

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL  
SOUTHERN ZONE, CHENNAI**

**IN**

**ORIGINAL APPLICATION No. O A 77 of 2021(SZ)**

**IN THE MATTER OF**

**Suo Motu proceedings initiated**

**based on letter received**

**From Justice A.V. Ramakrishna Pillai,**

**Former Judge, High Court of**

**Kerala, Chairman,**

**SLMC, Kerala.**

**:**

**Applicant(s)**

**Verses**

**The Chief Secretary,**

**Government of Kerala,**

**Thiruvananthapuram and Others**

**:**

**Respondent(s) And**

**ORIGINAL APPLICATION No. O A 442/2013(SZ)**

**Applicant(s) : Jith Kumar, Muthedathu**

**Versus**

**Respondent(s) : The State of Kerala & others**

**And**

**ORIGINAL APPLICATION No. O A 20 / 2017(SZ)**

**Abdul Basheer**

**Versus**

**Kochi Municipal Corporation & Others**

**ORIGINAL APPLICATION No. O A 276/2017(SZ)**

**Lawyers Environmental Awareness Forum**

**Versus**

**SEIAA, Thiruvananthapuram**

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



Dated this the 16<sup>th</sup> day of April 2023

**Adv. Rema Smrithi,**

**ADDITIONAL STANDING COUNSEL FOR THE RESPONDENT 4**

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL  
SOUTHERN ZONE, CHENNAI**

**IN**

**ORIGINAL APPLICATION No. O A 77 of 2021(SZ)**

**IN THE MATTER OF**

**Suo Motu proceedings initiated**

**based on letter received**

**From Justice A.V. Ramakrishna Pillai,**

**Former Judge, High Court of**

**Kerala, Chairman,**

**SLMC, Kerala.**

**:**

**Applicant(s)**

**Versus**

**The Chief Secretary,**

**Government of Kerala,**

**Thiruvananthapuram and Others**

**:**

**Respondent(s)And**

**ORIGINAL APPLICATION No. O A 442/2013(SZ)**

**Applicant(s) : Jith Kumar, Muthedathu**

**Versus**

**Respondent(s) : The State of Kerala & others**

**And**

**ORIGINAL APPLICATION No. O A 20 / 2017(SZ)**

**Abdul Basheer**

**Versus**

**Kochi Municipal Corporation & Others**

**ORIGINAL APPLICATION No. O A 276/2017(SZ)**

**Lawyers Environmental Awareness Forum**

**Versus**

**SEIAA, Thiruvananthapuram**

**VOLUME 1**

**Index**

Sl.No.	Description	Pages
1	Report submitted by the Chief Environmental Engineer	1 -2

Dated this the 16<sup>th</sup> day of April 2023

**Adv. Rema Smrithi,**

**ADDITIONAL STANDING COUNSEL FOR THE RESPONDENT**

**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL**

**SOUTHERN ZONE, CHENNAI**

**IN**

**ORIGINAL APPLICATION No. O A 514 of 2019(PB)**

**RENUMBERED AS O A 77 of 2021(SZ)**

**IN THE MATTER OF**

**Suo Motu proceedings initiated**

**based on letter received**

**From Justice A.V. Ramakrishna Pillai,**

**Former Judge, High Court of**

**Kerala, Chairman,SLMC, Kerala.**

**: Applicant(s)**

**Verses**

**The Chief Secretary,**

**Government of Kerala,**

**Thiruvananthapuram and Others : Respondent(s)And**

**ORIGINAL APPLICATION No. O A 442/2013(SZ)**

**Applicant(s) : Jith Kumar, Muthedathu**

**Versus**

**Respondent(s) : The State of Kerala & others**

**And**

**ORIGINAL APPLICATION No. O A 20 / 2017(SZ)**

**Abdul Basheer**

**Versus**

**Kochi Municipal Corporation & Others**

**And**

**ORIGINAL APPLICATION No. O A 276/2017(SZ)**

**Lawyers Environmental Awareness Forum**

**Versus**

**SEIAA, Thiruvanathapuram**

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

I, Baburajan P K, 52 years, S/o. Late P. A. Kuttappan, am now working as the Chief Environmental Engineer, Regional Office, Kerala State Pollution Control Board, Ernakulam. I am competent to and duly authorized to represent the Board. I know the facts and circumstances of the cases. The factual submissions made hereunder 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 report 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 National Green Tribunal as per the order dated 29.03.2023 directed the Kerala State Pollution Control Board and the Kochi Corporation to join hands to study the scientific method at the earliest to segregate the burnt plastics/burnt waste and the ashes under the burnt plastic to avoid water pollution during monsoon and possible air pollution during segregation. Kerala State Pollution Control Board is also directed to quantify the burnt waste and unburnt waste lying now in the dump site and fix realistic timelines for bio-mining along with suggestions on how the bio-mining can be expedited.
2. It is submitted that in compliance with the above order, the Board has entrusted National Institute of Interdisciplinary Science and Technology (NIIST) to carry out the study as directed by the Hon'ble NGT. The NIIST has conducted the study and submitted the report. A copy of the report submitted by NIIST in this regard is produced herewith and marked as **Annexure 1.**

All the facts stated above are true to the best of my knowledge, information and belief.

