

# Activity 9: Annual surveys



## Activity 9.14 Waste management survey for 2024 in Sharpeville



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Final Report

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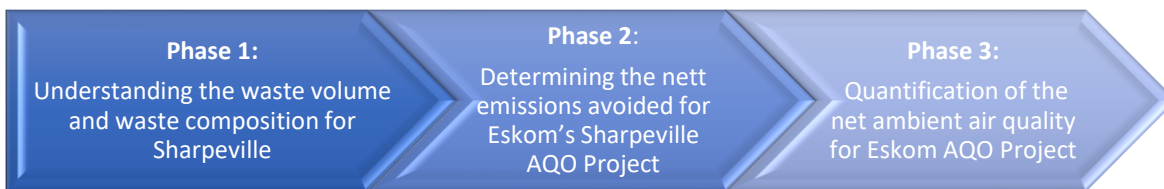
# 1 EXECUTIVE SUMMARY

## 1. BACKGROUND

Open burning of household waste is a common phenomenon in many areas in South Africa. This uncontrolled open burning generates a wide range of emissions from these ground-level and low-temperature burns cause air pollution, leading to adverse health effects among community residents (Wang, 2020). The composition of waste is an important factor influencing the emissions that are formed during the burning of waste (Rabaji, 2019).

During a 2017 Community Source Survey, Nova (2018) indicated that the dumping and burning of waste was seen as the second largest source of air pollution (after dust) in Sharpeville. Thus, as part of Eskom's Air Quality Offset (AQO) programme for Lethabo power station, a waste clean-up campaign of illegal waste sites has been introduced.

ARM is undertaking a study to quantify the air quality impact of Eskom AQO waste intervention at Sharpeville (ARM, 2024). A phased study (Figure i) will be conducted which will entail evaluating the waste composition profile, quantifying the nett emissions avoided and finally modelling the resultant impact aligned to the South African Regulations regarding air dispersion modelling (Gazette No 37804, 2014).



**Figure i: ARM phased approach to quantify the air quality impact of Eskom's AQO Sharpeville waste intervention**

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## 2. STUDY OBJECTIVE

The objective of this study is to undertake a waste management survey at the Sharpeville areas wherein Eskom is collecting waste to accurately determine the waste composition and burn characteristics.

## 3. STUDY METHODOLOGY

A waste management questionnaire was developed by ARM to capture both the waste composition and burn characteristics for each area. ARM together with Eskom subsequently sought local leadership approval on the questionnaire. Thereafter the questionnaire was administered via a focus group interview format to the personal engaged in the Eskom Sharpeville AQO waste clean-up operations. These personal encompassed community liaison officers, general labourers (waste pickers) and supervisors. Additionally, ARM conducted a site visit at each of the areas herein.

## 4. STUDY RESULTS

Eskom has executed the first four waste clean-up campaigns to date. A total of 14 illegal designated waste sites has been cleaned up to date. The study results for both the waste composition and burn characteristics for these sites is presented herein.

### 4.1 WASTE COMPOSITION

Figure ii provides the average waste composition for each waste clean-up campaign collected by Eskom. Whereas Figure iii provides an average waste composition across all four clean-up campaigns. The study findings indicate waste consisted of mainly paper (41%), plastic (37%) and glass (11%) (Figure iii). The large amounts of paper & glass waste remain in numerous illegal dumping sites throughout the Sharpeville area. This is due to lack of infrastructure and relevant facilities for paper and glass recycling within the township.

It's noted that when plastic waste is burnt, it releases toxic gases like dioxins, furans, mercury and PCBs into the atmosphere (Verma et al., 2016). Additionally, the combustion of plastics results in emissions of particulate matter, particulate bound heavy metals and PAHS released to the atmosphere (Valavanidid et al., 2008). On the other hand, burning waste paper in residential is a major health risk (Xiu, 2018). The risk is caused mainly by major air pollutants such as particulate matter with an aerodynamic diameter < 2.5 µm (PM<sub>2.5</sub>), CO, and NO<sub>x</sub> that are formed and emitted during the burning of waste paper (WHO, 2014, Xiu, 2018)

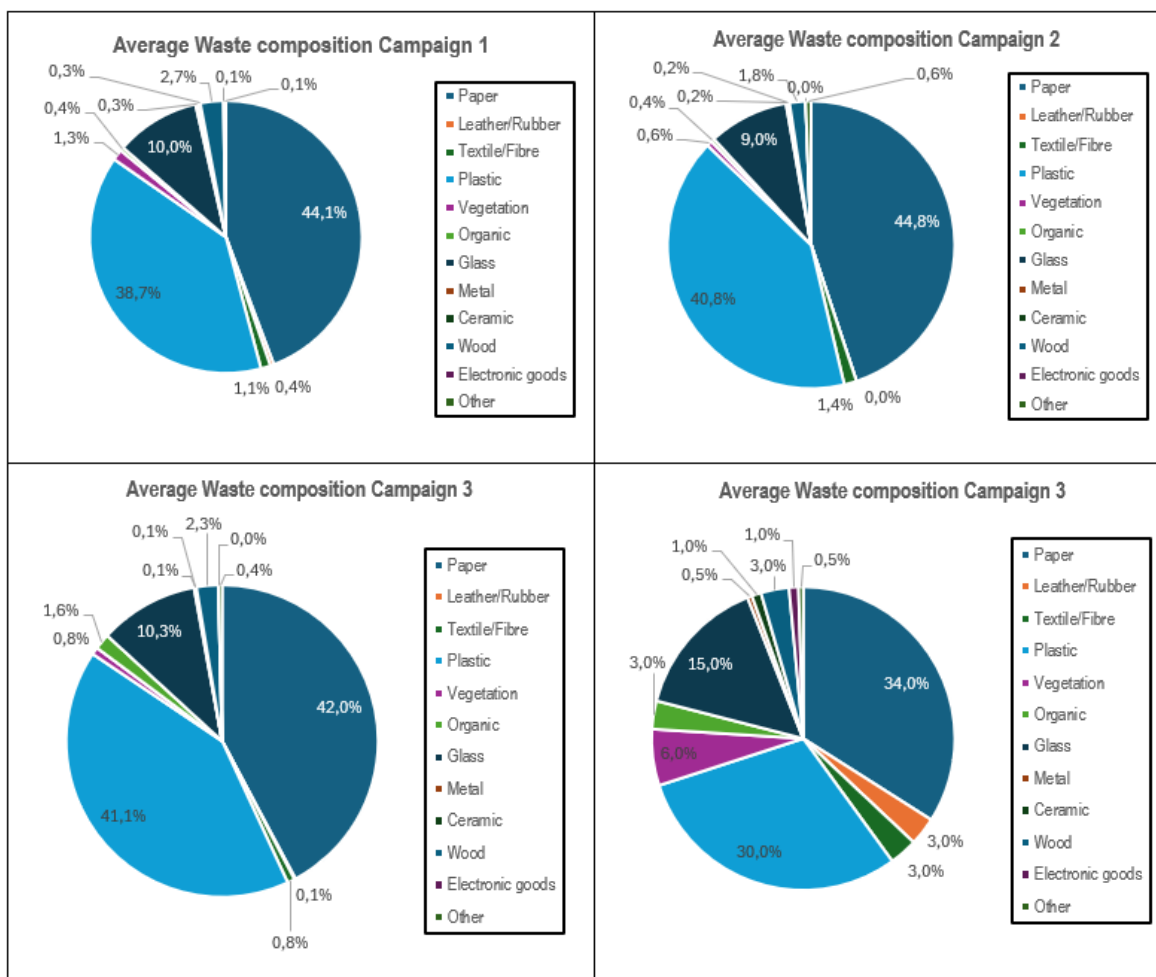


Figure ii. The average waste composition for each Eskom waste clean-up campaign

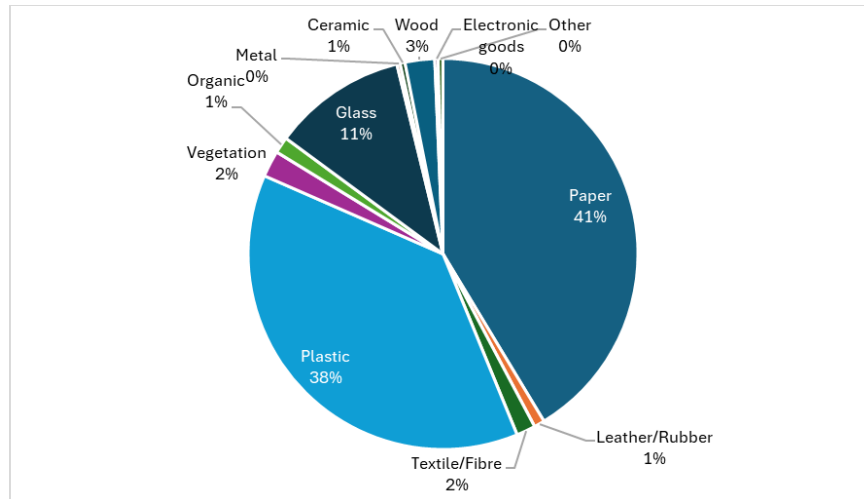


Figure iii. The average waste composition for all Eskom waste clean-up campaigns to date

#### 4.2 WASTE BURNING CHARACTERISTICS

It is noted that whilst Eskom cleaned up 14 illegal waste dumping sites at Sharpeville, waste burning occurred only at 6 sites (Mareka; Police Station (Ward 12); Phumasibathe; Ascot Road (Ward 14); Kgomomocho Primary School and Vuka Cemetery). Based on the respondents' feedback from the focus group interview, the burn characteristics for these sites are summarised in Table i. It is noted that the duration of the burn varied between 1 to 11 hours. In terms of the intensity, fires were generally smouldering. The fundamental difference between smouldering and flaming combustion is that smouldering occurs on the surface of the solid rather than in the gas phase. Due to the nature of smouldering fires which occur over a longer duration than flaming combustion, these fires typically result in elevated localised ground level concentration of pollutants (Ohlemiller, 2002).

