman Point Mumbai-400021, India.
16	DCM Shriram Ltd.	DCM Shriram Ltd. 2nd Floor (West Wing) World Mark 1, Aerocity Delhi - 110037
17	Gujarat State Fertilizers & Chemicals Limited	Gujarat State Fertilizers & Chemicals Limited P. O. Fertilizernagar-391750, Dist. Vadodara, Gujarat
18	Bhansali Engineering Polymers Ltd.	Bhansali Engineering Polymers Ltd Unit No. 401,4th Floor, Peninsula Heights, C.D. Barfiwala Road, Andheri (West), Mumbai 400058

Annexure V-I

तन्मय कुमार, भा.प्र.से.
अध्यक्ष

Tanmay Kumar, I. A. S.
Chairman

सत्यमेव जयते

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार
CENTRAL POLLUTION CONTROL BOARD
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA

D.O.No.B.17011/1/UPC-II-PWM (SUP)/2022
12th October, 2022

Your kind attention is invited to CPCB's letter dated February 25, 2022 on the subject vide which you were requested to issue necessary instructions to concerned Authorities for execution of activities related to enforcement of ban on SUP items.

Despite the SUP ban on July 01, 2022, it is observed that use of SUP items, specifically the thin carry bags continues unabated in the low end section of the economy specifically street vendors, sabji mandis, flower sellers etc.

For strict enforcement of SUP ban, intensive activities are planned during October-December 2022 with focus on street vendors, sabzi mandis flower sellers, local market, checks at borders, inspection of concerned industries etc. Representative of State UDD Board as well as SPCB are required to be deployed in the inspection team for enforcement of SUP ban. Further, considering the sensitivity of the inspection involved, all administrative support including police protection is to be provided to the inspection team to avoid untoward incidents. Brief note prepared by CPCB (enclosed) may please be referred to for further detail.

In view of the above, you are requested to direct the concerned authorities (State UDD/State Env Deptt, SPCB/PCC, State Police Deptt.) to deploy concerned officials and provide all necessary assistance for execution of the planned activities for enforcement of SUP ban as mentioned in the annexed Schedule.

Yours sincerely

12/10

(Tanmay Kumar)

The Chief Secretary, All States/UTs

Copy to:

1. Principal Secretary, UDDs (All States/UTs) : for information & necessary action please
2. Principal Secretary, Environment (All States/UTs) : for information & necessary action please
3. Director General of Police : for information & necessary action please
4. Chairman, (All SPCBs/PCCs) : for information & necessary action please
5. Regional Directors (All RDs CPCB) : for information & necessary action please

12/10

(Tanmay Kumar)

CPCB
'परिवेश भवन, पूर्वी अर्जुन नगर, दिल्ली-110 032, भारत
'Parivesh Bhawan, East Arjun Nagar, Delhi-110 032, India
Tel. +91-11-22307233, Tele Fax : +91-11-22304948, e-mail: ccb.cpcb@nic.in

Annexure I

Note on enforcement of Single Use Plastic (October- December 2022)

1.0 Background

Hon'ble MEF made the following observations during the meeting held on October 04, 2022:

- Use of alternatives SUP items observed in high-end sections of the economy.
- Use of SUP items continues unabated in the low end section of the economy specifically street vendors, sabji mandis, flower sellers etc.
- Interstate transportation of SUP items needs to be checked.

In view of above, the following plan of activities is proposed for enforcement of SUP ban during October- Decemeber 2022. Subsequent activities to be planned based on the outcome of the activities carried out in the next three months.

2.0 Proposed Plan of Action

2.1 Focus Areas

The SUP enforcement activities to focus on the following areas

- Street vendors including flower sellers.
- Sabji Mandi, Fish Markets etc
- Local markets
- Industries engaged in manufacturing of thin carry bags
- Checking at border areas to restrict interstate transportation of SUP items

2.2 Constitution of Teams & Coverage

CPCB shall conduct the inspections through 72 teams (27 teams at Head office and 45 teams at 9 CPCB Regional Directorates). Issuing of challans as well as seizure of SUP items has to be done onsite. The inspecting teams shall be directed to identify the suppliers/ manufacturers of SUP items through backtracking. As per Rule 12 (1) of the PWM Rules, State Boards have the authority for enforcement of the Rules related to manufacture of SUP items plastic products As per Rule 12 (2) Secretary, State UDD has the authority for enforcement of the provisions of these rules relating to use of SUP items. In view of above, representative of State UDD/State PCB shall be deployed in the inspection team. Further, considering the sensitivity of the inspection involved, police protection shall be provided to the inspection team to avoid untoward incidents as have been reported in the past. CPCB cover major million plus/ capital cities in the inspection.