Dated this the 16<sup>th</sup> day of April 2023

  
**CHIEF ENVIRONMENTAL ENGINEER**  
**BABURAJAN P.K.**  
**Chief Environmental Engineer**



**BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL  
SOUTHERN ZONE, CHENNAI**

**IN**

**ORIGINAL APPLICATION NO. 514 of 2019(PB)**

**RENUMBERED AS OA 77 of 2021 (SZ)**

**And**

**ORIGINAL APPLICATION No. OA 442/2013(SZ)**

**And**

**ORIGINAL APPLICATION No. OA 20/2017(SZ)**

**And**

**ORIGINAL APPLICATION No. OA 276/2017(SZ)**

**VOLUME 2**

**Index**

Sl.No.	Description	Pages
1	<b>Annexure 1:</b> Brahmapuram Fire Incident 2023: MSW Composition Estimation at Fire Breakout Area & Mitigation Plan NIIST Study report	1 - 18

Dated this the 16<sup>th</sup> day of April 2023

**Rema Smrithi**, Advocate

ADDITIONAL STANDING COUNSEL FOR THE RESPONDENT

# **Brahmapuram Fire Incident 2023: MSW Composition Estimation at Fire Breakout Area & Mitigation Plan**



**Environmental Technology Division  
CSIR - National Institute for Interdisciplinary Science & Technology  
Thiruvananthapuram, Kerala – 695 019**

**Submitted to**



**Kerala State Pollution Control Board**

**April 2023**

## **1.0 Introduction**

The Hon'ble National Green Tribunal vide order dated 29-3-2023 directed the Kerala State Pollution Control Board and the Kochi Corporation to join hands to study the scientific method at the earliest to segregate the burnt plastics/burnt waste and the ashes under the burnt plastic to avoid water pollution during monsoon and possible air pollution during segregation. The Kerala State Pollution Control Board should take necessary steps to quantify the burnt waste and unburnt waste lying now in the dump site and fix realistic timelines for bio-mining along with suggestions on how the bio-mining can be expedited. Accordingly, Kerala State Pollution Control Board entrusted CSIR-NIIST, Thiruvananthapuram to undertake the scientific study as directed by the Hon'ble NGT. As per the previous studies conducted by CSIR-NIIST during 2019 and 2020 fire breakout incidents, an estimated quantity in the range of 89.3 – 158.5 ngTEQ of dioxins per kg ash was observed [1,2].

## **2.0 Scope of the study**

The study was urgently conducted at the request of Kerala State Pollution Control Board to estimate the quantity of burned and unburned fractions present at Brahmapuram solid waste dumpyard at the aftermath of about 12 day long fire breakout incident during 2<sup>nd</sup> - 14<sup>th</sup> March 2023. Further it was also suggested to identify the quantity of ash content present at the site. A possible mitigation plan to control/minimize the leaching out as well as exposure of the contaminated residual ash need to be proposed based on the findings.

The extensive fire incident occurred at the Brahmapuram MSW dumpyard is expected to release large quantities of burned residue/ash which are contaminated with toxic substances such as dioxins, furans, PCBs, heavy metals etc. The toxic chemicals present in the burned residues/ash can get leached or flushed into the water streams as well as surrounding areas during rain which could pose significant threats to human and environmental health in the region. Hence, it is necessary to take immediate action plan at site to avoid exposure of burned residue/ash and manage it through scientific disposal techniques. The immense effort took by the Fire and Safety Department to put out the fire through lift-turn-water method has led to the mixing of waste layers and has also brought in considerable quantity of soil/mud into waste beds. Therefore, an onsite investigation was essential to identify the most fire affected zones in the dumpyard and the approximate quantity of burned residue levels at the

site. Such a study can specifically demarcate the priority zones in the dumpsite where the management strategies need to be implemented and can also provide an estimate of waste to be treated immediately. Such quantitation steps are inevitable to identify processing rate required for fire affected area reclamation and the probable time required for such activities. Further possible risk mitigation steps can also be framed based on the quantity of rejects/contaminated fractions at the site.

### **3.0 Objectives**

1. Representative sampling and characterisation of fire affected MSW piles at Brahmapuram dumpyard.
2. Estimation of burned residue/ash depositional levels at the dumpyard.
3. Strategic management plan for the disposal of burned residue/contaminated soil.

### **4.0 Methodology**

#### **4.1 Field sampling plot preparation**

A field walkthrough survey was conducted at the site to identify the fire affected area at the dumpyard and was recorded and plotted using handheld GPS (Garmin GPSMAP 65s). Total burned surface area was calculated and exported as a map for the selection of field sampling points. 100m x 100m grids were superimposed over the field plot for obtaining the stratified grids for representative sample collection. Arc GIS 10.6 software was employed for developing and super-imposing 100m x 100m grids over the field plot. Handheld GPS was used for the on-field identification of grid boundaries and red flags were used to demarcate the grids on field.