**Table i: Summary of the burn activity characteristics for the Sharpeville sites wherein waste is burnt**

Site	Campaign		
	Duration of Burn (Hours)	Frequency of Burn	Intensity of Fire
Mareka	11	Continuous	Smouldering
Ascot Sasol garage (Ward 14)	11	Continuous	
Police station (Ward 12)	3	Intermittent	
Phumasibathe	1	Intermittent	
Kgomocho primary school	1	Ad hoc	
Vuka cemetery (Ward 14)	1	Ad hoc	

## 5. RECOMMENDATIONS

Table ii provides a summary of the proposed recommendations for Eskom’s review and consideration. Its noted that these recommendations have been obtained & informed from the: ARM’s waste management survey; engagement with the local Sharpeville Councillors and the personal engaged in the Eskom Sharpeville AQO waste clean-up operations.

Table ii: Summary of recommendations obtained from the Study

Theme	Recommendations proposed for Eskom’s review & consideration		
	ARM	Local Councillors	Clean-up Campaign Personal
<b>1. Promoting waste minimisation, reuse, recycling and recovery of waste</b>	<ul style="list-style-type: none"> <li>▪ Eskom (together with the support of the local Councilors) to engage with the local Sharpeville scrapyards to determine the feasibility of them additionally collecting paper, cardboard and plastics.</li> <li>▪ Eskom (together with the support of the local Councilors) engage with the local waste pickers association to identify areas wherein recycling initiatives can be improved.</li> <li>▪ Eskom considers implementing a waste-separation recycling bins at the local primary school. The aim of this initiative is to promote the diversion of recyclable waste material from the school and to encourage behavioural change towards waste minimisation, which leads to a cleaner environment.</li> </ul>	<ul style="list-style-type: none"> <li>▪ It’s recommended that the Eskom clean-up campaign is extended to “2 weeks” as opposed to current “1 week campaign”.</li> </ul>	<ul style="list-style-type: none"> <li>▪ It’s recommended that the Eskom clean-up campaign is extended to “2 weeks” as opposed to current “1 week campaign”.</li> </ul>
<b>2. Environmental education and awareness training</b>	<ul style="list-style-type: none"> <li>▪ Its proposed Eskom considers a targeted environmental education and awareness training session with the waste pickers who frequently burn waste to highlight the adverse health impacts associated with burning waste, which may then reduce the frequency of waste been burnt.</li> </ul>		<ul style="list-style-type: none"> <li>▪ Its recommended environmental awareness and training session to be implemented at the Sharpeville schools</li> </ul>

Theme	Recommendations proposed for Eskom’s review & consideration		
	ARM	Local Councillors	Clean-up Campaign Personal
	<ul style="list-style-type: none"> <li>ARM noticed that community members were utilising the wheelie-bins to transport waste to the illegal dumps. Its proposed Eskom together with the Emfuleni waste department considers a targeted environmental education and awareness session with the wider community to land on a feasible solution herein.</li> </ul>		
	<ul style="list-style-type: none"> <li>Its noted post the Eskom 5th clean-up campaign at Sharpeville at the Vuka Cemetery, the ARM and Eskom teams noticed one of the older local residents was guarding the entrance to the cemetery to prevent more dumping. Its proposed Eskom investigates the feasibility of employing community members on a part-time basis to act as “waste-wardens” to guard the cleaned up areas to minimize and/or prevent waste dumping.</li> </ul>		
<p><b>3. Assisting the Emfuleni Municipality to provide effective and efficient delivery of waste services</b></p>	<ul style="list-style-type: none"> <li>Its proposed Eskom considers the feasibility of providing an additional waste service truck to the Emfuleni Municipality to assist with the collection of waste in Sharpeville.</li> </ul>	<ul style="list-style-type: none"> <li>Its recommended that 4 skips are placed in each ward with the Municipality.</li> <li>Its recommended that an engagement is held with local licensing authority (AQ) and Councilors.</li> <li>Its recommended that the Eskom Clean-up campaign 5 to be done prior to May 2024 elections</li> </ul>	<ul style="list-style-type: none"> <li>It’s recommended additional vehicles be provided to the Emfuleni Municipality to assist with waste management.</li> <li>Its recommended increased enforcement by the Emfuleni Municipality in terms of waste management.</li> </ul>

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## 6. CONCLUSION

It's evident from this study that the bulk of the waste dumped at the Sharpeville illegal waste sites include both highly flammable paper and plastics. Furthermore, due to long duration of the smouldering fires occurring at these sites, there exists a potential for short-term elevated localised ground level concentration of pollutants near the vicinity of these sites. This hypothesis will be tested by the next phases (Figure i) of the study wherein ARM shall conduct a subsequent dispersion modelling study to determine the nett air quality benefit for Eskom's Sharpeville AQO Project.

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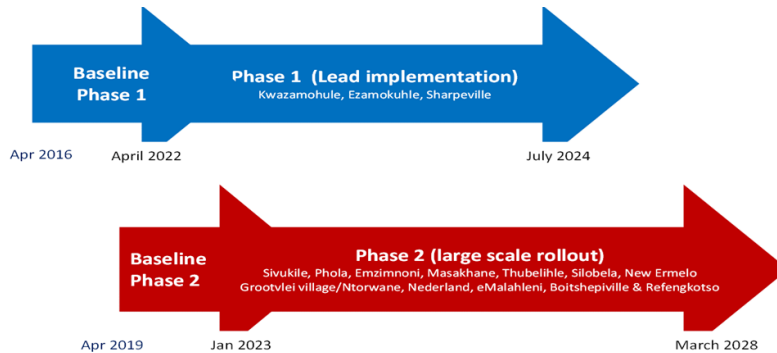
## 1. BACKGROUND

### 1.1 AIR QUALITY OFFSETS GUIDELINE

An environmental offset is an action(s), designed to compensate for a negative environmental impact of resource use, a discharge, emission, or other activity. The Department of Forestry, Fisheries & Environment (DFFE) defines air emissions offsets as an intervention, or interventions, specifically implemented to counterbalance the adverse and residual environmental impact of atmospheric emissions in order to deliver a net ambient air quality benefit within, but not limited to, the affected airshed where ambient air quality standards are being or have the potential to be exceeded and whereby opportunities and need for offsetting exist (Notice 333 of 2016).

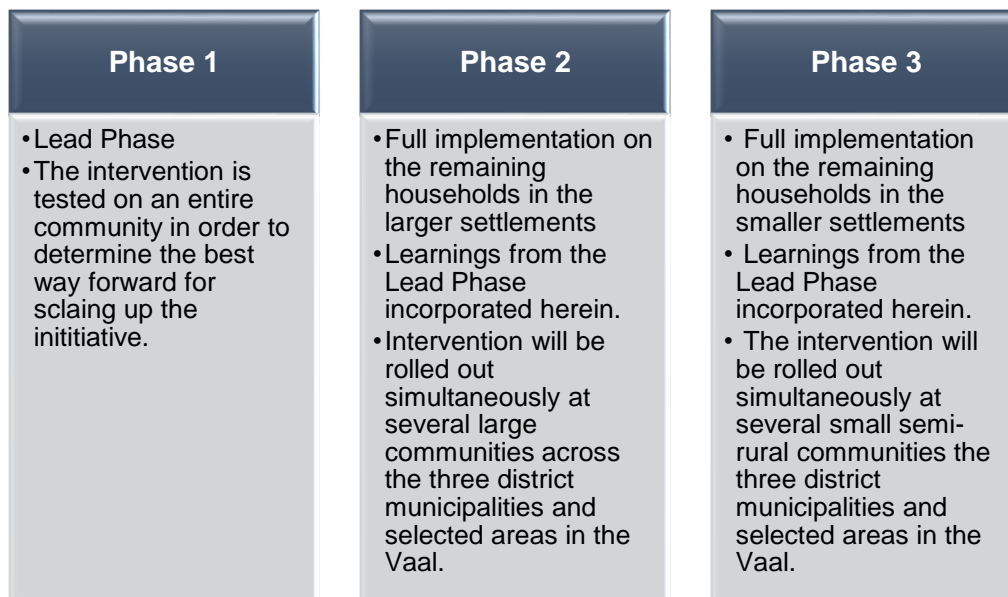
### 1.2 ESKOM'S APPROACH TO AIR QUALITY OFFSETS

DFFE Air Quality Offset Guideline has shaped and informed Eskom's Air Quality Offsets Implementation Plan. This Plan has been based on a scientific process of feasibility studies, testing and demonstration, and on consultation with key stakeholders. Figure 1 illustrates the concept schedule for the phased implementation of Eskom's air quality offsets.



**Figure 1: Concept Schedule for the implementation of Eskom’s air quality offsets (Matimolane, 2023).**

Eskom has adopted the phased approach (Figure 2) herein to increase the probability of success and to ensure that learnings from early phases are incorporated into the large-scale roll-out. (Matimolane, 2020).



**Figure 2: Eskom’s Phased approach to the rollout of air quality offset interventions (Matimolane, 2020).**

Eskom's air quality offsets programme is designed to reduce human exposure to harmful levels of air pollution by reducing emissions from local sources, like domestic coal burning and waste burning. Thus, air quality offsets can improve ambient air quality in low-income communities in the vicinity of Eskom's power stations. Eskom has developed air quality offset (AQO) implementation plans for Majuba Power Station (Ezamokuhle township); Hendrina Power Station (KwaZamokuhle township) and Lethabo Power station (Sharpeville).

### 1.3 ESKOM'S PLANNING, MONITORING AND VERIFICATION (PMV) PROJECT

For Eskom's PMV Project, interventions to reduce household emissions from domestic coal/wood burning will be rolled out in KwaZamokuhle and Ezamokuhle in the Mpumalanga Highveld. For formal dwellings the intervention will be a thermal insulation retrofit and an electricity starter pack and installation. The intervention for informal dwellings still needs to be selected and tested. Interventions also need to be identified and implemented to improve air quality in Sharpeville, Gauteng. Since domestic coal burning is less prevalent in Sharpeville, it is expected that a community-scale intervention, like reducing waste burning, will be more suitable there.

Air Resource Management (ARM) (Pty) Ltd has been appointed by Eskom to support the PMV services in support of the *Phase 1: Lead implementation* at: KwaZamokuhle; Ezamokuhle and Sharpeville. Its ARM (Pty) Ltd understanding that the overall objective *Lead Implementation Phase* is to benefit the specific local communities, minimize implementation risk, increase practical and scientific knowledge, and develop and refine monitoring, reporting and verifications processes. To achieve this, Eskom has included sixteen targeted work package Activities (Table 1) for these respective communities. This report focuses on *Activity 9.14: Waste management survey for 2024 in Sharpeville*.

