

**BEFORE THE HONOURABLE NATIONAL**  
**GREEN TRIBUNAL**  
**SOUTH ZONE, CHENNAI**

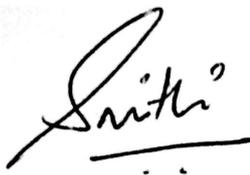
**Original Application No. 262 of 2017 (SZ)**

Applicant : K.K. Muhammed Iqbal

Vs

Respondents : The Kerala State Pollution Control Board  
& Others

**REPORT FILED BY THE CHIEF ENVIRONMENTAL ENGINEER**  
**FOR AND ON BEHALF OF THE KERALA STATE POLLUTION**  
**CONTROL BOARD**



Standing counsel for the 1<sup>st</sup> and 2<sup>nd</sup> respondent

**Rema Smrithi. V. K., Advocate**  
**Additional Standing Counsel, National**  
**Green Tribunal, (SZ), CHENNAI**

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**TRIBUNAL**  
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Dated this the 20<sup>th</sup> day of August, 2025.

**Rema Smrithi. V. K., Advocate**

**Standing Counsel for the 1<sup>st</sup> and 2<sup>nd</sup> Respondent**

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**VOLUME – II**

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Dated this the 20<sup>th</sup> day of August, 2025.

**Rema Smrithi. V. K., Advocate**

**Standing Counsel for the 1<sup>st</sup> and 2<sup>nd</sup> Respondent**

**BEFORE THE HONOURABLE NATIONAL GREEN**  
**TRIBUNAL**  
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Vs

Respondents : The Kerala State Pollution Control Board  
& Others

**REPORT FILED BY THE CHIEF ENVIRONMENTAL ENGINEER**  
**FOR AND ON BEHALF OF THE KERALA STATE POLLUTION**  
**CONTROL BOARD**

I, Baburajan P K, aged 55 years, am working as Chief Environmental Engineer, Regional Office, Kerala State Pollution Control Board, Ernakulam. I am competent to and duly authorized to represent the 1<sup>st</sup> Respondent in the above application. I know the facts and circumstances of the case. The factual submissions made here under are true and correct to the best of my knowledge, information and belief. In these circumstances, it is just and necessary that this Hon'ble Tribunal may be pleased to accept the accompanying information on file and it is so humbly prayed in the interests of justice in this case.

1. It is respectfully submitted that the Hon'ble NGT had delivered an order dated 29.07.2024 in which it was mentioned that "When the order specifically stated only the



removal of the plastic waste dumped, the act of the Project Proponent seems to be only covering up the same and allowing it to remain in the landfill and levelling the site by converting it into a car park”.

2. In compliance with the above order of the Hon’ble Tribunal, in order to review the status of remediation, a Joint Committee was constituted by the Chairperson, KSPCB vide order dated 28.01.2025 with the Chief Environmental Engineer, Regional Office, Ernakulam as the Nodal Officer & representative from the Central Pollution Control Board as a member and the Senior Environmental Engineer, Environmental Surveillance Centre, Eloor as member convenor to conduct a study regarding the present status of the site and to determine the method of remediation, required if any, to make the site contamination free.
3. It is respectfully submitted that the Joint Committee conducted meetings on 12.03.2025, 16.05.2025, 07.07.2025 and 04.08.2025 to study about the presence of micro plastic contamination at the site. The actions taken as part of the study are given below:-
  - i. Collected soil samples from the site and water samples from the river adjacent to the site and the samples were sent for analysis. The analysis report showed the presence of micro plastic in both water and soil samples.
  - ii. After reviewing the results of the samples collected, committee suggested that at least two additional reference samples should be collected i.e, one from upstream point of the river and another from the opposite bank of the river in order to comprehensively assess the potential micro plastic load due to waste dumping by Sree Sakthi Paper Mill.
  - iii. Two samples were again taken, one from upstream point and other from the opposite bank of the river. The analysis report of those samples showed the presence of micro plastic in the water sample taken from the upstream point and opposite bank.
  - iv. It was concluded by the Committee that the presence of micro plastic in the River can be from multiple sources and not solely from the site in question, since the samples collected from the upstream and the opposite banks of the River also contained micro plastic particles.
4. It is respectfully submitted that the Committee had a detailed deliberation on all the results and the overall situation. The committee discussed about the major anticipated impacts due to the presence of micro plastics in soil which are indicated as changes in soil characteristics, influencing soil microbial activity, destroying soil fauna and affecting plant growth, etc. The Committee had detailed discussions on the available standards and



approaches for such remediation requirements and found that most of such guidelines available are focused on contamination due to hazardous wastes, Heavy metals, Toxic substances etc. The committee concluded that there is currently no globally standardized, permissible limit for micro plastics in soil and hence no comparison was possible for assessing the micro plastics contamination. Also no studies as per literature put forward any remediation method for the micro plastic contaminated sites.

5. It is respectfully submitted that considering all the above circumstances and situation in the matter, the Committee is of the opinion that containment of the pollutant can also be adopted in this case of contamination. Since the top surface has already been compacted and converted into a parking site, an additional concrete/equivalent embankment can be provided in the River bank frontage of the site, to prevent any possible surface/sub surface water run-off. This can be materialised by preventive measures such as constructing sheet piles in the River bank, which will be one of the effective practical solutions in the present case in order to prevent chances of micro plastic run off reaching the river from the site. The committee also pointed out that for materialising the embankment construction and the related engineering activities, the ownership issues need to be reviewed and resolved accordingly, as the site is now under the custody of Kadungalloor Grama Panchayat. This has to be addressed in coordination with the District administration, Grama Panchayat authorities and the unit representatives, by bringing all the issues and Court directions into the notice of all these authorities. The report of the Joint Committee constituted by the Chairperson, KSPCB is attached as **Annexure 1**.
6. It is humbly submitted that the matter is being followed up diligently by the Kerala State Pollution Control Board for finalizing the procedures as explained above.

All that is stated above are true to the best of my knowledge information and belief.

Dated this the 20<sup>th</sup> day of August, 2025.



  
**BABURAJAN P.K.**  
Chief Environmental Engineer

**Chief Environmental Engineer**

**REPORT OF THE JOINT COMMITTEE CONSTITUTED BY THE  
CHAIRPERSON, KSPCB IN THE MATTER OF O. A 262 OF 2017  
BEFORE THE HON'BLE NGT, CHENNAI**

**1.0 Background on M/s. Sreesakthi Paper Mills Ltd., IDA, Edayar, Ernakulam:**

M/s. Sreesakthi Paper Mills Ltd., was a craft paper manufacturing unit situated in the Industrial Development Area (IDA), Edayar, Ernakulam in the state of Kerala. The industry was established in the year 1992 with one unit (Unit-1) and later expanded production by establishing another unit (Unit-2) in the year 2006. The industry was engaged in the manufacturing of craft paper by recycling waste paper and cardboard boxes. The production capacity of unit-1 at the time of establishment was 900-950 tons per month and KSPCB had granted permission for discharging 100 KLD of treated effluent into river Periyar with specific conditions.