#### **4.2 Minimum number of representative samples to be drawn from the field**

ASTM method D-5231-92 reapproved in 2016 was followed for determining minimum number of samples to be collected for ensuring required level of confidence and precision for MSW compositional data [3]. The eqn – 1 was used for calculating minimum number of sampling points, where  $n$  – minimum number of samples to be taken,  $t^*$  - student t statistic corresponding to the desired level of confidence,  $s$  – estimated standard deviation,  $e$  – desired level of precision and  $\bar{x}$  – estimated mean.

$$n = \frac{t^* \times s}{e \times \bar{X}} \quad \text{----- eqn -1}$$

Standard data table provided in the method was used for calculating the 'n' value as dumpyard specific data was not available. The burned residue content at the site is expected to be less than 5% of the total waste. Hence the data corresponding other to inorganics content (3% of total fraction) provided in the method was used for calculating minimum number of samples. Data confidence level was taken as 90% and additional 10% data precision were also considered for 'n' value calculation. It is necessary to draw minimum 68 samples from the site for 90% confidence and additional 10% precision was ensured by collecting 2 more samples as per the ASTM method cited above. Hence minimum of 70 samples need to be drawn from the field to conduct the MSW characterization studies.

#### **4.3 Characterization and estimation of burned residue levels at fire affected area**

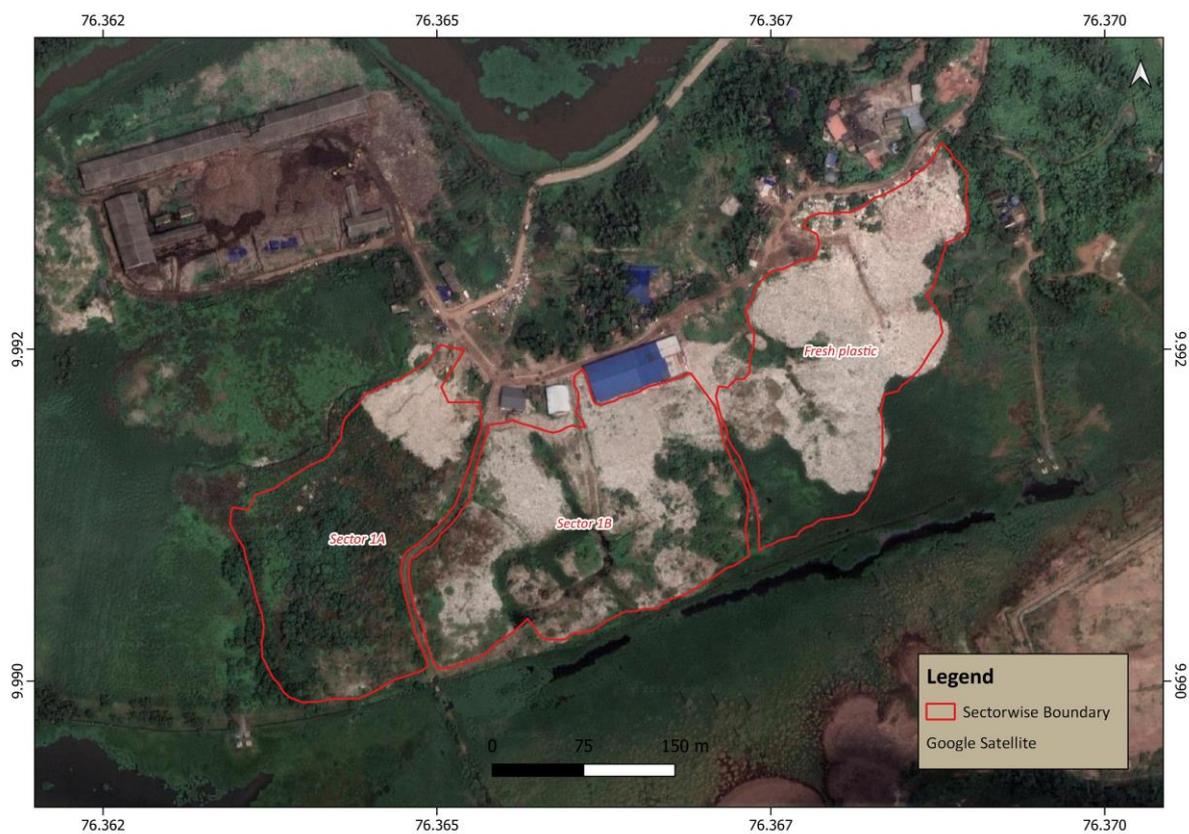
Grab samples as per ASTM method D5231-92 were taken from the field to conduct the compositional analysis. Front end loader excavators with appr. 0.7 m<sup>3</sup> bucket was used for MSW sampling. Samples drawn were deposited on a clean tarpaulin and manually segregated into 3 fractions – unburned, semi-burned and mud and soil mixed with fine ash. The fractions were weighed at site using a platform balance and the data was entered into field data sheets with grid identification numbers. Approximate volumes of each grid were also estimated at site using waste spread area and waste pile height. The bulk density of the composite waste at the site was determined by weighing the material in a drum of known volume. The bulk density was multiplied with the individual grid volume to compute the total mass of waste present in respective grids. The % composition observed in each of the grid was multiplied with corresponding MSW quantity to estimate the burned residue deposition respectively.