**Table 1: Eskom PMV Activity Schedule (Eskom PMV NEC Contract,27082020)**

Activities	Kwazamokuhle	Ezamokuhle	Sharpeville
Activity 1: Preliminary air quality assessment		✓	
Activity 2: Gather Area intelligence		✓	
Activity 3: Rapid in situ assessment		✓	
Activity 4: Obtain ethical clearance		✓	
Activity 5: Census	✓	✓	✓
Activity 6: Community source survey		✓	
Activity 7: Fuel source survey		✓	
Activity 8: Household surveys		✓	
Activity 9: Annual (household/community) surveys and monitoring of project effectiveness	✓	✓	✓
Activity 10: Ambient air quality monitoring	✓	✓	✓
Activity 11: Conduct indoor air quality monitoring	✓	✓	
Activity 12: Atmospheric Dispersion Model	✓	✓	✓
Activity 13: Design of Intervention		✓	✓
Activity 14: Development of Database Reporting	✓	✓	✓
Activity 15: Strategic Assistance and offsets methodology	✓	✓	✓
Activity 16: Research and Development	✓	✓	✓

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## 2 INTRODUCTION

### 2.1 MUNICIPAL SOLID WASTE MANAGEMENT

#### 2.1.1 GLOBALLY

Solid-waste management is a global environmental challenge. Wilson and Velis (2015) calculated that approximately  $2 \times 10^9$  tons per year of municipal solid waste (MSW) is generated globally. Whilst high-income countries have higher per capita MSW generation, waste generation in the middle- and low-income countries are growing rapidly due to population growth and economic development (Ferronato and Torretta, 2019).

In general, waste disposal practices include collection, recycling, land filling, incineration, and open burning (Wiedinmyer et al., 2014). In contrast to the nearly 100% collection and controlled disposal rates in high and upper-middle-income countries, low-income countries often have collection rates of less than 50 %, with nearly 0% controlled disposal common in rural areas (Wang, 2023a).

It is estimated that at least 2 billion people worldwide still lack access to MSW collection, treatment, or disposal services and infrastructure (Cook and Velis, 2021; Wilson et al., 2015). In rural communities of developing countries, particularly regions where waste collection service is expensive, unavailable, or infrequent, uncontrolled open burning of household solid waste is a common practice for decreasing MSW mass and volume, reducing unpleasant odours from decomposing materials, fuelling heating and cooking activities, and destroying pathogens (Cook and Velis, 2021).

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### 2.1.2 SOUTH AFRICA

Solid Waste generation per capita varies widely within South Africa depending on income and location (urban and rural). At present, not all waste is collected and managed formally, with only 61% of the population estimated to have access to kerbside removal of waste (DEA, 2014). The ever-increasing socio-economic activities have brought about an increase in the generation of waste in South Africa beyond effective levels of management (Nwokedi, 2011).

Within South Africa, waste management is the responsibility of local government; however, large discrepancies exist in the level of service provided by different municipalities. Municipalities often encounter problematic situations beyond the ability of the municipal authority to manage (Sujauddin *et al.*, 2008) primarily because of the lack of organisation, financial resources, complexity and system multi dimensionality (Rabaji, 2019). Where most larger municipalities provide a complete service, including waste collection and appropriate disposal, many smaller municipalities typically rural lack the capacity for any form of waste service delivery. While the range in waste service delivery is most notable between urban and rural municipalities, it has been suggested that variation can, and does, occur across provinces, district councils and local municipalities (Rodseth, 2020). This is highly skewed to more affluent urban communities, with significantly lower levels in urban informal areas, tribal areas and rural formal areas. (DFFE, 2014).

A lack of formalised waste management can result in unregulated management practices, i.e. waste management or disposal occurring outside of, or separate to, formal waste systems. These include for example, illegal dumping and the associated uncontrolled burning of MSW (Rodseth, 2020).

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## 2.2 THE AIR QUALITY IMPACT OF BURNING MSW

Globally, about half of the household waste (i.e., about  $1 \times 10^9$  tons) is burned in open, uncontrolled fires every year (Wang, 2023a). Open burning of household waste is a common phenomenon in many areas in South Africa. Due to limited resources for collection and proper disposal, household and municipal solid waste is often dumped in neighbourhoods and open burned in piles to reduce odour and create space for incoming waste. This uncontrolled MSW open burning generates a wide range of emissions from these ground-level and low-temperature burns cause air pollution, leading to adverse health effects among community residents (Wang, 2020).

These air contaminants include criteria pollutants, such as carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), sulfur dioxide (SO<sub>2</sub>), particulate matter with aerodynamic diameter of 2.5 µm (PM<sub>2.5</sub>) and 10 µm (PM<sub>10</sub>), and lead. Burning also emits other hazardous air emissions, such as heavy metal elements, polychlorinated and polybrominated dioxins and furans, and polycyclic aromatic hydrocarbons (PAHs) (Wang, 2023b). Many of these pollutants are carcinogenic or mutagenic; they may cause immunological and developmental impairments and lead to respirable and cardiovascular diseases. It is estimated that exposure to PM<sub>2.5</sub> from open burning of solid waste causes at least 270 000 premature deaths in the world every year (Williams et al., 2019; Kodros et al., 2016). In addition, open burning emits large amounts of carbon dioxide (CO<sub>2</sub>) and light-absorbing carbon (including black carbon, BC), two of the largest climate forcers of global warming (Bond et al., 2013; IPCC, 2013).

**2.2.1 THE SIGNIFICANCE OF WASTE COMPOSITION AS IT RELATES TO WASTE BURNING AND AIR QUALITY ISSUES**

Lemieux (1998) measured emissions from open burning of domestic waste against the controlled combustion of municipal waste in a municipal waste combustor (MWC). Table 2 provides a summary of this data which shows the average results for the various pollutants that were measured, along with the ratio between the avid recycler and the non-recycler. As noted by Rabaji (2019) the estimated emissions varied, not only based on the type of burning (controlled versus uncontrolled), but also based on the composition of the waste. The composition of waste that is being burned is therefore an important factor influencing the emissions that is formed during the burning of waste (Rabaji, 2019).

**Table 2: Summary of the measured emissions for the various pollutants (Lemieux, 1998)**

Parameter	Average, per mass lost			Average, per household		
	Recycler	Non-Recycler	Ratio	Recycler	Non-Recycler	Ratio
<b>WASTE COMPOSITION</b>						
total daily waste (kg)	1.5	4.9	0.31	1.5	4.9	0.31
PVC in waste (kg)	0.07	0.01	7.00	0.07	0.01	7.00
paper waste (kg)	0.98	3.02	0.32	0.98	3.02	0.32
all plastics (kg)	0.23	0.36	0.64	0.23	0.36	0.64
food (kg)	0	0.28	0.00	0	0.28	0.00
textiles, leather (kg)	0	0.18	0.00	0	0.18	0.00
wood (kg)	0.06	0.05	1.20	0.06	0.05	1.20
glass/ceramics (kg)	0.1	0.5	0.20	0.1	0.5	0.20
metals (kg)	0.14	0.49	0.29	0.14	0.49	0.29
<b>COMBUSTION RESULTS</b>						
max. bed temp (°C)	370	740	0.50	370	740	0.50
fraction burned (%)	66.7	49.1	1.36	66.7	49.1	1.36
unburned residue (kg)	0.50	2.49	0.20	0.50	2.49	0.20
<b>AIR CONTAMINANT EMISSIONS</b>						
		(mg/kg burned)			(mg/household day)	
benzene	725	1240	0.58	725	2983	0.24
acetone	190	940	0.20	190	2262	0.08
styrene	310	740	0.42	310	1780	0.17
total TICs <sup>a</sup>	4000	14400	0.28	4002	34645	0.12
naphthalene <sup>b</sup>	40	48	0.83	40	115	0.35
phenol	85	140	0.61	85	337	0.25
dichlorobenzenes	320	160	2.00	320	385	0.83
trichlorobenzenes	400	110	3.64	400	265	1.51
tetrachlorobenzenes	140	74	1.89	140	178	0.79
pentachlorobenzene	100	53	1.89	100	128	0.78
hexachlorobenzene	48	22	2.18	48	53	0.91
acenaphthylene	3.4	11	0.31	3.4	26	0.13
naphthalene <sup>c</sup>	5.2	18	0.29	5.2	43	0.12
phenanthrene	3.3	7.3	0.45	3.3	18	0.19
aldehydes & ketones	140	2800	0.05	140	6737	0.02
total PCDD	0.047	0.038	1.24	0.047	0.091	0.51
total PCDF	0.22	0.0061	36	0.220	0.015	15
total PCB	0.97	2.86	0.34	0.97	6.87	0.14
PM10	5800	19000	0.31	5803	45712	0.13
PM2.5	5.3	17.4	0.30	5.3	42	0.13
HCl	2400	284	8.47	2401	682	3.52
HCN	200	468	0.43	200	1126	0.18
<b>RESIDUALS IN ASH</b> μm (or ng) per kg ash						
PCDD, ng/kg	14851	1556	9.54			
PCDF, ng/kg	34040	5800	5.87			
PCB, μg/kg	220	122	1.80			
Cr	300	92	3.26			
Cu	4910	343	14			
Pb	164	32	5.13			
Zn	11500	721	16			

<sup>a</sup>Tentatively identified (VOC) compounds.

<sup>b</sup>Semi-volatile organics analysis.

<sup>c</sup>PAH specific analysis.

MSW includes various waste streams *inter alia*: paper, plastics, glass, metal, organics and other. As demonstrated by Oelofse (2015) MSW composition varies per province (Table 3). Thus, it's important to understand the composition of MSW that is being burned at a specific site.

**Table 3: MSW composition expressed as percentage by weight (Oelofse, 2015)**

Provinces	Paper	Plastics	Glass	Metal	Organic	Other
	Percentage contribution by weight					
Cape Town	24	15	12	7	32	9
Western Cape	24	22	9	8	22	16
Northern Cape	21	18	10	3	10	39
Free State	14	12	8	6	42	19
North West	11	9	6	2	58	14
Gauteng	17	10	5	3	36	30

## 2.3 ESKOM'S AQO PROJECT TO REDUCE MSW BURNING IN SHARPEVILLE

### 2.3.1 CONTEXT

According to Rabaji (2019) the Sharpeville Township, being located within the Vaal Triangle region, already experiences significant pollution from surrounding industries and mines. During a Community Source Survey in 2017 (Nova, 2018), when asked to make a list of sources that pollute the air, indicated that the dumping and burning of waste was seen as the second largest source of air pollution (after dust). The emissions from industries in general is noted as being perceived as the fourth largest contributor to air

pollution (Nova, 2018). Thus, as part of Eskom’s Air Quality Offset (AQO) programme for Lethabo power station, a waste clean-up campaign has been introduced.