The raw materials used in the manufacturing of craft paper were old cartons boxes and waste paper, which were collected from both local markets and imported from different countries. The industry was situated in 8.75 acres of land and about 81 cents of land were utilized for dumping plastic waste, incinerator ash generated from the processes. The solid waste generated from the unit contained steel clips, stapler pins, plastic wastes including plastic labels, plastic laminations, sacks and other plastic wastes. The other wastes generated from the industry were ETP sludge, ash from the captive power plant and incinerator. Waste oil and incinerator ash generated from the industry were brought under the ambit of hazardous wastes.

**2.0 Details regarding the High Court and NGT Litigations:**

The Hon'ble High Court of Kerala vide orders dated 13.07.2018, 08.10.2018, 16.11.2018 and 04.02.2019 in WP(C) no.5803 of 2018 had specifically directed M/s Sree Sakthi Paper Mills to shift the plastic wastes stored in the premises situated at the bank of River Periyar and also directed the Board to release money as instalment to M/s KEIL from the bank guarantee forfeited (Rs. 24 lakhs) from the Company. The entire wastes were shifted under strict supervision of the Board and the amount already released were in accordance with the directions issued by the Hon'ble High Court. The unit had shifted 6713.250 MT of wastes to KEIL and the shifting was completed in March 2020. KSPCB had released Rs.24 lakh, bank guarantee forfeited from the company to KEIL towards the disposal cost of plastic waste

from Sreesakthi Paper Mills Ltd and the company out of the total cost of Rs.1,53,07,052/-. Thereafter, a Committee was constituted as per the order dated 20.01.2020 of the Hon'ble National Green Tribunal, South Zone Bench in OA 262/2017 to report the environmental issues due to the unscientific disposal of plastic waste by M/s. Sreesakthi Paper Mills. The first Joint Committee meeting and site inspection was carried out on 19.02.2020.

**3.0 Meeting and Investigations done by the Joint Committee constituted as per NGT order dated 20.01.2020:**

The Joint Committee inspected the site and collected soil samples from the site where plastic was previously dumped. It was observed during the inspection that plastic was spread over the plot and site preparation activities were ongoing to convert the plot into a parking area for trucks. On investigation, it was found that plastic wastes were still present in the soil on the surface and within 1 feet depth. Surface/ top soil samples were collected for the analysis of plastic. Based on that sampling, it was concluded that the soil was contaminated with Poly Ethylene (PE), Poly Propylene (PP) and Polyethylene Terephthalate (PET) particles/ crumbs. Once the presence of plastic waste in the soil was confirmed, the Joint Committee carried out the second phase of soil sampling in the areas adjacent to the Periyar River where site preparation activities were yet to start. Soil samples were collected up to three feet depth at 5 different locations and average plastic quantity in the soil sample was estimated as 21883.65 mg/ Kg of soil. The report submitted by the Joint Committee is attached as **Annexure 1**.

**4.0 Environmental Damage and Compensation assessed by the earlier Committee:**

The unit had removed the complete plastic waste which had been heaped above the ground level at the site and had compacted the yard with earth, GSB and P sand on the site and levelled the same. The area was converted to a parking ground for vehicles. The complete plastic waste previously heaped at the site has been removed by the company.

The Environmental Compensation assessed by the Joint Committee was Rs. 1,42,56,000/- and the environmental damage was assessed as Rs. 72,82,486.96/-. This makes a total of Rs. 2,15,38,486.96/-. It was found that the total amount spent by the company towards the removal of plastic waste, levelling the site and renovating the site to a parking yard in connection with remediating the site was Rs.2,06,28,353/-. There was a shortage of Rs. 9,10,134/- and the board instructed M/s. Sree Sakthi Paper Mills to remit the balance amount to the Board's Environmental Protection Fund. M/s. Sree Sakthi Paper Mills had remitted the balance amount to the Kerala State Pollution Control Board on 27.12.2022.

**5.0 Meetings and Site Investigations by the Joint Committee constituted by the Chairperson, KSPCB:**

An order dated 29.07.2024 was delivered by the Hon'ble NGT wherein the Hon'ble Tribunal stated as follows:-

*“When the order specifically stated only the removal of the plastic waste dumped, the act of the Project Proponent seems to be only covering up the same and allowing it to remain in the landfill and levelling the site by converting it into a car park.”*

In order to review the status of remediation, a Joint Committee was constituted by the Chairperson, KSPCB with the Chief Environmental Engineer, Regional Office, Ernakulam as the Nodal Officer & representative from the Central Pollution Control Board as a member and the Senior Environmental Engineer, Environmental Surveillance Center, Eloor as member convenor to conduct a study regarding the present status of the site and the process of remediation, required if any, to make the site contamination free.

As part of the study, the Joint Committee conducted a preliminary meeting and inspection at the site on 12.03.2025. Further, on 16.05.2025, the Committee had its second meeting at KSPCB, ESC Office Eloor and discussed in detail about the overall scenario of the matter and reviewed the order of Hon'ble NGT. Based on the discussions, it was decided by the Committee to conduct another site inspection and to assess the present conditions of the site and carry out sampling and analysis of soil samples and river water samples for analysing the presence of micro plastics. It was decided in the meeting that further decisions can be taken on whether remediation is required or not and the nature of the remediation process to be carried out, if required, after assessing the site conditions and reviewing the analysis results.

Following the meeting, the Committee members visited the site in contention. During the site visit, it was observed that thick vegetation growth has happened especially, near to the river bank, making it inaccessible for collection of any samples. The site is presently under the ownership of M/s.Kamakhya Industrial and Logistics Parks Pvt Ltd, a logistic company, after closing of operations of the paper mill and it was observed that the same is used as a parking lot for the trucks and lorries. However, it was also noticed that some mixed plastic waste was dumped in a few sacks near the parking area along the banks of the river Periyar. It was also understood that the District Collector has allotted 40.47 Are (1 acre) of land to the Kadungalloor Grama Panchayat for the purpose of construction of MCF and the wastes are being dumped by the authorities presently. The Committee observed that the allotted site to

the Grama Panchayat is located towards the River Bank, covering the River access towards this side. It was decided by the Committee that samples of the water from river and soil from the site shall be collected by KSPCB after making proper access for accessing the River Bank side and accordingly samples from the river adjacent to the site and soil from the site were collected on 26.05.2025 in order to assess the micro plastic contamination. Soil Samples were taken at a depth of 10cm, 25cm and 50 cm and given to the School of Environmental Sciences, Mahatma Gandhi University, Kottayam for analysis.