### **5.0 Results and Discussion**

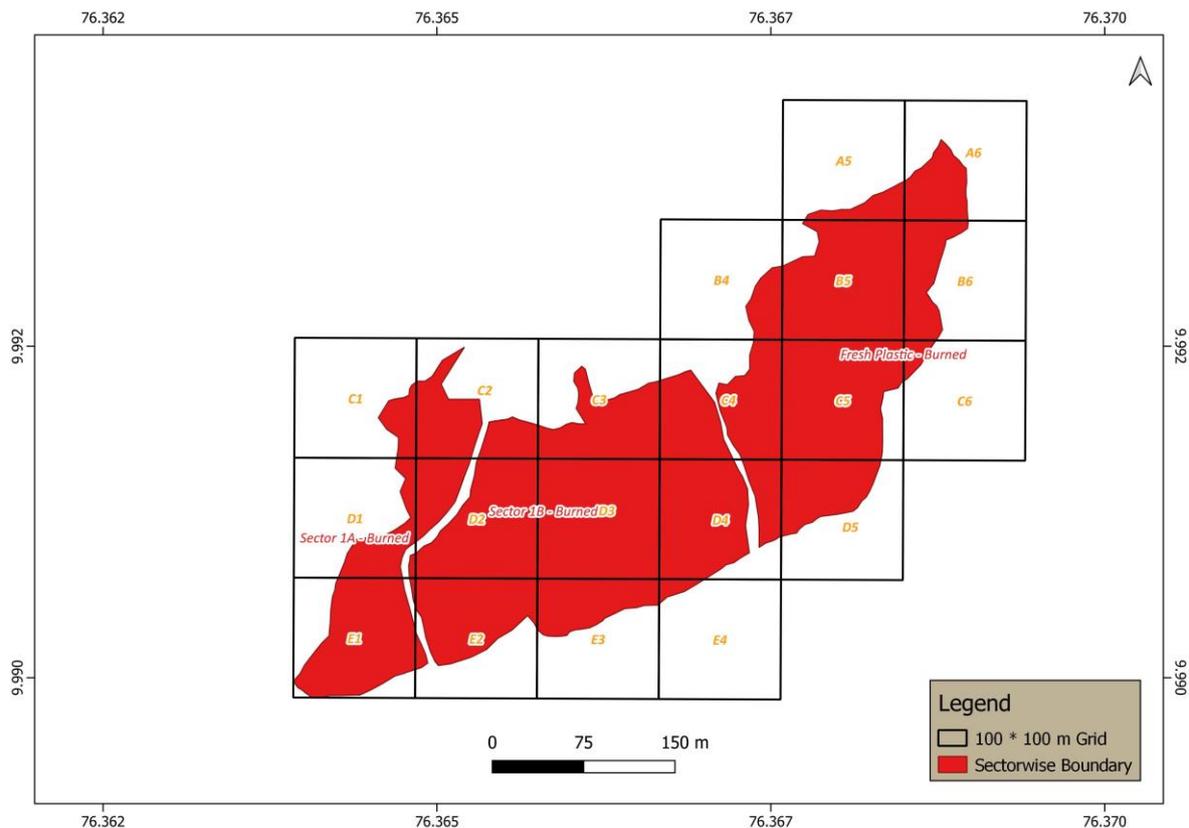
#### **5.1 Sampling grid superimposed field plot**

The fire breakout area at Brahmapuram is currently divided into 3 main sectors namely sector 1A (33879 m<sup>2</sup>), sector 1B (44213 m<sup>2</sup>) and fresh plastic sector (46742 m<sup>2</sup>). As informed by the corporation officials, both sector 1A and 1B contains legacy waste and fresh plastic sector contains predominantly sorted plastic wastes. From the walk-through survey, it was observed

that 15885 m<sup>2</sup> area in sector 1A, 43177 m<sup>2</sup> area in sector 1B and 36187 m<sup>2</sup> area in fresh plastic sector has been affected by fire. Fig-1 depicts the MSW dumpyard at Brahmapuram with the different sectors and fig 2 shows sampling grids superimposed over the fire breakout area. Considering an appr. waste pile height of 5 m in sector 1A and 1B, and 3 m in fresh plastic sector and a terrain factor of 1.5 to accommodate the uneven land surface, total of 605807 m<sup>3</sup> of waste was present in the fire affected zone. The bulk density of the waste present at the site was determined to be 345 kg/m<sup>3</sup> of waste. Hence the total quantity of waste present cumulatively at the fire ridden area spread across these 3 zones is appr. 2.09 lakh tonnes.



**Fig -1: Brahmapuram MSW dumpyard sector wise plot**



**Fig 2: Brahmapuram MSW dumpyard field plot with sampling grids**

## 5.2 Grid wise MSW composition

10 grids – C2, D2, E2, C3, D3, E3, C4, D4, B5 and C5 were selected for the residual composition analysis in the present study. The grids were selected in such a way as to maintain a diagonal representation of the whole sampling field as well as to cover maximum waste dumped area inside the sampling grids. It was observed that 6 out of 10 identified grids areas are nearly 100% covered with MSW piles, while 4 grids have 2/3<sup>rd</sup> area covered with MSW. The selected grids covered appr. 86667 m<sup>2</sup> of the 95249 m<sup>2</sup> fire ridden area (91%) at site. Selected grids also covered 1.8 tonnes of 2.09 tonnes present in the fire ridden area as well. For a stratified sampling the selected grids were further divided into four 50m x 50m grids and 2 grabs from each of the grids were sampled for composition analysis. Thus, a total of 80 representative samples were collected from the 10 selected grids for the present composition analysis and the grid wise composition results are shown in table – 1. The unburned fractions ranged from 33.3 – 70.6%, semi-burned fractions 0.8 – 10.9% and soil/mud mixed with ash 25.2 - 65.9%. It can be observed that on an average more than 50% in the studied grids areas were unburned, 3-5% as semi-burned and 45-47% as soil/mud

mixed with ash. The images of various operations conducted as part of the present study is given in fig 3-11.