### 2.3.2 SHARPEVILLE AQO GOAL

The primary goal of the Sharpeville AQO initiatives is to clean up designated illegal waste sites (consisting of non-hazardous solid waste) in Sharpeville, along with removing litter in the vicinity of the cleared areas. The waste will be collected and disposed of at approved waste disposal sites, in accordance with the Environment Conservation Act, 73 of 1989, and the National Environmental Waste Management Act (Act 59 of 2008). (Matimolane, 2024). This will prevent waste from being burnt and the consequent release of harmful emissions (Figure 3).



**Figure 3: Waste burning outside a primary school in Sharpeville**

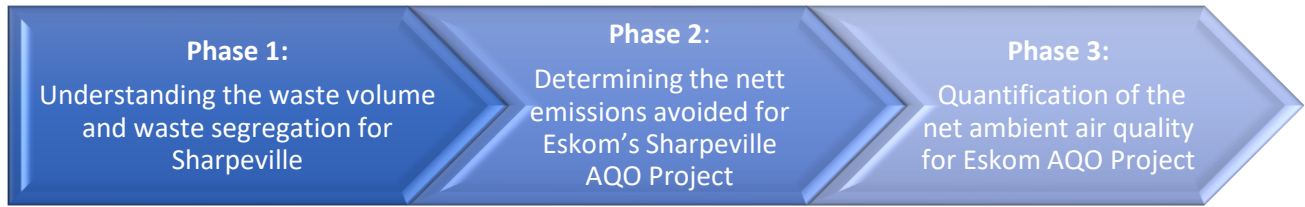
The first four campaigns were executed successfully by Eskom, meeting deadlines without any safety incidents (Matimolane, 2024). Figure 4 illustrates the areas wherein waste was collected for each of the four campaigns.



Figure 4: Map showing the areas wherein waste was collected for each of the campaigns

### 2.3.3 ARM STUDY TO DETERMINE THE AIR QUALITY BENEFIT OF ESKOM'S AQO WASTE INTERVENTION IN SHARPEVILLE

ARM is undertaking a study to quantify the air quality impact of Eskom AQO waste intervention at Sharpeville (ARM, 2024). A phased study (Figure 5) will be conducted which will entail evaluating the waste composition profile, quantifying the nett emissions avoided and finally modelling the resultant impact aligned to the South African Regulations regarding air dispersion modelling (Gazette No 37804, 2014).



**Figure 5: ARM phased approach to quantify the air quality impact of Eskom's AQO Sharpeville waste intervention**

As noted previously, waste composition varies widely within South Africa depending on income and location (urban and rural) (DEA, 2014). Waste that is dumped in an area is not heterogenous and can include various waste streams. Hence, its key to understand the waste segregation and total percentage waste contribution at each of the sites in Sharpeville where waste is been collected. This will enable an accurate application and estimation using the relevant emission factors.

## 2.4 STUDY OBJECTIVE

As highlighted above (section 2.3.3) a critical path to quantify the air quality impact of Eskom AQO waste intervention at Sharpeville is to first unpack the waste composition and burn characteristics. The objective of this study is to undertake a waste management survey at the Sharpeville areas wherein Eskom is collecting waste (Figure 3) to accurately determine the waste composition and burn characteristics.

---

### **3 METHODOLOGY**

A waste management questionnaire (Annexure 1) was developed by ARM to capture both the waste composition and burn characteristics for each area (Figure 4). ARM together with Eskom subsequently sought local leadership approval on the questionnaire. Thereafter the questionnaire was administered via a focus group interview format to the personal engaged in the Eskom Sharpeville AQO waste clean-up operations. These personal encompassed community liaison officers, general labourers (waste pickers) and supervisors. Additionally, ARM conducted a site visit at each of the areas herein (Figure 4).

#### **3.1 LOCAL LEADERSHIP ENGAGEMENT & APPROVAL**

ARM met with the Councillors for Sharpeville Wards 12 & 13 on the 26<sup>th</sup> of March 2024 at the Sharpeville Councillors Office (Figure 6). ARM outlined the Eskom AQO Project for Sharpeville with specific emphasis on ARM's phased approach to quantify the air quality impact of Eskom's AQO Sharpeville waste intervention (Figure 5). Thereafter ARM explained the proposed waste management survey to be conducted and the associated questionnaire (Annexure 1) to be undertaken. The Councillors overwhelmingly supported the project and the proposed waste management questionnaire providing their approval for ARM to commence with the study.



Figure 6: Sharpeville Councilors Office, Sharpeville

### 3.2 FOCUS GROUP INTERVIEW

ARM held a focus group interview (FGI) with the personal engaged in the Eskom Sharpeville AQO waste clean-up operations. These personal encompassed community liaison officers, general labourers (waste pickers) and supervisors. The FGI was held on the 5<sup>th</sup> of April at the Rhythm Lounge venue in Sharpeville. The discussions were led by ARM's moderator and utilised the questionnaire (Annexure 2) to: introduce; guide; probe and collate responses from the personal present at the discussion. ARM encouraged the respondents to interact and express their views freely. The responses were collated in ARM's online survey platform (JotForm survey app).

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### 3.3 SITE VISIT

For each the sites wherein, Eskom had collected waste (Figure 4), ARM conducted a site-visit herein to get a better understanding of the site's: extent; characteristics of waste dumping and burning and composition of waste being dumped there.

The following section presents the findings for the components (sections 3.1 to 3.3) discussed above.

## 4 STUDY RESULTS

This chapter contains the results of the study, which focused on:

- i. Evaluating and cataloguing the waste dumping sites in terms of their size, waste composition and level of activity for each site wherein Eskom had collected the waste;
- ii. Characterising the waste composition of waste dumped for each of the four campaigns conducted by Eskom as well as to provide an average waste composition collected to date by Eskom and
- iii. Providing the high-level burn activity characteristics for the sites wherein waste is burnt.

### 4.1 EVALUATION AND CATALOGUING OF SHARPEVILLE WASTE DUMPING SITES

Eskom has executed the first four waste clean-up campaigns to date. A total of 14 illegal designated waste sites has been cleaned up to date (Figure 7). A full description of these 14 sites is provided in section 4.1.1 to 4.1.14 , which also provides imagery of the waste dumping sites.



Figure 7: Location of the illegal waste sites that Eskom has cleaned up to date

4.1.1 SITE 1: WARD 14 ASCOT SASOL GARAGE

Site location: -26.697133; Longitude:27.87722



**Site Description:**

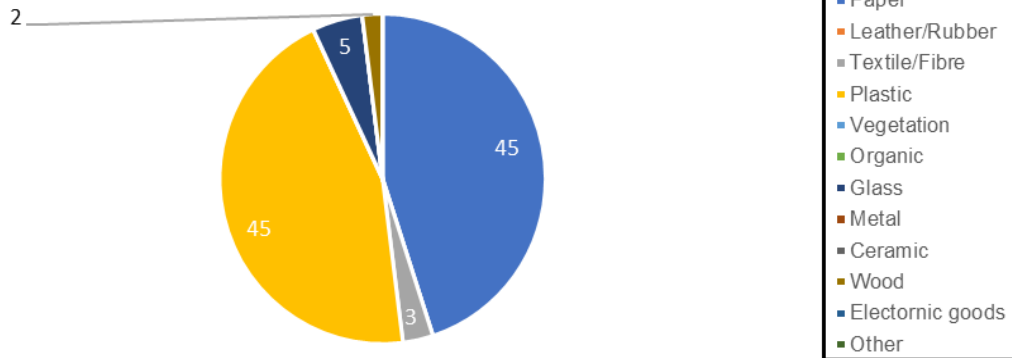
This site is located at the southern entrance into Sharpeville close to the Sasol Garage on Ascot road

**Waste transport:** Waste is illegally dumped in this area by wheelbarrow, wheelie bin and mostly through vehicles entering or exiting Sharpeville, with a number of those vehicles belonging to non-residents.

**Waste composition:** As this site contains a majority of household waste, one finds a majority of paper (45%) and plastic (45%), and then glass (5%), wood (2%) and textile/fibre (3%),

**Waste Burning:** Waste burning at this site is continuous with a faint intensity. Duration of burning has been noted to be 10+ hours through the waste campaigns, with 10% of waste being burnt.

Ascot Sasol Garage Waste Composition (%)



4.1.2 SITE 2: PHUMASIBATHE

Site location: Latitude: -26.690931, Longitude: 27.862357



**Site Description:**

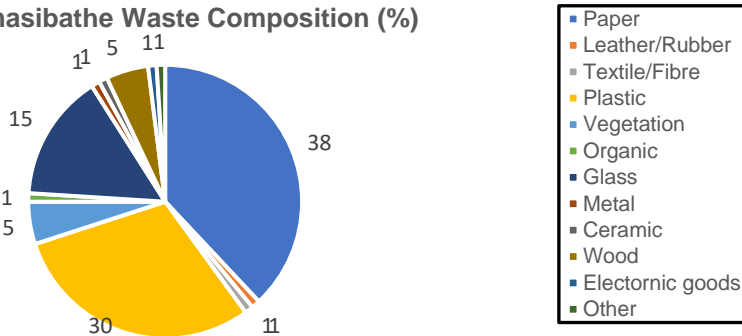
Phumasibathe is located to the west of Sharpeville along Andries Potgieter Road, located in in the and forms part of the informal settlement located on Sekese Street.

**Waste transport:** Waste is illegally dumped at the area mostly by vehicle, wheelbarrow, wheelie bins and general littering by passing by foot traffic, with the residents of the informal settlement being the main contributors.