Another meeting of the joint committee was held on 07.07.2025 through VC for reviewing the analysis reports of the soil and water samples collected. The analysis report showed the presence of microplastic in both water and soil samples. The analysis report is enclosed herewith and marked as **Annexure 2**. After reviewing the results of the samples collected, CPCB member suggested that, in order to comprehensively assess the potential microplastic load due to waste dumping by Sree Sakthi Paper Mill, at least two additional reference samples should be collected i.e, one from upstream point of the river and another from the opposite bank of the river. Accordingly, two samples were taken from the River on 09.07.2025, one from upstream point and other from the opposite bank and handed over to the School of Environmental Sciences, Mahatma Gandhi University, Kottayam for analysis of micro plastics.

The committee again met on 04.08.2025 through VC for reviewing the analysis reports of the additional samples collected. The analysis report showed the presence of microplastic in the water sample taken from the upstream point and opposite bank. The analysis report is enclosed herewith and marked as **Annexure 3**. The Committee had a detailed deliberation on all the results and the overall situation, as observed during the visits and going through all the available documents and guidelines in this regard.

#### **6.0 Deliberations by the Committee and conclusion:**

As per the available studies and literature, the major anticipated impacts due to the presence of micro plastics in soil are indicated as changes in soil characteristics, influencing soil microbial activity, destroying soil fauna and affecting plant growth, etc, owing to their potential impacts as well as their long life span and persistence. Another possible long term impact of the micro plastic content in soil is the destruction of the soil structure, the reduction of infiltration capability of soil for rain and irrigation water, adverse impacts on the soil water holding capacity and the porosity of the soil. The presence of micro plastics has also the

potential to disturb the soil nutrient cycle, alter microbial structure and ultimately affect crop growth.

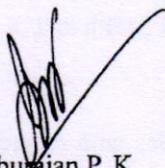
However, the Committee was of consolidated opinion that such impacts may not be considerable in this case, as the site in question is located within an industrial area, with no agricultural usage or cultivation of any sort being practised. Further, due to the conversion of the site as a parking ground, with multiple layers of compaction being done on the top surface, the impact on infiltration capability of soil and soil water holding capacity may not be relevant for the contented site.

Further, the Committee had detailed discussions on the available standards and approaches for such remediation requirements. Most of such guidelines available are focused on contamination due to hazardous wastes, Heavy metals, Toxic substances etc. As per the MoEF & CC Guidance document for assessment and remediation of contaminated sites (NPRPS) 2015, desk study, site inspection, sampling and testing need to be conducted to assess the contamination. This testing will result in a list of concentration levels for various parameters/substances and these concentration levels have to be compared with the Screening levels and the Response levels. Screening and response levels are important to assess the level of contamination. Screening levels are generic concentrations of hazardous substances in soil and sediments, groundwater and surface water at or below which potential risks to human health or the environment are not likely to occur and where no further investigation and assessment is needed. Response levels are generic concentrations of hazardous substances in soil and sediments at or above which it is very likely there is a threat to human health or the environment that may be imminent. At or above this level some form of response is required to provide an adequate level of safety to protect public health and/or the environment.

Since no standard could be found as per this document for the microplastics with regard to screening or response level, no comparison was possible for assessing the microplastics contamination. Also no studies as per literature put forward any remediation method for the microplastic contaminated sites. Hence the committee concluded that there is currently no globally standardized, permissible limit for microplastics in soil. While research is ongoing to understand the impacts of microplastics on soil health and ecosystems, establishing a universally accepted threshold remains a complex challenge due to various factors.

The Committee also deliberated on the analysis results of the water samples collected from the River and it was concluded by the Committee that the presence of microplastic in the River can be from multiple sources and not solely from the site in question, since the samples collected from the upstream and the opposite banks of the River also contained micro plastic particles.

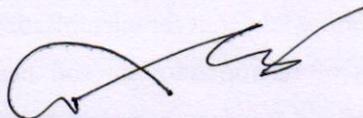
Considering all the above circumstances and situation in the matter, the Committee is of the opinion that since containment of the pollutant is also an accepted measure in such cases of contamination, the same can also be adopted in the contented site. Since the top surface has already been compacted and converted into a parking site, an additional concrete/equivalent embankment can be provided in the River bank frontage of the site, to prevent any possible surface/sub surface water run-off. This can be materialised by preventive measures such as constructing sheet piles in the River bank, which will be one of the effective practical solutions in the present case in order to prevent chances of microplastic run off reaching the river from the site to The Committee has made the suggestion, considering the overall scenario and the land use pattern, as the site is located in an industrial area and with least possibility of its use for any other purpose other than industrial or commercial purposes and the site is not an ecologically sensitive area, except for the proximity to the River Bank. However, for materialising the embankment construction, the ownership issues need to be reviewed and resolved accordingly, as the site is now under the custody of Kadungalloor Grama Panchayat. This has to be addressed in coordination with the District administration, Grama Panchayat authorities and the unit representatives, by bringing all the issues and Court directions into the notice of all these authorities.



Baburajan P. K  
Chief Environmental Engineer  
Regional Office, Ernakulam

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Date: 2025.08.19 14:21:28

Vivek K  
Scientist-E  
CPCB-Regional Directorate  
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Abhilash. B  
Environmental Engineer  
KSPCB, ESC, Eloor

**BEFORE THE HONOURABLE NATIONAL GREEN TRIBUNAL****CHENNAI****Original Application No.262 of 2017 (SZ) &****M A No. 215 of 2017 (SZ)****Applicant: K K Muhammed Iqbal****Versus****Respondents: The Kerala State Pollution Control Board & Others****REPORT FILED BY THE COMMITTEE CONSTITUTED BY THE HONOURABLE****TRIBUNAL AS PER THE ORDER DATED 20.01.2020 IN THE ABOVE****APPLICATION**

We the Committee constituted by the Hon'ble National Green Tribunal vide order dated 20.01.2020 in O.A.No.262 of 2017. We know the facts and circumstances of the case. The factual submission made here under is true and correct to the best of our knowledge, information and belief. In these circumstances, it is just and necessary that this Honourable Tribunal may be pleased to accept the accompanying report as submitted by the committee constituted by the Honourable Tribunal and it is so humbly prayed in the interests of justice in this case.

### ***1.0 Honourable NGT directions***

The Joint Committee was constituted by the Honourable National Green Tribunal vide order dated 20.01.2020 in O.A.No.262 of 2017. In line with the honourable NGT order dated 20-01-2020, the three-member joint committee was formed and was assigned with the following directives:

- ***To inspect the industrial clusters of Eloor, Edayar region regarding the efficiency of ETPs and CETPs in operation and also to observe the details of sewage discharge from the industrial clusters of Greater Kochi area which are discharging it into the river Periyar. Along with which the water quality of river Periyar and the status of implementation of ZLD facility by the industries in the region and its efficacy assessment so as to ensure all effluent that is generated gets recycled without discharging the same into river Periyar.***
- ***Consideration of the question on damage to environment caused on account of the violation committed by Sreesakthi Paper Mills Ltd for non-disposal of the plastic waste generated by them and keeping it in their premises for a long period and to assess the environmental compensation as per the guidelines given by the Central Pollution Control Board in this regard.***

Though, the assessment of efficiency of the ETPs, CETPs and implementation of ZLD in the industrial clusters of Greater Kochi along the banks of river Periyar was a major activity of the committee as per the order dated 20.01.2020; the activity of the joint committee was later limited/ restricted to the dumped plastic waste by M/s. Sreesakthi Paper Mills, in an order dated 29-01-2021 in this matter. As per the directions, the joint committee exclusively investigated the question of potential environmental damage caused/ inflicted by the violation committed M/s. Sreesakthi Paper Mills and to impose appropriate environmental compensation for the violation committed by the industry.