<b>Grid Code</b>	<b>Date and time of sample collection</b>	<b>Composition</b>	<b>% Composition</b>
<b>C2</b>	11/04/2023 & 8.30 am -9.00 am	Unburned	36.7
		Soil & Ash mixture	63.3
		Semi-burned	Negligible
<b>D2</b>	11/04/2023 & 9.00 am -9.30 am	Unburned	48.0
		Soil & Ash mixture	43.4
		Semi burned	8.6
<b>E2</b>	11/04/2023 & 9.30 am -10.00 am	Unburned	61.8
		Soil & Ash mixture	35.1
		Semi burned	3.1
<b>C3</b>	11/04/2023 & 3.30 pm -4.00 pm	Unburned	44.5
		Soil & Ash mixture	44.6
		Semi burned	10.9
<b>D3</b>	11/04/2023 & 4.00 pm -4.30 pm	Unburned	49.1
		Soil & Ash mixture	47.6
		Semi burned	3.3
<b>E3</b>	11/04/2023 & 4.30 pm -5.00 pm	Unburned	33.3
		Soil & Ash mixture	65.9
		Semi burned	0.8
<b>C4</b>	10/04/2023 & 5 pm -6 pm	Unburned	70.6
		Soil & Ash mixture	25.2
		Semi burned	4.1
<b>D4</b>	11/04/2023 & 4.45 pm -5.15 pm	Unburned	54.1
		Soil & Ash mixture	45.1
		Semi burned	0.8
<b>B5</b>	11/04/2023 & 5.30 pm -5.50 pm	Unburned	60.4
		Soil & Ash mixture	39.6

		Semi burned	Negligible
<b>C5</b>	11/04/2023 & 5.50 pm -6.15 pm	Unburned	40.8
		Soil & Ash mixture	54.2
		Semi burned	5.0

**Table 1: Grid wise compositional data at Brahmapuram MSW dumpyard**



**Fig 3: Walkthrough survey at the field for GPS mapping**



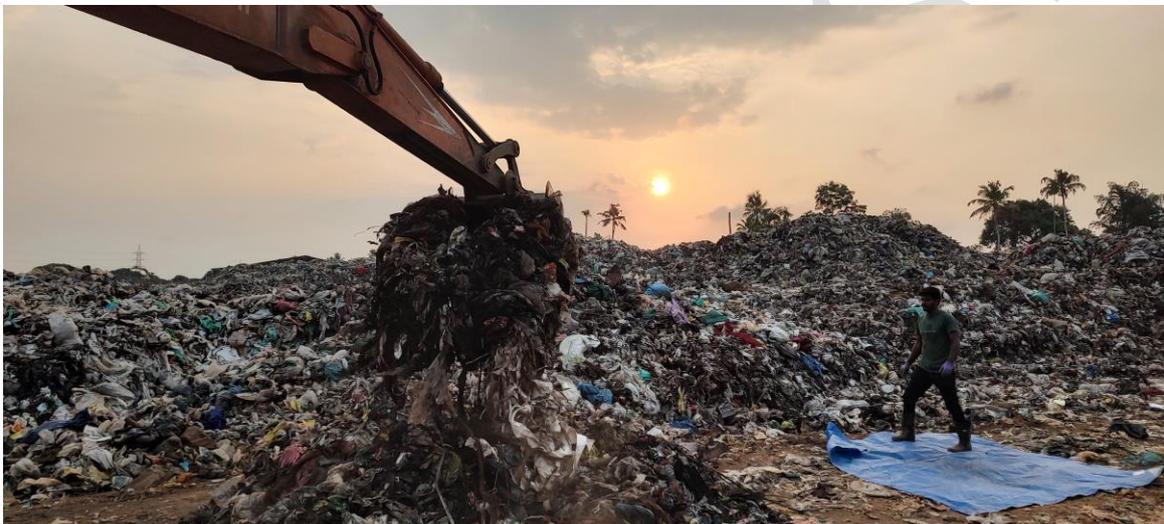
**Fig 4: Grid marking at the site using red flags and GPS points**