**Waste composition:** As this site contains a majority of household waste, one finds a majority of paper (38%) and plastic (30%), and then glass (15%), wood (5%), and the remainder of waste consisting of metal, ceramic, organic material, leather/rubber, textile/fibre, electronic goods and other materials at 1% each. The clean-up team noted there is a large amount of asbestos and building material that is dumped by construction teams working on sites close by

**Waste Burning:** Waste burning is intermittent at this site, with most burning occurring in winter in the early morning with approximately 20% of waste burnt in an hour

Phumasibathe Waste Composition (%)



4.1.3 SITE 3: MAREKA WARD 13

Site location: Latitude: -26.679928 Longitude:27.871608



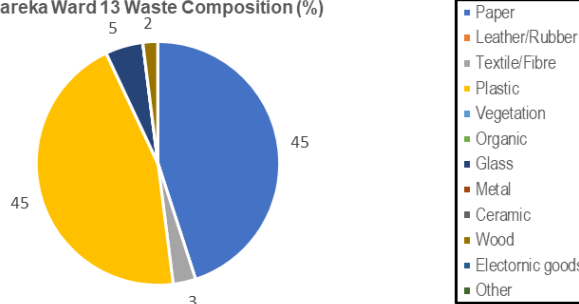
**Site Description:** The Mareka site is located next to Mareka Street in the centre of Sharpeville

**Waste transport:** Waste is illegally dumped at the site via wheelbarrow and wheelie bin.

**Waste composition:** Waste at this site mostly consists of paper (45%) and plastic (45%), with a small amount of glass (5%), textiles/fibres (3%) and wood (2%).

**Waste Burning:** Approximately 35% of waste is burnt at this site, with a faint fire intensity but a continuous burn period of 11 hours.

Mareka Ward 13 Waste Composition (%)



4.1.4 SITE 4: POLICE STATION

Site location: Latitude: -26.68209; Longitude: 27.87715

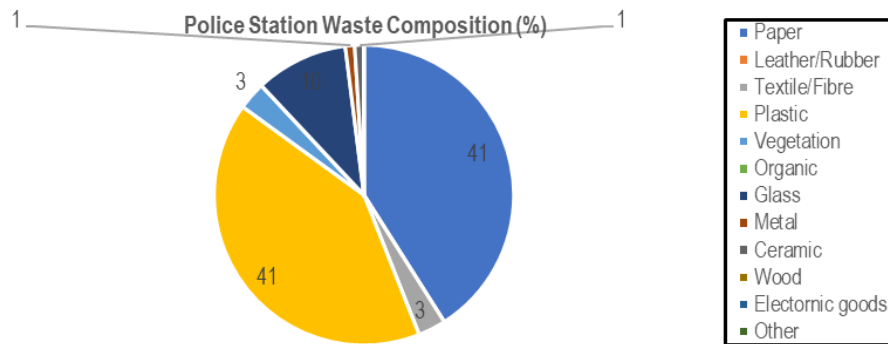


**Site Description:** The police station waste site is located along Hulwana Street in, an alley way that is situated between the SAPS Sharpeville property and Matsie Steyn Primary School. This site is close to an open field where soccer field was established.

**Waste transport:** Waste is dumped in this area through wheelbarrows, vehicles and wheelie bins.

**Waste composition:** Waste at the site mostly consists of paper (41%) and plastic (41%). The remaining waste is composed of textile/fibre (3%), glass (10%) and dumped vegetation (3%), with metal (1%) and ceramics (1%) making up a small percentage of the waste.

**Waste Burning:** Waste burning is intermittent with a smouldering intensity and duration of approximately 3 hours. 90% of the waste is burnt on the site.



4.1.5 SITE 5: PHELINDABA CEMETERY

Site location: Latitude: -26.672436 ; Longitude: 27.882508



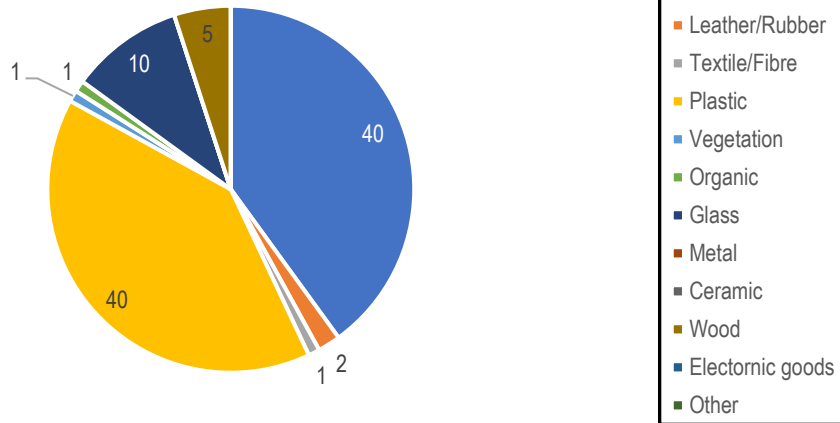
**Site Description:** Phelindaba cemetery is located to the top northeast side of Sharpeville close to Mareka Street and located beneath an Eskom power pylon and approximately 20m from the nearest household.

**Waste transport:** Waste is transported to the site through adhoc littering, wheelbarrows and wheelie bins

**Waste composition:** Waste at this site mostly consists of paper (40%) and plastic (40%), with glass making up 10% of the waste, and the remainder being made up leather/rubber, textile/fibre, vegetation, organic material and wood.

**Waste Burning:** No waste burning is noted to occur at this site

Phelindaba Cemetery Waste Composition (%)



4.1.6 SITE 6: HOSTEL - WARD 12

Site location: Latitude: -26.676426; Longitude:27.889083



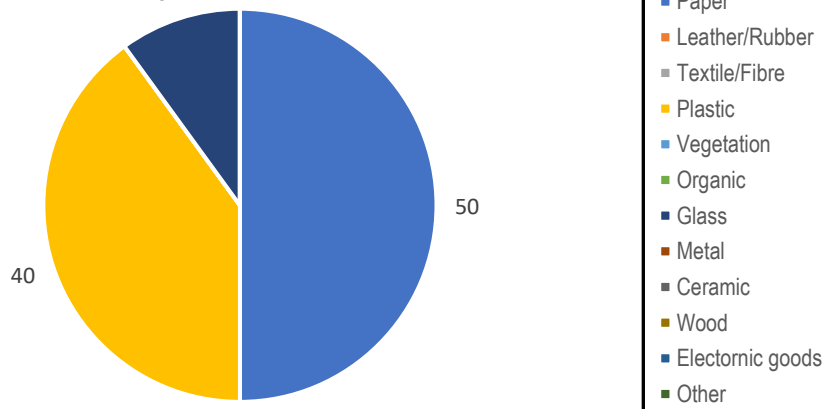
**Site Description:** The hostel site is an open stand located to the eastern side of Sharpeville, 30m from the nearest household.

**Waste transport:** Waste is transported to this site through adhoc littering, wheelbarrows and wheelie bins.

**Waste composition:** Waste at the site mostly consists of paper (50%), 40% of plastic, and the remainder consisting of glass (10%)

**Waste Burning:** No waste burning was noted at this site

Hostel Ward 12 Waste Composition (%)



4.1.7 SITE 7: VUYO PRIMARY SCHOOL

Site location: Latitude: -26.698080; Longitude: 27.874775



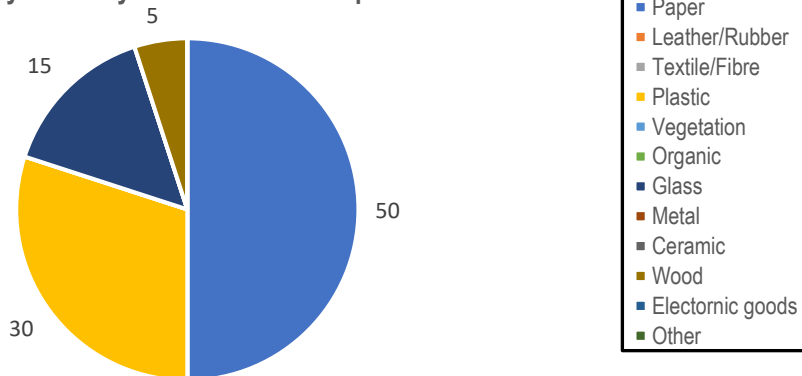
**Site Description:** The Vuyo primary school waste site is located behind Vuyo Primary School next to Dlamini street and situated near and beneath Eskom power pylons.

**Waste transport:** Waste is transported to the site through adhoc littering, wheelie bins and wheelbarrows.

**Waste composition:** Waste at the site mostly composes of paper (50%), then plastic (30%), glass (15%) and the remainder consisting of wood (5%).

**Waste Burning:** No waste burning is noted at this site

Vuyo Primary School Waste Composition



4.1.8 SITE 8: LEBOWA CHURCH

Site location: Latitude: -26.686932; Longitude:27.880154



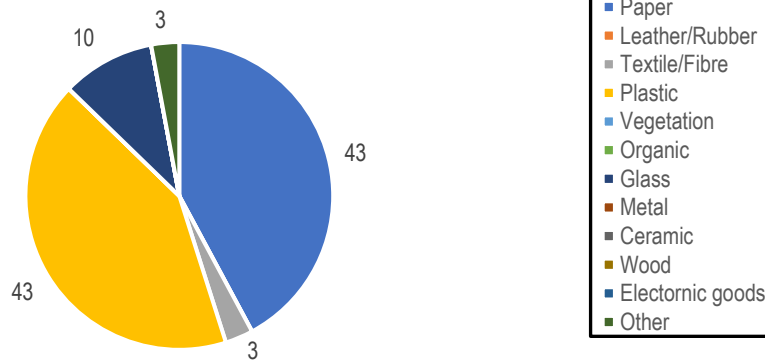
**Site Description:** The Lebowa church waste site is located at the southeastern area of Sharpeville in an open field along Hulwana avenue.

**Waste transport:** Waste is transported at this site through adhoc littering, wheelbarrow and vehicles

**Waste composition:** Waste at this site mostly consists of paper (43%), plastic (43%), glass (10%), and the remainder of waste being made up of textile/fibre, and other materials (3%)

**Waste Burning:** No waste burning is noted at this site

Lebowa Church Waste Composition (%)



4.1.1.9 SITE 9: EBENZA & NG KERK

Site location: latitude: -26.687777778; longitude:27.873888889

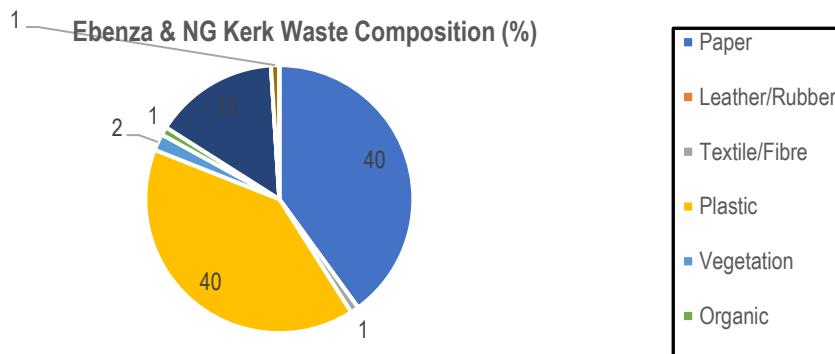


**Site Description:** The Ebenza & NG Kerk waste site is located across from the local municipal park close to Khantsi street, by a traffic circle less than 30m from the closest home to this site.