### ***2.0 About the industry M/s. Sreesakthi Paper Mills Ltd., IDA, Edayar, Ernakulam.***

M/s. Sreesakthi Paper Mills Ltd., was a craft paper manufacturing unit situated in the Industrial Development Area (IDA), Edayar, Ernakulam in the state of Kerala. The industry was established in the year 1992 with one unit (Unit-1) and later expanded production by

establishing another unit (Unit-2) in the year 2006. The industry was engaged in the manufacturing of craft paper by recycling waste paper and cardboard boxes. The production capacity of unit-1 at the time of establishment was 900-950 tons per month and KSPCB had granted permission for discharging 100 KLD of treated effluent into river Periyar with specific conditions. The following consents to establish (CTE)/ consents to operate (CTO) were issued by KSPCB for applications received from Sreesakthi Paper Mills Ltd.

- Consent was issued in the year 2007 during its renewal for increasing the production capacity of unit I to 1500 tons/month (TPM)
- CTE was issued to unit 2 in the year 2006 for a production capacity of 70,000 tons per annum (TPA).
- Consent was also issued in the year 2007 to establish an incinerator with a capacity 400 Kg/day for disposing the plastic waste generating from the process
- CTO was issued to unit 2 in 2007 (with capital investment 20 crores and production capacity 70,000TPA) with the consent condition to attain zero discharge before 31/12/2007.
- CTE for expansion was issued for the installation of 22TPH power boiler for Captive Power Plant (CPP) of 48 MW/day capacity on 29/11/2011 with a validity up to 31.08.2014. The water consumption rate of the CPP was 20 KLD.

The raw materials used in the manufacturing of craft paper were old cartons boxes and waste paper which were collected from both local market and imported from different countries. The consented water consumption limit imposed on the industry was 300KLD. The pollution control measures/ devices provided by the industry during its operation phase were:

- ETP for the treatment of trade effluent generated
- Cyclone dust separator with 30 m stack provided for CPP boiler
- Wet scrubber cum quenching facility to the 30m stack connected to the incinerator
- Acoustic enclosure with adequate stack height for DG sets

The industry was situated in 8.75 acres of land and about 81 cents of land were utilized for dumping plastic waste, incinerator ash generated from the processes. The solid waste

generated from the unit contained steel clips, stapler pins, plastic wastes including plastic labels, plastic laminations, sacks and other plastic wastes. The other wastes generated from the industry were ETP sludge, ash from the captive power plant and incinerator. Waste oil and incinerator ash generated from the industry were brought under the ambit of hazardous wastes. The waste management were done as per the following:

- ETP sludge was disposed through the common TSDF M/s. KEIL, Kochi
- Incinerator waste was dumped in the unit premise/plot.
- The plastic wastes generated were disposed through the conventional type incinerators installed and later it was sent to co-processing in cement units.
- Later the plastic waste was disposed to TSDF, M/s. KEIL, Kochi as per the order of the Hon'ble High Court in the matter of WP(C) 5803/2017.

As per the directions of Honorable High Court of Kerala, the plastic wastes were removed from the site. The quantum of plastic waste removed and disposed to the common TSDF (M/s. KEIL, Kochi) is enclosed herewith and marked as **ANNEXURE R1(a)**. The reclaimed area is in the process of converting to a parking space for warehouse operated M/s. Cella Space currently established in the location for industrial/ warehousing/ logistics purposes. Consent to Establish (PCB/ESC/IC/CE-50/2019) was issued to the above unit on 09.11.2019 (valid up to 23.10.2024) and subsequently consent to operate (PCB/ESC/CO/IC-64/2020) was issued on 24.11.2020 (valid up to 31.10.2025). The area in which plastic waste was dumped is now in the process of converting into a parking area of M/s. Cella Space after the removal of dumped plastic wastes.

### ***3.0 Joint Committee meetings and site investigations***

The first joint committee meeting and site inspection was carried out on 19.02.2020. In the meeting, decision was taken to collect soil sample to assess the extent of plastic wastes still present in the site. On 19.02.2021, the Joint Committee inspected the site and collected soil samples from the site where plastic was previously dumped. On the day of inspection, it was observed that plastic was spread over the plot and site preparation activities were already initiated to convert the plot into a parking area for trucks. On investigation, it was found that plastic wastes were still present in the soil on the surface and within 1 feet depth. Surface/ top

soil samples were collected for the analysis of plastic (*ANNEXURE-PHOTOGRAPHS*). Soil samples were segregated by progressive sieving of soil samples and were sent to Central Institute of Petrochemical Engineering and Technology (CIPET) on 20.02.2021 for analysis. Weight by weight percentage of plastic present in the soil samples collected is summarized in table: 1.

**Table 1: Quantification of plastics in soil samples**

| <i>S. No</i> | <i>Sample ID</i> | <i>Total sample weight (Kg)</i> | <i>Weight of Plastic (mg)</i> | <i>Plastic content (mg/ Kg)</i> | <i>% Plastic</i> |
|--------------|------------------|---------------------------------|-------------------------------|---------------------------------|------------------|
| 1            | SR1              | 1.1                             | 90,000                        | 81,818                          | 8.18             |
| 2            | SR2              | 2.03                            | 10,000                        | 4926                            | 4.9              |
| 3            | SR3              | 1.6                             | 5,000                         | 3125                            | 3.1              |
| 4            | SR4              | 1.1                             | 90,000                        | 81,818                          | 8.18             |

Qualitative assessment of samples using Fourier Transform Infrared Spectroscopy (FTIR) and Differential Scanning Calorimetry (DSC) for confirming the presence of plastic in the soil was carried out. As per the analysis of soil samples, the soil is contaminated with Poly Ethylene (PE), Poly Propylene (PP) and Polyethylene Terephthalate (PET) particles/ crumbs. Details of the analysis is given in table: 2 and the analysis result from CIPET is enclosed herewith and marked as **ANNEXURE R1(b)**. The analysis of soil samples confirmed the presence of plastic particles/ crumbs in the soil samples taken from the plot.