**Fig 5: Grab sampling from random spots inside the grids**



**Fig 6: Grab sampling from random spots inside the grids**



**Fig 7: Piling of grab samples outside the marked grid for coning and quartering exercise**



**Fig 8: Representative sample from grid C4.**



**Fig 9: Manual sorting of the representative sample into unburned, semi-burned and soil/mud mixed ash fractions**



**Fig 10: Sorted fractions were filled into different sacks for weighing.**



**Fig 11: Transferring of MSW compositions for weighing and recording.**

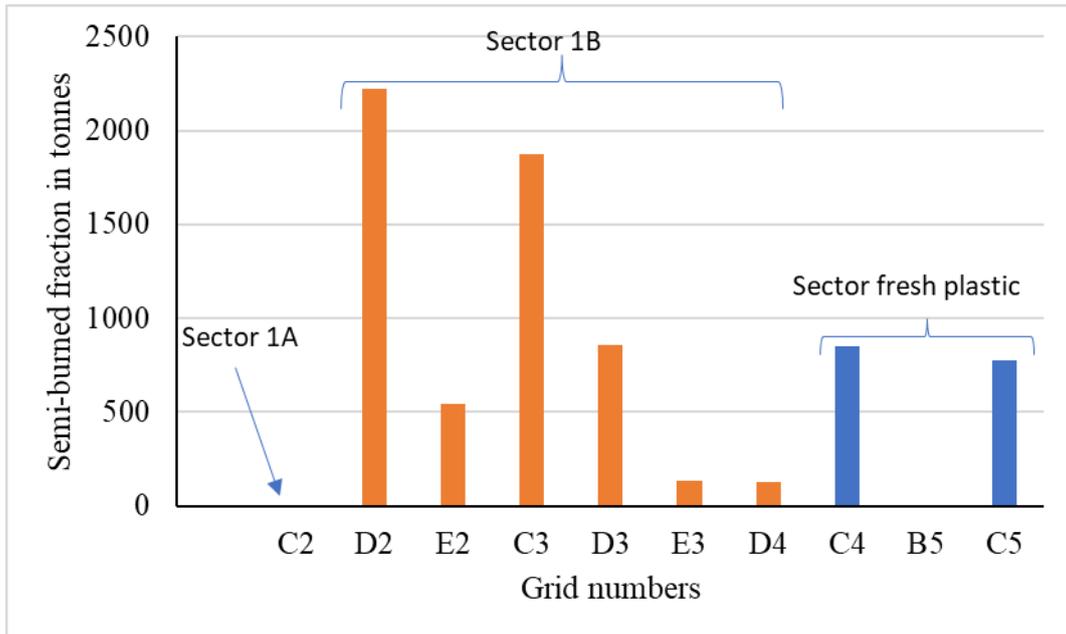
### **5.3 Grid Wise Burned Residue/Ash Levels**

The fine separation between ash and soil/mud at the study site was quite impractical as the ash particles were predominantly found assimilated with soil particles. Also, the site is in a dampened condition due to continuous watering as part of fire precautionary measures, which further keeps the ash particles bound to soil. Therefore, the higher quantity of semi-burned

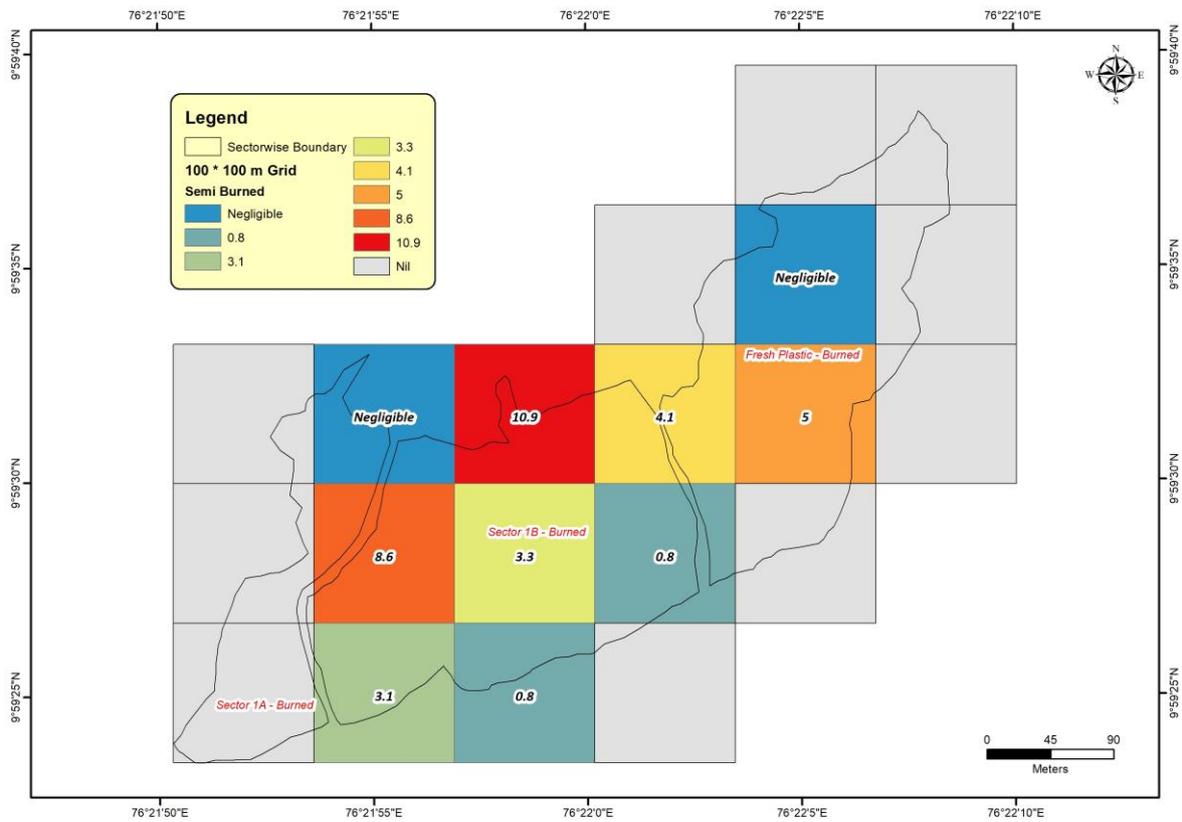
fraction was considered as the indicative parameter to identify the extent of burning in each of the grid areas in the present study. The semi-burned fractions ranged from 125 – 2221 tonnes at studied grids (table 2). Considering the average composition as 3.9%, semi-burned fraction in the sampled zone accounts for appr. 7500 tonnes and in the whole fire ridden zone it accounts for appr. 8000-8200 tonnes. Assuming the soil/mud mixed with ash fraction contains 5% ash, the estimated quantity of ash particles in mixed fraction will account to appr. 4300 tonnes in the sampled zone and 4800 tonnes in the whole fire ridden zone. On cumulative basis appr. 12800-13000 tonnes of burned residue/ash is present at the fire ridden area dispersed among 2.09 lakh tonnes of dumped waste. On composition basis, it accounts for appr. 6-7% of burned residue/ash content w.r.t the total composite waste present in the fire ridden area. The compositional analysis as well as ground observation suggests that grids C3 and D2 contain higher semi-burned levels and hence these areas require immediate attention for reclamation (fig 12). Both C3 and D2 grids are demarcated under the sector 1B and hence sector 1B need to be given priority during reclamation activities (fig 13). Further considering the leaching hazards into Kadambrayar due to proximity, sector 1A shall be given the second preference followed by fresh plastic sector.