2.3 Inspection Schedule

Inspection is proposed to be carried for 4 days a month covering the following specific areas

- Day 1: Street Vendors, Flower sellers, Local markets (October 17, 2022)
- Day 2: Wholesale Markets (for Delhi – Ghazipur, Azadpur, Okhla) /– Other RDs /SPCBs to identify these markets in their respective jurisdiction (October 18, 2022)
- Day3: Industrial Areas (for Delhi – Narela, Bawana, Seelampur area (October 19 2022- Other CPCB RDs/State Boards to identify industrial Areas in their jurisdiction)
- Day 4: Checking at interstate borders (For Delhi all checking shall be carried at interstate borders. Other CPCB RDs/State Boards to identify checkpoints accordingly) (October 20, 2022)

Necessary directions being issued to SPCB/PCCs to cover all cities/towns in their jurisdiction through their Regional offices. Letter is being issued to Chief Secretaries of all States to issue necessary instructions to concerned Authorities for deployment of State UDD officers for inspection and provision of police protection to inspection team.

Annexure V-J

SPEED-POST / E-MAIL

केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय भारत सरकार
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE GOVT. OF INDIA

F. No.B-17011/7/UPC-II-PWM (MLP)/2021

Dated: 01.12.2021

To,

The Chairperson,
Central Board of Indirect Taxes and Customs
North Block, Secretariat Building,
New Delhi - 110001

Sub: Registration of Importers as per provision of Plastic Waste Management Rules, 2016 as amended

Sir,

Ministry of Environment, Forest and Climate Change has notified Plastic Waste Management (PWM) Rules 2016 (copy enclosed) to give thrust to plastic waste management including source segregation, processing and disposal of plastic waste based on the "Polluter Pays Principle"

As per Section 9 of PWM Rules, Producers, Importers & Brand Owners (PIBOs) who introduce plastic waste in the market due to their products in form of carry bags, multi-layered packaging, plastic sheets or like, are required to fulfill Extended Producer Responsibility to ensure environmentally sound management of this plastic waste.

The PIBOs are further required to obtain Registration from concerned State Pollution Control Board (SPCB)/ Pollution Control Committee (PCC) or Central Pollution Control Board in accordance with Section 13(2) of the PWM Rules which provides that:

"Every producer or brand-owner shall, for the purpose of registration or for renewal of registration, make an application in Form-I to

i. *"The concerned State Pollution Control Board or Pollution Control Committee of the Union territory, if operating in one or two States or Union Territories"; or*
ii. *"The Central Pollution Control Board, if operating in more than two States or Union Territories"*

For effective implementation of the above, you are requested to get the necessary instructions issued to the concerned to ensure verification of registration obtained from CPCB/SPCB/PCC (as applicable) at the time of clearing the consignment of Importers of plastic carry bags/multi-layered packaging/plastic sheets or like.

Yours faithfully,

1/12/21

(Tanmay Kumar)
Chairman

Encl.: As above

Annexure- VI

Item No. 02 Court No. 1

BEFORE THE NATIONAL GREEN TRIBUNAL
PRINCIPAL BENCH, NEW DELHI

Original Application No. 475/2024

News item titled "Mountains of plastic are choking the Himalayan States" appearing in The Hindu dated 04.03.2024

Date of hearing: 12.07.2024

CORAM: HON'BLE MR. JUSTICE PRAKASH SHRIVASTAVA, CHAIRPERSON
HON'BLE MR. JUSTICE ARUN KUMAR TYAGI, JUDICIAL MEMBER
HON'BLE DR. A. SENTHIL VEL, EXPERT MEMBER

ORDER

1. This original application is registered *suo motu* on the basis of the news item titled "Mountains of plastic are choking the Himalayan States" appearing in 'The Hindu' dated 04.03.2024.

2. The news item relates to the deposition and accumulation of microplastic in the Himalayan Mountains, rivers, lakes and streams. As per news article, these microplastics can be trapped in glaciers for a long time and released into rivers during snow melting. The article states that unscientific plastic disposal is causing soil and water pollution in the Indian Himalayan Region and impacting its biodiversity, which is having an adverse impact on the fresh water sources that communities downstream depend on. As per the news item, rapid and unplanned urbanization and changing production and consumption patterns are allegedly responsible for the plastic waste crisis in the Indian Himalayan Region. The article further states that a quantum jump in tourist foothall is another reason for exacerbation of the problem. As per the Himalayan Cleanup waste audit in 2022, 92.7% of trash was plastic with 72% of waste being non recyclable plastic. The news item states that India has one of the highest mismanaged waste index (MWI), at 98.55%, in the world India is at 4th position. MWI is the gap in waste management

capacity and plastic consumption. It further claims that India is merely recycling 12% of its plastic waste (through mechanical recycling).