**Table 2: Qualitative assessment/ identification of plastics in soil samples**

| <i>S.No</i> | <i>Sample ID</i>        | <i>Test Method</i>             | <i>Result</i>                                                               |
|-------------|-------------------------|--------------------------------|-----------------------------------------------------------------------------|
| 01          | SR-1 (Coarse Particles) | ASTM D 3418<br>&<br>ASTM E1252 | Polyethylene (PE)<br>Polypropylene (PP)<br>Polyethylene Terephthalate (PET) |
| 02          | SR-1 (Fine Particles)   |                                | Polyethylene Terephthalate (PET)                                            |

Once, the presence of plastic waste in the soil was confirmed, the Joint Committee carried out the second phase of soil sampling in the areas adjacent to the Periyar River where site preparation activities was yet to start. Soil samples were collected up to three feet depth at 5

different locations using powered earth augur driller. Photographs of the same is enclosed herewith and marked as **Annexure R1(c)**. The soil samples collected were assessed for the extent of plastic wastes by progressive sieving and separation of plastic materials. The macro plastics present in the soil samples was quantified on the basis of percentage (weight/weight). The details of soil investigation are presented in table: 3. Average plastic quantity estimated in the soil sample is 21883.65 mg/ Kg of soil.

**Table 3: Assessment of plastics in the soil samples collected from the plot**

| <i>Samples</i>                                        |                   | <i>Sampling Coordinates</i>       | <i>Bulk Density (Kg/m<sup>3</sup>)</i> | <i>Total Weight (Kg)</i> | <i>Weight of Plastic (mg)</i> | <i>Plastic (mg/kg)</i>        | <i>% Plastics in the Samples</i> |
|-------------------------------------------------------|-------------------|-----------------------------------|----------------------------------------|--------------------------|-------------------------------|-------------------------------|----------------------------------|
| <i>ID</i>                                             | <i>Depth (Ft)</i> |                                   |                                        |                          |                               |                               |                                  |
| SS1                                                   | 1                 | 10° 04' 44.0" N                   | 810.5                                  | 0.54                     | 2818                          | 5218.51                       | 0.52                             |
| SS1                                                   | 3                 | 76° 18' 53.6"E                    | 953.7                                  | 0.56                     | NIL                           | NIL                           | NIL                              |
| SS3                                                   | 1                 | 10° 04' 43.9" N                   | 808                                    | 0.42                     | 5395                          | 12845                         | 1.28                             |
| SS3                                                   | 2                 | 76° 18' 53.4"E                    | 360.5                                  | 0.25                     | 35000                         | 140000                        | 14                               |
| SS4                                                   | 1                 | 10° 04' 43.8" N<br>76° 18' 53.4"E | 942.4                                  | 0.64                     | NIL                           | NIL                           | NIL                              |
| SS5                                                   | 1                 | 10° 04' 43.4" N                   | 564.6                                  | 0.40                     | NIL                           | NIL                           | NIL                              |
| SS5                                                   | 3                 | 76° 18' 52.6"E                    | 572.15                                 | 0.26                     | NIL                           | NIL                           | NIL                              |
| SS6                                                   | 3                 | 10° 04' 44.9" N<br>76° 18' 53.7"E | 1010                                   | 1.4                      | 23808                         | 17005.71                      | 1.7                              |
| <b><i>Average quantity of plastic in the soil</i></b> |                   |                                   |                                        |                          |                               | <b><i>21883.65 mg/ Kg</i></b> |                                  |

Based on above sampling, analysis and assessment, it is confirmed that three types of plastic materials (PE, PP and PET) are still present in the soil as a contaminant. The plastic still present in the site is quantified as illustrated in table: 4.

**Table 4: Estimated total weight of plastic remaining in the site**

| <i>S.No</i> | <i>Particulars</i>                                                 | <i>Calculations</i>                   |
|-------------|--------------------------------------------------------------------|---------------------------------------|
| 1           | Total contaminated area= 78 cents                                  | 3156.66 m <sup>2</sup> (78 x 40.47)   |
| 2           | Average depth                                                      | 3 ft = 0.91 m                         |
| 3           | Total volume of contaminated soil                                  | 3156.66*0.91=2872.56 m <sup>3</sup>   |
| 4           | Average Bulk density                                               | 752.73 kg/m <sup>3</sup>              |
| 5           | Weight of the contaminated soil<br>(Volume x Average Bulk density) | 2872.56 x 752.73<br>(21,62,262.09 Kg) |
| 6           | Average Plastic Content in the soil                                | 21883.65 mg/Kg                        |
| 7           | Estimated total weight of the plastics                             | 47.318 Tons                           |

#### **6.0 Assessment of environmental damage/ cost of plastic pollution**

One of the directives of the honourable NGT is to consider the question on damage to environment caused on account of the violation committed by Sreesakthi Paper Mills Ltd for non-disposal of the plastic waste generated by them and keeping it in their premises for a long period. Unmanaged or poorly managed plastic wastes have serious implication on the environment. Environmental damages due to specific anthropogenic activities have far reaching effects on various habitats and ecosystems and also impair human's consumer & non-consumer values. Environmental damages significantly vary in terms of the damage's space, scope, level and magnitude. Due to this, significant indices or markers of environmental damage differ considerably and one of the initial steps of environmental damage assessment is to determine the unique indices or markers which help assess the actual damage. However, due to the complicated conception of ecosystems, it would be a daunting task to understand and assess the extent of environmental damages. In most of the cases, the baseline indices and markers required to envisage the extent of environmental/ ecological/ social costs are not available for the accurate assessment of environmental damages and often the assessment has to be done on 'notional' basis under the ambit of 'polluter pays principle'.

As per the European Parliament study (The environmental impacts of plastics and micro-plastics use, waste and pollution: EU and national measures, 2020), the inherent economic impact due to plastic waste is very vast, with an estimated economic damage to the global

marine ecosystems surpassing € 11 billion. The study also put forth that, in Europe, € 630 million are spent every year to clean plastic waste from coasts/ beaches, while the failure to recycle costs to the European economy is € 105 billion. According to WWF (World Wide Fund for Nature) International's report (Plastics: The costs to society, the environment and the economy; 2021), the impacts of plastic pollution, generate significant costs for society and these costs are not accounted in plastic's market price. The lifetime cost of the plastic produced in 2019 will be at least US\$3.7 trillion (+/- US\$1 trillion) and is more than the GDP of India.

Since the introduction of plastic and its industrial production, the volumes of plastics produced have outpaced those of almost any other material. However, the characteristics that render plastics highly desirable are also those that render them ubiquitous and persistent in the environment, as a large fraction of plastics is designed to be discarded almost immediately after their use. Studies shows that, only 9% of all the plastic ever manufactured has been recycled and most of the plastic waste ends up in landfills and, ultimately, in the environment. Most plastics do not degrade, instead, they slowly fragment into smaller particles, referred to as micro plastics, and, further disintegrate into nano-plastics. These plastic particles, have profound detrimental consequences for ecosystems, biota, and the environment, but also for the economy and human health.

As per the European Union study for Policy Department for Citizens' Rights and Constitutional Affairs Directorate-General for Internal Policies (The environmental impacts of plastics and micro-plastics use, waste and pollution: EU and national measures, 2020), approximately two-thirds of all plastic ever produced has been released into the environment, where it continues to impact ecosystems as it fragments and degrades. Only a small fraction of plastic waste is recycled and plastic recycling is considered as an expensive process owing to the inherent complexities of collection, transportation, processing, and re-manufacturing. These considerable costs in combination with the low commercial value of recycled plastic on the one hand and the low cost of virgin polymers on the other seldom renders the recycling process profitable and often requires huge subsidies to sustain.