<b>Grid numbers</b>	<b>Estimated quantity of MSW unburned (tonnes)</b>	<b>Estimated quantity of MSW semi-burned (tonnes)</b>	<b>Estimated quantity of soil/mud mixed with ash (tonnes)</b>	<b>Total estimated quantity (tonnes)</b>
<b>C2</b>	6324.1	Negligible	10925.9	17250
<b>D2</b>	12414.8	2221.6	11238.6	25875
<b>E2</b>	10654.9	543.3	6051.8	17250
<b>C3</b>	7680.3	1874.0	7695.7	17250
<b>D3</b>	12713.9	855.4	12305.7	25875
<b>E3</b>	5739.8	137.0	11373.1	17250
<b>C4</b>	14623.1	852.2	5224.7	20700
<b>D4</b>	8398.3	125.8	7000.9	15525
<b>B5</b>	9370.1	Negligible	6154.9	15525
<b>C5</b>	6332.9	774.9	8417.2	15525
<b>Total estimated quantity (tonnes)</b>	94252.3	7384.2	86388.6	188025

**Table 2: Grid wise quantity of unburned, semi-burned and soil + ash mixture**



**Fig 12: Sector wise semi-burned fraction quantity in studied grids.**



**Fig 13: Spatial distribution of % semi-burned residue composition over the field plot**

## 6.0 Major observations of the study

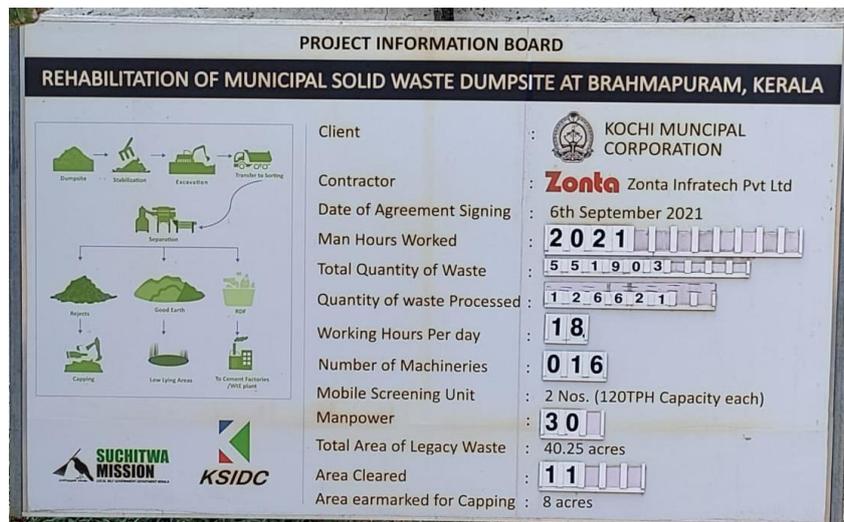
The study observes that appr. 12800-13000 tonnes of burned residue and ash (semi-burned fraction and 5% ash mixed mud/soil combined) are present in the dumpsite. However, the specific fractionation of ash/burned residue from the dumped MSW heap would be difficult considering fire affected waste volume of appr. 2.09 lakh tonnes. The sector wise estimated quantities of unburned, semi-burned and ash mixed mud/soil fractions in the fire ridden area is given in table 3. Currently separation of the legacy waste is being conducted at the site where three fractions are obtained – Reduced Derived Fuel (RDF) fraction, good earth and rejects. As per the project information board at site (Fig 14) RDF fraction is utilized for waste to energy processes/co-incineration processes, good earth fraction is employed for raising low lying areas and rejects are subjected to pervious capping.