**Waste transport:** Waste is transported to this site through adhoc littering, wheelbarrow and vehicles.

**Waste composition:** Waste at this is site mostly consists of paper and plastic (40%), glass (15%), with the remainder consisting of wood (1%), organic material (1%) and dumped vegetation (2%)

**Waste Burning:** No waste burning was noted at this site



4.1.10 SITE 10: TSOELEPEDI

Site location: Latitude: -26.687222; Longitude:27.868611



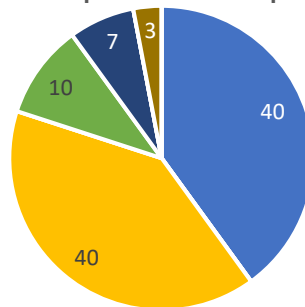
**Site Description:** The Tsoelepedi waste site is located by a traffic circle along Seeiso street.

**Waste transport:** Waste is transported to the site through adhoc littering, wheelbarrow and vehicles.

**Waste composition:** Waste at this site mostly consists of paper and plastic (40%), organic material (10%), glass (7%) and wood (3%). The organic material was mostly dumped by the PWC team.

**Waste Burning:** No waste burning is noted at this site

Tsoelepedi Waste Composition (%)



- Paper
- Leather/Rubber
- Textile/Fibre
- Plastic
- Vegetation
- Organic
- Glass
- Metal
- Ceramic
- Wood
- Electronic goods
- Other

4.1.11 SITE 11: Kgomotso PRIMARY SCHOOL

Site location: Latitude: -26.6838888889; Longitude:27.8666666667



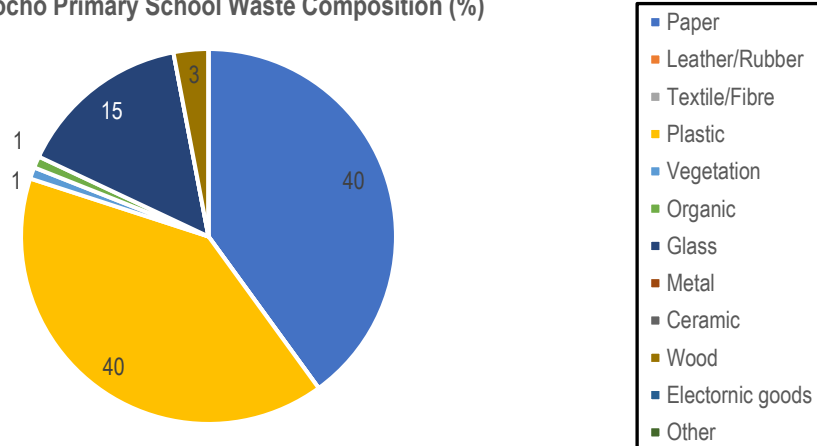
**Site Description:** The waste site by Kgomotso Primary school is located at the Northwestern entrance of Sharpeville along Mareka Street, just less than 5m from the fencing surrounding the primary school

**Waste transport:** Waste is mostly transported to this site through wheelie bins, wheelbarrows, adhoc littering from persons waiting for transport and vehicles.

**Waste composition:** Waste at this site consists mainly of paper (40%) and plastic (40%), glass (15%), and the remainder consisting of vegetation (1%), organic (1%),and wood (3%)

**Waste Burning:** 5% of waste material is burnt at this site, with a smouldering fire present lasting for an hour. Wasting burning at this site mostly occurs in the winter months (May to July)

Kgomotso Primary School Waste Composition (%)



4.1.12 SITE 12: ROMA CHURCH

Site location: Latitude: -26.6869444444 Longitude:27.8777777778



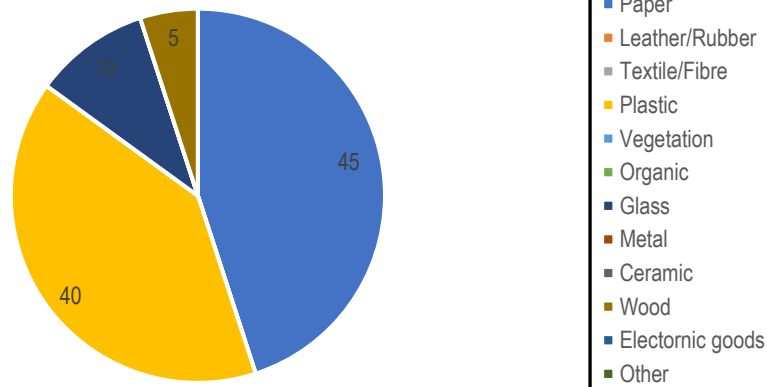
Site Description: The Roma church waste site is located in an open field along Nhlapo Street, less than 20m from the nearest household.

**Waste transport:** Waste is transported to this site through wheelie bins, wheelbarrow and adhoc littering. Interesting to note that despite being close to a road servitude, vehicles were noted to not be a method waste transport to this site.

Waste composition: Waste at this site consists of paper (45%), plastic (40%), glass (10%), and the remainder being wood (5%).

**Waste Burning:** No waste burning is noted at this site

Roma Church Waste Composition (%)



4.1.13 SITE 13: MOHLOLI SECONDARY SCHOOL

Site location: Latitude: -26.690277 Longitude:27.877127



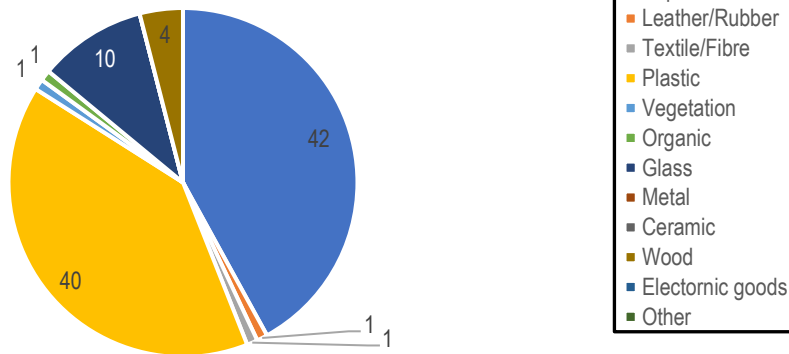
**Site Description:** The Mohloli Secondary school waste site is located along Zwane Street, on the eastern boundary of Sharpeville, less than 30m away from the nearest household.

**Waste transport:** Waste is transported to this site though adhoc littering, wheelbarrow and wheelie bin. Despite being next to a road servitude, vehicles are not used to transport waste to this site.

**Waste composition:** Waste at this site consists of paper (42%), plastic (40%), glass (10%), and the remainder consisting of leather/rubber (1%), textile/fibre (1%), vegetation (1%), organic material (1%) and wood (4%).

**Waste Burning:** No waste burning is noted at this site

Mohloli Secondary Waste Composition (%)



4.1.14 SITE 14: VUKA CEMETERY

Site location: Latitude: -26.690931, Longitude: 27.862357

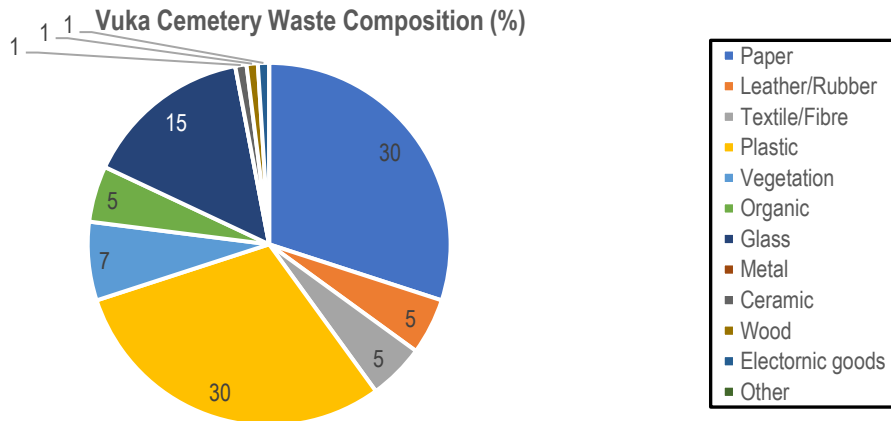


**Site Description:** The Vuka Cemetery waste site is located along the main road Andries Potgieter Road, beneath and close to the Eskom power pylons.

**Waste transport:** As the site is closed off from the residential areas to the east of the cemetery, the site is mostly accessed via the main road, which leads to waste being transported by vehicles.

**Waste composition:** Waste at this site consists of paper (30%), plastic (30%), glass (15%), vegetation(7%),organic material (5%),leather/rubber (5%),textile/fibre(5%),ceramic materials (1%) , wood(1%) and electronic goods (1%)

**Waste Burning:** 10% of waste is burnt at this site at an ad hoc frequency, with fires being smouldering intensity. Burning mostly occurs in the winter months due to people waiting for transporting burning materials to keep warm.



## 4.2 SUMMARY OF THE EVALUATED WASTE DUMPING SITES

### 4.2.1 WASTE COMPOSITION

The following tables (Table 4 to 7) and figures (Figure 8 to 11) provides the waste composition for each waste clean-up campaign collected by Eskom. Whereas Figure 12 provides a comparison of the average waste composition collected over all 4 campaigns. Its evident from Figure 12 that most of the sites are characterised by a significant amount of both paper and plastic and then glass.