Improper handling/ disposal of plastic waste/ process sub-products/ raw materials leads to the formation of primary micro plastics and over the period of time secondary micro plastics are generated from the plastic litter/ waste dumps/ or by the abrasions in landfill or dumpsites. In the case of plastics, the term “end of life” does not equate to “end of impact” and the waste plastic materials persist and pollute long after their intended use. Now it is well established that there is no such thing as “end of life” for plastics and depending on how plastic is handled, it may pose a significant threat to the environment and to the climate when it reaches the waste phase of its life-cycle. WWF International in a report (Plastics: The costs to society, the environment and the economy; 2021) provided an overview on the quantifiable and non-quantifiable costs imposed by the plastic lifecycle. As per the report, the cost imposed by plastic on account of market production cost and waste management are currently quantifiable. However, the cost of greenhouse gas (GHG) emissions from plastic and unmanaged plastic wastes have both quantifiable and unquantified elements. But the cost of plastic imposed on health are currently unquantified.

In this specific matter, it is the issue of unmanaged plastic waste on the banks of river close to the estuarine/ brackish water ecosystem and the quantifiable cost elements are:

- Lost ecosystem service costs of estuarine/ coastal/ marine plastic pollution paid for indirectly by governments and all other stakeholders, given the environmental and economic consequences.
- Revenue reductions from fisheries and tourism as a result of estuarine/ marine plastic pollution.
- Clean-up costs, containment, remediation activities and restoration cost.

The unquantifiable cost of unmanaged plastic waste is on account of lost ecosystem service costs of plastic pollution on terrestrial ecosystems (any ecosystems which are found on land including rainforests, deserts, and grasslands). In this case, this aspect may not be significant since, the polluted/ contaminated site is in notified industrial area. However, there are chances of spillage and carry forward of plastic particles from the site to the river, then to the estuarine/ brackish water system and ultimately to the marine environment.

In the WWF International's report on 'Plastics: The costs to society, the environment and the economy; 2021, the GHG emissions from end-of-life processes per tonne of plastic waste is estimated as ~0.53 tonnes of CO<sub>2</sub><sup>e</sup>(Carbon dioxide equivalent) per tonne of waste generated. Associated cost of carbon from GHG is estimated as \$ 100.00 per tonne. In another landmark study, the social cost of carbon associated with GHG emissions for India is estimated as \$ 86.00<sup>@</sup> per tonne of CO<sub>2</sub>. The plastic waste management cost is estimated as \$ 125.68\* per tonne of waste as per the WWF's report. All the cost estimates are based on the 2019 US consumer price index (CPI). To adopt the above cost factors, it is required to relate the above to the Indian consumer price index. It is suggested that the cost estimates of various factors/ elements based on US CPI shall be related in terms of corresponding Indian CPI. The US consumer price index as on July, 2021 is 273.012 point (<https://tradingeconomics.com/united-states/consumer-price-index-cpi>) and corresponding CPI of India was 162.9 points(<https://tradingeconomics.com/india/consumer-price-index-cpi>). For the assessment of potential environmental damage/ cost of plastic pollution, the above cost factors are adjusted to Indian CPI and are summarized in table: 5.

**Table 5: Cost elements adjusted to Indian CPI for the assessment of damage.**

| No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Cost element                                  | Estimated cost/ ton     | Adjusted to Indian CPI           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------|----------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Cost of proper plastic waste management       | \$ 125.68*              | \$ 74.99 <sup>1</sup>            |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | GHG emissions from end-of-life plastic waste. | \$ 100.00*              | \$ 59.66 <sup>1</sup>            |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Social cost of carbon emission                | \$ 86.00 <sup>@</sup>   | India specific cost <sup>@</sup> |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Unmanaged plastic waste: Ecological cost      | \$ 3300.00 <sup>#</sup> | \$ 1,969.03 <sup>1</sup>         |
| <p><i>CPI: Consumer Price Index</i><br/> <sup>1</sup> Cost adjusted to Indian consumer price index (CPI) as on July 2021.<br/> * Plastics: The costs to society, the environment and the economy; published in September 2021 by WWF – World Wide Fund for Nature (Formerly World Wildlife Fund), Gland, Switzerland.<br/> <sup>@</sup> Country level social cost of carbon, Katharine Ricke, Laurent Drouet, Ken Caldeira and Massimo Tavoni, Nature Climate Change, Vol 8, October 2018, <a href="https://doi.org/10.1038/s41558-018-0282-y">https://doi.org/10.1038/s41558-018-0282-y</a><br/> <sup>#</sup> Global ecological, social and economic impacts of marine plastic. Beaumont N J,</p> |                                               |                         |                                  |

*Margrethe Aanesen, Melanie C. Austen, Tobias Börger, James R. Clark, Matthew Cole, Tara Hooper, Penelope K. Lindeque, Christine Pascoe, Kayleigh J. Wyles. Marine Pollution Bulletin, Volume 142, 2019, Pages 189-195, ISSN 0025-326X, <https://doi.org/10.1016/j.marpolbul.2019.03.022>*

Based on the above cost factors, indicative environmental damage/ cost of plastic pollution was estimated as summarized in table: 6. The quantifiable cost factor with respect to the market price of plastic waste was not considered as the plastic waste dumped is a waste by-product of kraft paper making process and hence the market price of plastic is not imposed. Cost of plastic pollution on account of health is unquantifiable due to lack of baseline data and relevant health data. The clean-up/ containment cost on account of unmanaged plastic waste may be waived as the proponent is developing a concreted parking space in the site and if the construction is properly engineered to contain the remnant plastic in the site. Revenue reduction with respect to unmanaged plastic waste was not quantified as the site is in notified industrial area and due to lack of relevant data on revenue reduction from tourism and fisheries. The environmental damage/ cost of plastic pollution on account of GHG emissions from end-of-life plastic waste has been estimated to be \$ 59.66<sup>1</sup>, however, India specific social cost of carbon was put forth (\$ 86.00<sup>®</sup>) recently and it is more appropriate to impose the social cost of carbon for the estimated GHG emissions in this scenario.