Sectors	Estimated quantity of unburned (tonnes)	Estimated quantity of semi-burned (tonnes)	Estimated quantity of ash mixed mud/soil (tonnes)	Total estimated quantity (tonnes)
Sector 1A	20592.3	1603.0	18866.0	41061.3
Sector 1B	55972.0	4357.1	51279.7	111608.8
Sector fresh plastic	28146.3	2191.0	25786.8	56124.1
<b>Total estimated quantity (tonnes)</b>	104710.6	8151.1	95932.5	208794.2

**Table 3: Sector wise estimates of unburned, semi-burned and ash mixed mud/soil fractions.**

The same separation process can be employed for the reclamation of fire ridden zone. In, addition the separation activity should be performed at multiple ends parallely to clear the fire ridden area within minimum duration. As per the project information board placed at the Brahmapuram plant (fig 13), it claims to have 2 separator units with 120 tonnes per hour capacity each and 18 working hours every day. This implies that 4320 tonnes can be separated per day and in 60 days appr. 2-2.5 lakh tonnes can be moved out of the site. The separation and reclamation efforts has to be continued at the site at full scale and the entire

fire affected area should be completed before the start of monsoon (1<sup>st</sup> week of June). Possibility of leaching of toxic residues in the ash and thereby human exposure probabilities increases during the rains as the dumpyard lacks leachate collection facilities/hydrogeological isolation linings.



**Fig 14: Project information board at Brahmapuram plant**

In case, the present operational capacity of separators is less than that of 120 tonnes per hour, multiple separators need to be installed at war footing and complete the separation of the above identified fire affected area before 1st week of June 2023. The onsite observations of the ongoing separation activity do not seem to meet the claimed capacity of 120 tonnes per hour, which need to be verified by KSPCB / Kochi Corporation and necessary steps should be taken to ensure adequate operational capacity.

The present study results indicate that comparatively higher quantity of burned residue/ash is present in sector 1B and hence reclamation work at sector 1B need to be immediately prioritized. However, since there is only little possibility to separate the toxic ash from residual soil/mud present in MSW heaps, the good earth as well as the rejects fractions of separation activity will contain contaminated (toxic) ashes/burned residues. Hence both of these fractions from the fire affected areas should not be allowed to dump openly or to fill low lying areas. Both the fractions should be heaped and capped with impervious lining. The land area for capping of these fractions shall be identified on an urgent basis and the residues shall be capped with impermeable layer on sides and top. The site identification must be

made considering the flood plains of adjacent Kadambrayar. Any superstructure or constructional activities at the site should not disturb the underlying waste bed and may be permitted to use for vehicle parking or open storage yard. This suggestion is subjected to detailed geotechnical investigations at site and should be conducted based on the geotechnical expert advice.

The separated RDF fraction from the fire affected zones need to be baled and should be transferred out of the site. At present, it is heaped at another location in the dumpyard, which again poses risk of fire hazards in those regions. It should not be kept in the premises till the proposed WtE plant is commissioned. Instead, the 2<sup>nd</sup> option given in the project information board ie. transporting to cement plant as co-fuel may be followed immediately. This fraction shall be allowed to perform other high temperature processes such as co-incineration/waste to energy processes also as most of the toxic chemicals will get disintegrated at high temperatures.

## 7.0 Recommendations

- The total fire ridden area at the Brahmapuram MSW dumpyard plotted by walkthrough survey is 95249 m<sup>2</sup> where appr. 2.09 lakh tonnes of composite MSW is being dumped.
- The compositional analysis suggests that appr. 1.05 lakh tonnes of unburned (50.1%), 8151 tonnes of semi-burned (3.9%) and 95,932 tonnes of ash mixed mud/soil waste fractions (45.9 %) are present in the fire ridden waste piles.
- Higher composition of semi-burned content was observed in sector 1B (appr. deposited waste – 1.1 lakh tonnes) where appr. 4500 tonnes of semi-burned residues and 51000 tonnes of ash mixed mud/soil are present. Hence it should be reclaimed on a priority basis. Sector 1A shall be given second preference considering the closeness to Kadambayar and finally fresh plastic sector may also be cleared.
- The separation process currently employed at site shall be employed for the fire ridden site reclamation process on priority basis. However, the processing rate should be raised to rates specified in project information board (240 tonnes per hour with 18 working hours a day) so as to complete the process before the forthcoming monsoon (1<sup>st</sup> week of June 2023).
- The separated combustible fraction (RDF fraction) should be transferred out of the site immediately to avoid further fire accidents and it shall be processed through high temperature processes such as co-combustion, co-incineration or waste to energy operations.
- The reject as well as the good earth fraction generated from the separation process is contaminated with toxic chemicals generated during the firebreak out incidents (burned residue/ash) and hence both the fractions should be capped with impervious lining in the sides as well as on the top. The capped land area may be used for vehicle parking or open storage yard without disturbing the underlying waste bed. This suggestion is subjected to detailed geotechnical investigations at site and should be conducted based on the geotechnical expert advice.

## 8.0 References

1. Study Report on the emission of dioxins and dioxin – like PCBs during the dumpyard fire at Brahmapuram in February 2019, submitted to KSPCB, April 2019.
2. Study Report on the emission of dioxins and dioxin – like PCBs during the dumpyard fire at Brahmapuram in February 2020, submitted to KSPCB, December 2021.
3. ASTM D5231-92, Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste, ASTM Internationals, reapproved in 2016.

CSIR-NIIST