3. NGT in the matter "In re: News item published in The Hindu dated 27.02.2022 titled 'Tourism has brought economic prosperity to the Himalayan region, but the environmental cost has been catastrophic" (OA No. 178/2022) directed the G.B. Pant National Institute of Himalayan Environment to undertake study and to update any study already conducted in light of the inputs available in the media report and to submit a report to the Chief Secretaries of 12 States in Himalayan region as well as to the Secretary, Environment and Secretary, Tourism, Government of India for further action. The G.B. Pant Institute submitted a report on 25.11.2022 and later withdrew it on 03.12.2022.

4. NGT again in OA No. 145/2024, Friends V Union of India, took up the matter related to solid waste being dumped on Leh- Manali Highway in the Lahaul and Spiti district of Himachal Pradesh. The matter is currently pending before the NGT.

5. The news item raises substantial issue relating to compliance of the environmental norms and implementation of the provisions of scheduled enactment.

6. Power of the Tribunal to take up the matter *suo-motu* has been recognized by the Hon'ble Supreme Court in the matter of *"Municipal Corporation of Greater Mumbai vs. Ankita Sinha & Ors." reported in 2021 SCC Online SC 897.*

7. Hence, we implead the following as respondents in the matter:

(1). Central Pollution Control Board, through its Member Secretary, Parivesh Bhawan, East Arjun Nagar, Delhi-110032

(2). G.B. Pant National Institute of Himalayan Environment, Through its Director Kosi-Katarmal, Almora-263 643, Uttarakhand, India

(3). Ministry of Environment, Forest and Climate Change, Through its Secretary, Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi- 110003

(4). Himachal Pradesh Pollution Control Board, Through its Member Secretary, Him Parivesh, Phase – III, New Shimla, Himachal Pradesh, India-171009

(5). Jammu and Kashmir Pollution Control Committee, Through its Member Secretary, Parivesh Bhavan, Forest Complex, Transport Nagar, Jammu – 180006

(6). Ladakh Pollution Control Committee, Through its Member Secretary, Civil Secretariat, Leh, Ladakh- 194101

(7). Uttarakhand Pollution Control Board, Through its Member Secretary, Gaura Devi Bhawan, 46 B IT Park Sahastradhara, Dehradun, Uttarakhand – 248 001

(8). Arunachal Pradesh Pollution Control Board, Through its Member Secretary, Paryavaran Bhawan, Yupia Road, Papu Nalah, Naharlagun– 791110

(9). Meghalaya Pollution Control Board, Through its Member Secretary, "ARDEN",Lumpyngngad, Shillong – 793 014, Meghalaya.

(10). Nagaland Pollution Control Board, Through its Member Secretary, Signal Point, Dimapur, Nagaland – 797 112

(11). Mizoram Pollution Control Board, Through its Member Secretary, Mizoram New Capital Complex (MINECO), Khatla, Khatla Thlânmual Road, Aizawl, Mizoram – 796001

(12). Sikkim Pollution Control Board, Through its Member Secretary, Forest Secretariat, C Block, Deorali, Gangtok - 737102, East Sikkim

(13). Manipur Pollution Control Board, Through its Member Secretary, Near Imphal-West, D.C. Office Complex, Lamphelpat, Imphal-795004.

(14). Tripura Pollution Control Board, Through its Member Secretary, Parivesh Bhawan, Pandit Nehru Complex, Gorkhabasti, P.O. Kunjaban, Agartala, Tripura – 799006

(15). Assam Pollution Control Board, Through its Member Secretary, Member Secretary, Pollution Control Board Assam, Bamunimaidam, Guwahati-21

(16). West Bengal Pollution Control Board, Through its Member Secretary, Paribesh Bhawan, 10A, Block-LA, Sector-III, Bidhannagar, Kolkata-700 106

8. Issue notice to the above respondents for filing their response at least one week before the next date of hearing.

9. List alongwith MA No. 14/2024 in OA 178/2022 on 18.10.2024.

Prakash Shrivastava, CP

Arun Kumar Tyagi, JM

Dr. A. Senthil Vel, EM

July 12, 2024
Original Application No. 475/2024
DV