**Table 6: Indicative Environmental Damage Cost due to plastic pollution**

| No.                                                                                                                                                                                                                                                                         | Cost element                                                                      | Unit cost                | Estimated quantity                                                                   | Damage/ Cost adjusted to Indian CPI     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------|-----------------------------------------|
| 1                                                                                                                                                                                                                                                                           | Cost of proper plastic waste management                                           | \$ 74.99 <sup>1</sup>    | 47.32 Tons                                                                           | \$ 3,548.53<br><b>Rs. 2,61,455.45</b>   |
| 2                                                                                                                                                                                                                                                                           | Social cost of carbon on account of GHG emissions from end-of-life plastic waste. | \$ 86.00 <sup>®</sup>    | 47.32 Tons (0.53 tons of GHG/ ton of plastic waste). Total GHG emissions 25.08 tons. | \$ 2156.85<br><b>Rs. 1,58,916.38</b>    |
| 3                                                                                                                                                                                                                                                                           | Unmanaged plastic waste: Ecological cost                                          | \$ 1,969.03 <sup>1</sup> | 47.32 Tons                                                                           | \$ 93,174.50<br><b>Rs. 68,65,097.13</b> |
| <b>Cost of plastic pollution/ environmental damage: Rs. 72,85,468.96</b>                                                                                                                                                                                                    |                                                                                   |                          |                                                                                      |                                         |
| US \$ Exchange rate Rs. 73.68 as on 20-09-2021.                                                                                                                                                                                                                             |                                                                                   |                          |                                                                                      |                                         |
| CPI: Consumer Price Index                                                                                                                                                                                                                                                   |                                                                                   |                          |                                                                                      |                                         |
| <sup>1</sup> Cost adjusted to Indian consumer price index (CPI) as on July 2021.                                                                                                                                                                                            |                                                                                   |                          |                                                                                      |                                         |
| <sup>®</sup> Country level social cost of carbon, Katharine Ricke, Laurent Drouet, Ken Caldeira and Massimo Tavoni, <i>Nature Climate Change</i> , Vol 8, October 2018, <a href="https://doi.org/10.1038/s41558-018-0282-y">https://doi.org/10.1038/s41558-018-0282-y</a> . |                                                                                   |                          |                                                                                      |                                         |

The estimated environmental damage/ cost of plastic pollution was limited to the phase after the removal plastic waste from the site. The environment damage cost of historic plastic pollution due to waste plastic dump in the site and the river is not considered as relevant data on the quantity of waste dumped and the quantum of plastic reached river and adjoining estuary is not available. The joint committee is of the opinion that the environmental damage/ cost of plastic pollution owing to the accumulation of plastic waste in the site from the inception of the industry could not be assessed due to paucity of relevant data. There are no records on the daily generation of plastic waste, the quantum of waste incinerated, daily dumping rate in the dump site and the possible carry over to the river during monsoon period. Since the requisite data are not available, the committee has not ventured in to the environmental damage footprint of the past accumulation/ dumping of plastic waste in the site adjacent to the river. Relevant data and baseline indices are lacking for the quantification of revenue loss/ reduction on account of fisheries and tourism in the affected river and estuary. Thus the cost of plastic pollution with respect to the above are not quantified.

The proponent is in the process of converting the site as a parking lot with impervious concrete/ bitumen surface with compound wall. However, if the proposed construction can be done under the supervision of expert agency and other competent authorities with the objective of containing the contaminated soil and prevent further flow of plastic contaminated soil into the river, the calculated environmental damage/ cost of plastic pollution due to remnant plastic in the site can be utilized/ earmarked for this activity. Authorities have to review the engineering aspect and has to make sure that the construction will secure the site and prevent further flow of contaminated soil into the river without disturbing the natural drainage pattern of the site and without compromising river's flood plain zone.

It was also reported that the incinerator ash was disposed in the dump site for several years and there could be possible contamination of soil on account of heavy metals and other organic contaminants. A detailed study is warranted on the contamination status of soil with respect to heavy metals and other organic contaminants as per the schedule II of HWM Rules, 2016 or as per the Guidance Document for Assessment and Remediation of Contaminated Site in India, issued by MoEF & CC. During the investigations, the project proponent carried out works in the site and the Joint Committee could not carry out extensive soil sampling to

assess the extent of contamination in the site. The COVID-19 pandemic situation also hindered the sampling and inspections. It was learnt that the project proponent has carried out a third party study on the possible contamination in the site through the CSIR institute NIST, Thiruvananthapuram.

Though the above proposed damage calculation was discussed in detail by the committee, representative of NEERI has insisted on recording his views that in consideration of the facts and limitations, most attainable solution is to impose penalty rather than environmental compensation on the unit by the statutory bodies KSPCB/ CPCB in terms of violation caused for unplanned and negligent waste management in its premises. The NEERI representative is also of the opinion that the aspect of environmental damage shall be quantified scientifically in terms of facts and data and only after that, the damage cost calculation part may be proceeded. The detailed note by the NEERI representative on his views on the limitations to the existing scenario on environmental damage assessment for the alleged plastic waste storage is enclosed herewith and marked as **Annexure R1(d)** and the para wise justifications to the note by the other committee members are enclosed herewith and marked as **Annexure R1(e)**.

#### ***7.0 Assessment of Environmental Compensation (EC)***

As per the records available, the industry violated consented conditions on several occasions and there were several complaints raised against the industries on the grounds of pollution especially about the heaped up plastic garbage/ dump. The joint committee proposed to assess the environmental compensation (EC) from the date of issue of first notice for the removal of plastic dump. First notice was served by KSPCB to the unit on 29.11.2016 for removing the heaped plastic garbage from the premises and removal of plastic waste initiated by M/s. KEIL was on 01.09.2018 only after the intervention of Honourable High Court of Kerala. Thus number of days of violation after serving notice and the first action on removing the waste are 641 days. M/s. KEIL completed the removal of plastic dump on 01.03.2020 and the number of days between the serving notice and completion of transportation/ disposal of plastic waste to common TSDF are 1188 days (Table: 7). Even after the notice, the industry has not taken any action on the notice served on them by KSPCB. The actual removal happened only after the intervention of Honourable High Court, hence the number of days of

violations shall be from the first notice to completion of removal, which is 1188 days. Violations prior to the notice served on 29-11-2016 are not considered as the exact period of violations are not available.

**Table 7: Number of days of violation**

| <i>Year</i>                     | <i>Month</i>       | <i>Days</i> |
|---------------------------------|--------------------|-------------|
| 2016                            | November           | 1           |
| 2016                            | December           | 31          |
| 2017                            | January - December | 365         |
| 2018                            | January - December | 365         |
| 2019                            | January - December | 365         |
| 2020                            | January            | 31          |
| 2020                            | February           | 29          |
| 2020                            | March              | 1           |
| <b>No. of days of violation</b> |                    | <b>1188</b> |

Environmental compensation (EC) was assessed based on the CPCB guidelines using the following formula. The descriptors used in the formula and values considered for the descriptors are summarized in table: 8.

$$EC (Rs.) = PI \times N \times R \times S \times LF$$

**Table 8: EC descriptors and values considered**

| <i>Components</i> | <i>Description</i>                        | <i>Value considered</i>        |
|-------------------|-------------------------------------------|--------------------------------|
| PI                | Pollution Index of industrial sector      | Red category (PI = 80)         |
| N                 | Number of days of violation took place    | 1188 days                      |
| R                 | Rupee factor (100-500)                    | Industrial area (R factor 100) |
| S                 | Scale of operation (Small/ Medium/ Large) | Large (S = 1.5)                |
| LF                | Location factor                           | Industrial area (LF = 1)       |

The EC (Rs.) is worked out as = 80 x 1188 x 100 x 1.5 x 1 = 1,42,56,000.00

The estimated EC for a violation period of 1188 days is Rs. 1,42,56,000.00

### 7.0 Summary

The estimated financial liability on account of environmental damage/ cost of plastic pollution and environmental compensation are summarized in table: 9.