**Table 4: Waste composition for Eskom clean-up campaign 1**

Waste Type	Site						
	Ascot Sasol garage	Hostel (Ward 12)	Mareka	Phelindaba Cemetery	Phumasibathe	Police station	Vuyo Primary School
Paper	45	50	45	40	38	41	50
Leather/Rubber	0	0	0	2	1	0	0
Textile/Fibre	3	0	3	1	1	3	0
Plastic	45	40	45	40	30	41	30
Vegetation	0	0	0	1	5	3	0
Organic	0	0	0	1	1	0	0
Glass	5	10	5	10	15	10	15
Metal	0	0	0	0	1	1	0
Ceramic	0	0	0	0	1	1	0
Wood	2	0	2	5	5	0	5
Electronic goods	0	0	0	0	1	0	0
Other	0	0	0	0	1	0	0
<b>Total</b>	100	100	100	100	100	100	100

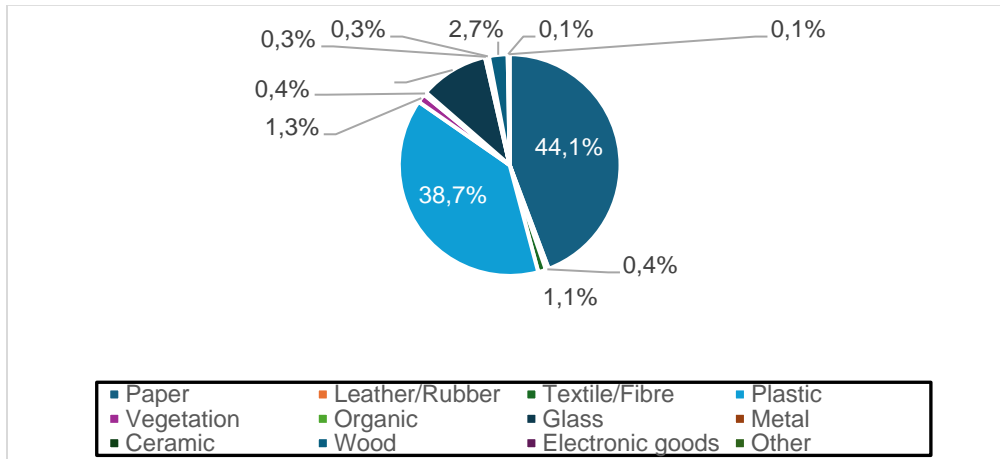


Figure 8: Schematic illustrating the waste composition for Eskom clean-up campaign 1

Table 5: Waste composition for Eskom clean-up campaign 2

Waste Type	Site				
	Ascot Sasol garage	Lebowa Church	Mareka	Police station	Vuyo Primary School
Paper	45	43	45	41	50
Leather/Rubber	0	0	0	0	0
Textile/Fibre	3	1	3	2	0
Plastic	45	43	45	41	30
Vegetation	0	0	0	3	0
Organic	0	0	0	0	0
Glass	5	10	5	10	15
Metal	0	0	0	1	0
Ceramic	0	0	0	1	0
Wood	2	0	2	0	5
Electronic goods	0	0	0	0	0
Other	0	3	0	0	0
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

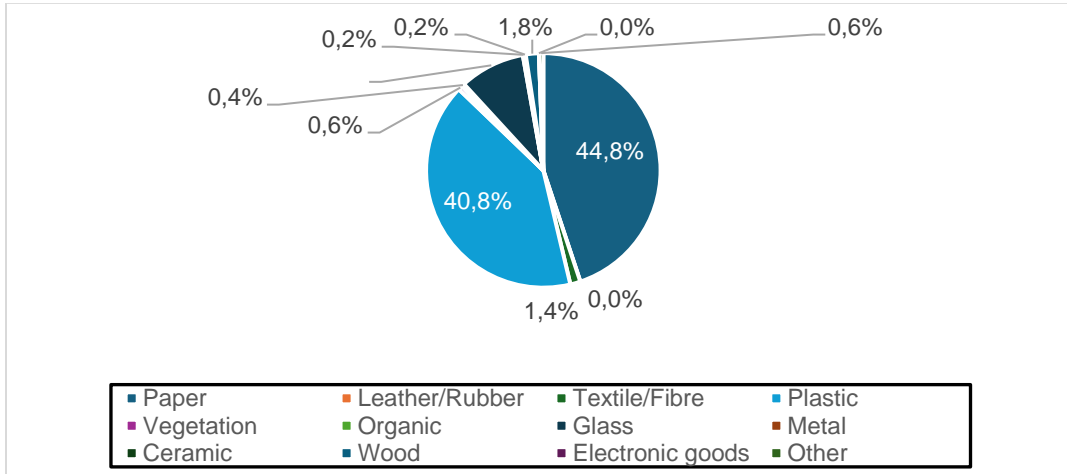


Figure 9: Schematic illustrating the waste composition for Eskom clean-up campaign 2

Table 6: Waste composition for Eskom clean-up campaign 3

Waste Type	Site							
	Ascot Sasol garage	Ebenza & NG Kerk	Kgomochi primary school	Lebowa Church	Mohloli Secondary school	Police station	Roma Church	Tsoelepedi
Paper	45	40	40	43	42	41	45	40
Leather/Rubber	0	0	0	0	1	0	0	0
Textile/Fibre	3	1	0	1	1	3	0	0
Plastic	45	40	40	43	40	41	40	40
Vegetation	0	2	0	0	1	3	0	0
Organic	0	1	0	0	1	0	0	10
Glass	5	15	15	10	10	10	10	7
Metal	0	0	0	0	0	1	0	0
Ceramic	0	0	0	0	0	1	0	0
Wood	2	1	3	0	4	0	5	3
Electronic goods	0	0	0	0	0	0	0	0
Other	0	0	0	3	0	0	0	0
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

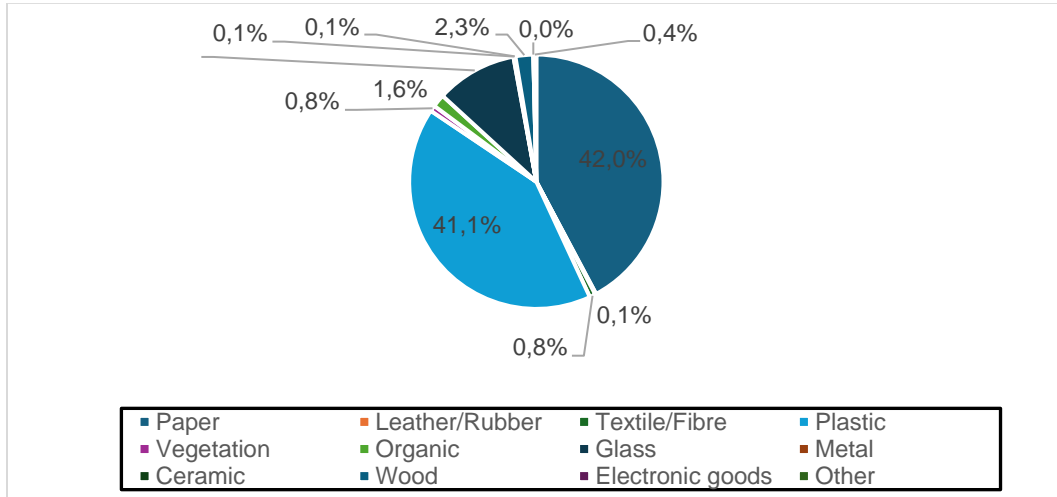


Figure 10: Schematic illustrating the waste composition for Eskom clean-up campaign 3

Table 7: Waste composition for Eskom clean-up campaign 4

Waste Type	Site	
	Phumasibathe	Vuka Cemetery
Paper	38	30
Leather/Rubber	1	5
Textile/Fibre	1	5
Plastic	30	30
Vegetation	5	7
Organic	1	5
Glass	15	15
Metal	1	0
Ceramic	1	1
Wood	5	1
Electronic goods	1	1
Other	1	0
<b>Total</b>	<b>100</b>	<b>100</b>

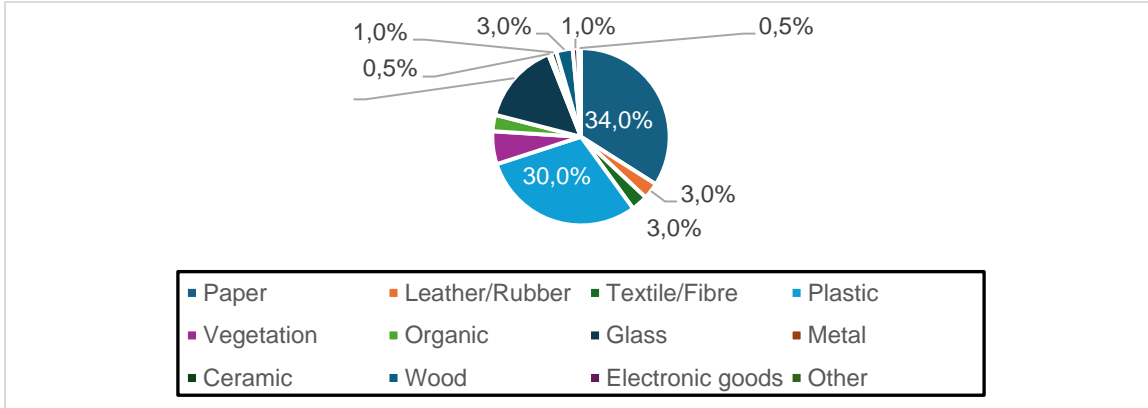


Figure 11: Schematic illustrating the waste composition for Eskom clean-up campaign 4

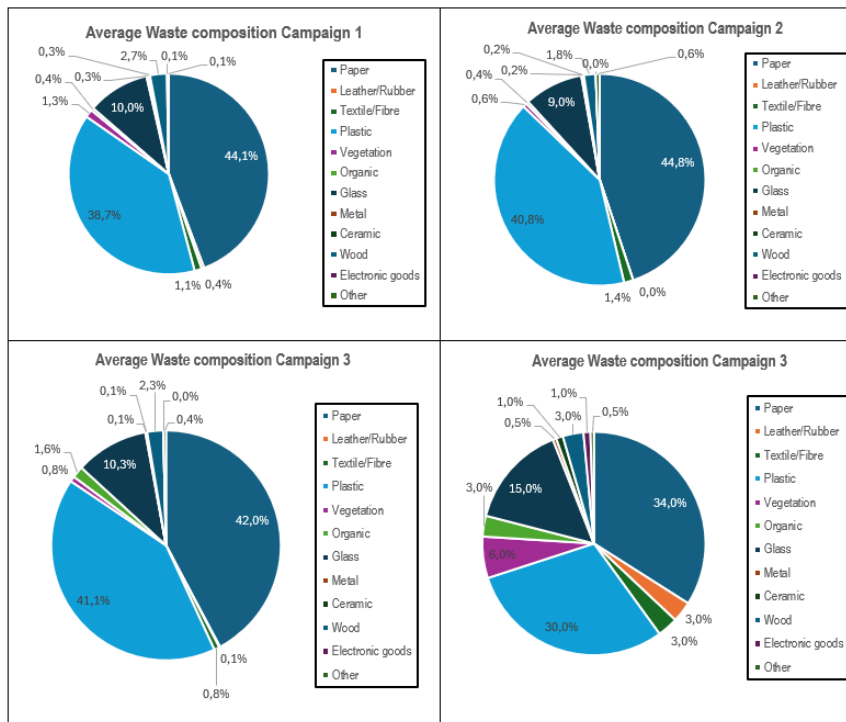


Figure 12: A comparison of the average waste composition for each waste campaign

#### 4.2.1.1 Comparison of the Sharpeville waste composition to the Rabaji 2018 Sharpeville study

- **Waste dumping in Sharpeville (Emfuleni Municipality): An investigation of the characteristics and the potential impacts on air quality**