**Table 9: EC descriptors and values considered**

| <b>No.</b> | <b>Components</b>                                                                               | <b>Damage/ EC</b>  | <b>Remarks</b>                                                                                                                                                                                                                                                                                                                                     |
|------------|-------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1          | Environmental damages/ cost of plastic pollution due to the remnant plastics in the soil/ site. | Rs. 72,85,468.96   | This component may be utilized for the restoration/ containment of the site. In case the proponent is willing to contain/ secure the site with proper engineered measures, this component can be utilized for that purpose under the supervision of expert agencies and other stake holders.                                                       |
| 2          | The estimated Environmental Compensation (EC) for the total violation period of 1188 days.      | Rs. 1,42,56,000.00 | Environmental compensation for not taking action for the complete removal/ disposal of accumulated plastic waste in the site. Though KSPCB has issued notice in 2016, the industry has not taken any measure to comply with the notice. Only after the intervention of honorable High Court of Kerala, the removal of plastic waste was initiated. |



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# Mahatma Gandhi University

## SCHOOL OF ENVIRONMENTAL SCIENCES

Priyadarsini Hills P.O., Kottayam-686560, Kerala, India

01.07.2025

### Microplastic Analysis Report

Client : Kerala State Pollution Control Board

No. of samples received: 7 (Water -1 & Soil - 6)

The Microplastic analysis was carried out for the following parameters: Abundance, Shape, Size and Colour, as per the request of the client. Extraction of microplastics were carried out in the laboratory following the NOAA (National Oceanic and Atmospheric Administration) protocol of Marine Debris Program, USA (Masura, J., Baker, J., Foster, G., Arthur, C., 2015. Laboratory Methods for the Analysis of Microplastics in the Marine Environment: Recommendations for Quantifying Synthetic Particles in Waters and Sediments). For visual interpretation of the microplastic particles, a stereomicroscope (Carl - Zeiss Stemi 508, Germany) fitted with a digital camera was used. The results are provided below.

### Water Sample

| SL. No. | Sample ID  | Abundance<br>(No. of microplastics) | Shape of microplastics       | Size of microplastics<br>(Size Range in $\mu\text{m}$ ) | Colour of microplastics           |
|---------|------------|-------------------------------------|------------------------------|---------------------------------------------------------|-----------------------------------|
| 1       | C1 - Water | 27/ Litre                           | Fiber, Fragment, Film & Foam | 72 – 5032.738 $\mu\text{m}$                             | Blue, Yellow, White & Transparent |

PTO

## Sediment sample

| SL. No. | Sample ID | Abundance (No. of microplastics) | Shape of microplastics          | Size of microplastics (Size Range in $\mu\text{m}$ ) | Colour of microplastics                      |
|---------|-----------|----------------------------------|---------------------------------|------------------------------------------------------|----------------------------------------------|
| 1       | A1-10 CM  | 1220/kg                          | FIBER, FRAGMENT, FILM           | 40.867-4091.813 $\mu\text{m}$                        | BLUE, GREEN, RED, TRANSPARENT, YELLOW        |
| 2       | A2-25 CM  | 1340/kg                          | FIBER, FRAGMENT, FILM           | 101.125-4806.373 $\mu\text{m}$                       | BLUE, GREEN, RED, YELLOW, TRANSPARENT        |
| 3       | A3-50 CM  | 680/kg                           | FIBER, FRAGMENT, FILM           | 85.051 – 2541.91 $\mu\text{m}$                       | BLUE, GREEN, RED, TRANSPARENT, YELLOW        |
| 4       | B1-10 CM  | 940/kg                           | FIBER, FRAGMENT, FILM<br>FOAM   | 88.542-4177.591 $\mu\text{m}$                        | BLUE, GREEN, RED, TRANSPARENT, WHITE, YELLOW |
| 5       | B2-25 CM  | 960/kg                           | FIBER, FRAGMENT, FOAM<br>, FILM | 99.594-4301.729 $\mu\text{m}$                        | BLUE, GREEN, RED, TRANSPARENT, WHITE, YELLOW |
| 6       | B3-50 CM  | 920/kg                           | FIBER, FRAGMENT, FILM<br>FOAM   | 97.543 -3143.435 $\mu\text{m}$                       | BLUE, RED, TRANSPARENT, WHITE, YELLOW        |

\*A2, B1, B2 samples also detect mesoplastic with size range 6882.433  $\mu\text{m}$ , 6433.638  $\mu\text{m}$ , 7156.368  $\mu\text{m}$  respectively.

*Sangeetha Sivan*

Sangeetha Sivan  
Name & Signature of analyst

P.D. Hills  
1 July 2025

*Malay*

Director

**Dr. MAHESH MOHAN**  
Associate Professor & Director  
School of Environmental Sciences  
Mahatma Gandhi University  
Kottayam, Kerala, Pin - 686 560



## Microplastic Analysis Report

**Client** : Kerala State Pollution Control Board

**No. of samples received:** 2 (water samples only)

The Microplastic analysis was carried out for the following parameters: Abundance, Shape, Size and Colour, as per the request of the client. Extraction of microplastics were carried out in the laboratory following the NOAA (National Oceanic and Atmospheric Administration) protocol of Marine Debris Program, USA (Masura, J., Baker, J., Foster, G., Arthur, C., 2015. Laboratory Methods for the Analysis of Microplastics in the Marine Environment: Recommendations for Quantifying Synthetic Particles in Waters and Sediments). For visual interpretation of the microplastic particles, a stereomicroscope (Carl - Zeiss Stemi 508, Germany) fitted with a digital camera was used. The results are provided below.

### Water Sample

| SL. No | Sample ID  | Abundance<br>(No. of microplastics) | Shape of microplastics       | Size of microplastics<br>(Size Range in $\mu\text{m}$ ) | Colour of microplastics                        |
|--------|------------|-------------------------------------|------------------------------|---------------------------------------------------------|------------------------------------------------|
| 1      | OPP-CELLA  | $29 \pm 15.55$                      | Fiber, Fragment              | 27.09-3342.26 $\mu\text{m}$                             | Blue, Red, Transparent, Green & Black          |
| 2      | PATHALAM-B | $26 \pm 2.12$                       | Fiber, Fragment, Film & Foam | 26.59 – 1794.04 $\mu\text{m}$                           | Blue, Red, Transparent, Green & Black & Yellow |

Viji N V  
Name & Signature of analyst

P.D. Hills  
20 July 2025

Dr. Mahesh Mohan  
Director  
School of Environmental Sciences