In July 2018, Rabaji undertook a postgraduate study (Rabaji, 2019) to investigate the extent of waste dumping and burning in Sharpeville, within the context of the fact that waste burning may contribute to air pollution. The intent of the study was also to provide waste composition information that can serve as a basis for more accurate air emissions modelling, as it relates to the burning of waste. Thirty-three waste dumping sites were identified during the pilot study. One of the thirty-three sites (the largest and most active of the sites) was then selected for further detailed assessment, where waste (composition) characterisation was performed.

- **Comparison of the waste composition to Rabaji 2018 study**

Rabaji indicated that the waste consisted mainly of organic waste (29%), other wastes such as rock, ceramics, etc. (27%) and paper and cardboard (19%), while other wastes such as plastic film, nappies, polystyrene packaging and burned tyres were also noted (Figure 13). Only small amounts of glass were encountered (Rabaji, 2019). In contrast this ARM study noted that on average over the four Eskom clean-up waste campaigns, the waste consisted of mainly paper (41%), plastic (37%) and glass (11%) (Figure 13). The large amounts of paper waste remain in numerous illegal dumping sites throughout the Sharpeville area. This is due to lack of infrastructure and relevant facilities for paper recycling within the township. The local scrap yards do not cater for the collection of paper and cardboard (Rabaji, 2019).

Its noted for the Rabaji study, whilst the thirty-three waste dumping sites were identified during the pilot study, the waste composition analysis was only done at one site and the waste characterisation was carried out in one day. Therefore, this provides only a

snapshot of the characteristics of the sites. Waste characterisation included only waste that was dumped at the site and did not include a full account of the waste that was generated by the population (Rabaji, 2019). In contrast the ARM waste characterisation was conducted for 14 sites (section 4.1.1 to 4.1.14) which provides a statistically larger sampling size and a better representation of the waste composition as opposed to a single site. Furthermore, in the Rabaji study, although the opportunity for engagement with the community presented itself, engagements with the community were limited, due to the fact that the original study design did not provide for interviews/conversations with the community, and it was not submitted as such to the ethics committee (Rabaji, 2019). In contrast in this ARM waste management study a questionnaire was administered which was utilised to get a more accurate understanding of the reasons for waste dumping and burning.

It's noted that the Rabaji study was conducted in July 2018, whereas this ARM study was conducted in March 2024. In areas where waste services are minimal or infrequent a larger volume of the waste will be illegally dumped and eventually burned. Its plausible that since 2018 to 2024, that there has been a deterioration in the waste services provided by Emfuleni Local Municipality resulting in change in both the volume and composition of waste been illegally dumped in Sharpeville.

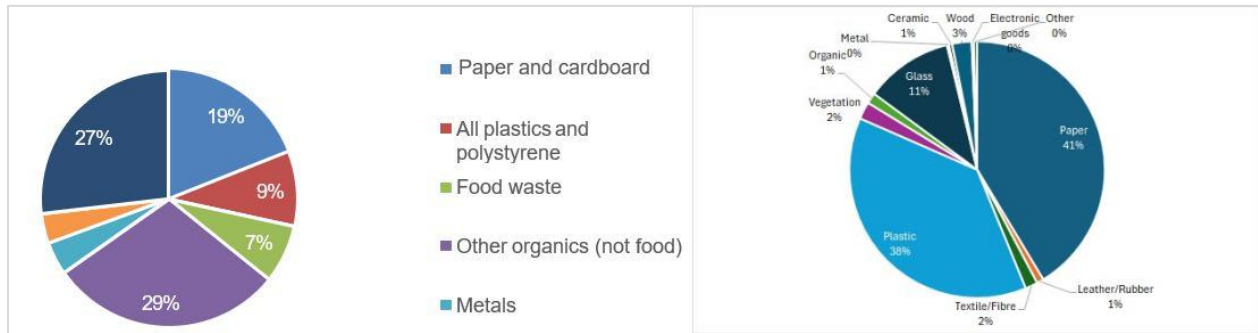


Figure 13: Comparison of waste composition (left, Rababji 2018 study and right ARM 2024 study)

#### 4.2.2 WASTE BURNING CHARACTERISTICS

It is noted that whilst Eskom cleaned-up 14 illegal waste dumping sites at Sharpeville, waste burning occurred only at 6 sites. These 6 sites are:

- i. Mareka;
- ii. Police Station (Ward 12);
- iii. Phumasibathe;
- iv. Ascot Road (Ward 14) ;
- v. Kgomocho Primary School and
- vi. Vuka Cemetery.

Based on respondents feedback from the FGI (section 3.2) the burn characteristics for these sites are summarised in . It is noted that the duration of the burn varied between 1 to 11 hours. In terms of the intensity, fires were generally smouldering. The fundamental difference between smouldering and flaming combustion is that smouldering occurs on the surface of the solid rather than in the gas phase. Smouldering is the slow, flameless form of combustion, sustained by the heat evolved when oxygen directly attacks the surface of a condensed-phase fuel. Thus, many solid materials can sustain a smouldering

reaction, including coal, cellulose, wood, cotton, tobacco, peat, plant litter, humus, synthetic foams, charring polymers including polyurethane foam and some types of dust. (Ohlemiller, 2002). Due to nature of smouldering fires which occur over a longer duration than flaming combustion, these fires typically result in elevated localised ground level concentration of pollutants.

**Table 8: Summary of the burn activity characteristics for the Sharpeville sites wherein waste is burnt**

Site	Campaign		
	Duration of Burn (Hours)	Frequency of Burn	Intensity of Fire
Mareka	11	Continuous	Smouldering
Ascot Sasol garage (Ward 14)	11	Continuous	
Police station (Ward 12)	3	Intermittent	
Phumasibathe	1	Intermittent	
Kgomocho primary school	1	Ad hoc	
Vuka cemetery (Ward 14)	1	Ad hoc	

Based on the waste composition and burn characteristic information obtained from this waste management survey, ARM will then conduct a subsequent dispersion modelling study to determine the nett air quality benefit for Eskom's Sharpeville AQO Project.

## 5 RECOMMENDATIONS

It's evident from the survey results (section 4.2) that the largest fraction of waste dumped at Sharpeville constituted of both paper and plastic. This is due to lack of infrastructure and relevant facilities for paper and glass recycling within the township. The local scrap yards do not cater for the collection of paper and cardboard (Rabaji, 2019).

Its noted that when plastic waste is burnt, it releases toxic gases like dioxins, furans, mercury and PCBs into the atmosphere (Verma et al., 2016). Additionally, the combustion of plastics results in emissions of particulate matter, particulate bound heavy metals and PAHS released to the atmosphere (Valavanidid et al., 2008). On the other hand, burning waste paper in residential is a major health risk (Xiu, 2018). The risk is caused mainly by major air pollutants such as particulate matter with an aerodynamic diameter  $< 2.5 \mu\text{m}$  ( $\text{PM}_{2.5}$ ), CO, and  $\text{NO}_x$  that are formed and emitted during the burning of wastepaper (WHO, 2014, Xiu, 2018)

Taking the above into account, it ARM's recommendation that the following areas are considered:

- 1) Promoting waste minimisation, reuse, recycling and recovery of waste:
  - ✓ Its proposed that Eskom (together with the support of the local Councilors) engage with the local Sharpeville scrapyards to determine the feasibility of them additionally collecting paper, cardboard and plastics
  - ✓ Its proposed that Eskom (together with the support of the local Councilors) engage with the local waste pickers association to identify areas wherein recycling initiatives can be improved
  - ✓ Its proposed that Eskom considers implementing a waste-separation recycling bins at the local primary school. The aim of this initiative is to promote the diversion of recyclable waste material from the school and to encourage behavioural change towards waste minimisation, which leads to a cleaner environment.

2) Environmental education and awareness training:

- ✓ ARM noticed that the Sharpeville waste-pickers generally burn paper and plastic at the illegal dumping sites (Figure 14). They commented to ARM *“It’s just something we do when we are here. We burn the rubbish”*. Its proposed Eskom considers a targeted environmental education and awareness training session with the waste pickers to highlight the adverse health impacts associated with burning waste, which may then reduce the frequency of waste been burnt.
- ✓ ARM noticed that community members were utilising the wheelie-bins to transport waste to the illegal dumps (Figure 14). This sentiment was reiterated by the local Councillors who indicated to ARM that wheelie-bins has contributed to an increased volume of dumping at the illegal dumps. Its proposed Eskom together with the Emfuleni waste department considers a targeted environmental education and awareness session with the wider community to land on a feasible solution herein.
- ✓ Its noted post the Eskom 5<sup>th</sup> clean-up campaign at Sharpeville at the Vuka Cemetery (Figure 14), the ARM and Eskom teams noticed one of the older local residents was guarding the entrance to the cemetery to prevent more dumping. Its proposed Eskom investigates the feasibility of employing community members on a part-time basis to act as “waste-wardens” to guard the cleaned up areas to minimize and/or prevent waste dumping.

3) Assisting the Emfuleni Municipality to provide effective and efficient delivery of waste services

- ✓ It proposed Eskom considers the feasibility of providing an additional waste service truck to the Emfuleni Municipality to assist with the collection of waste in Sharpeville.



**Figure 14: (left to right) Community members utilising wheelie-bins to transport waste to illegal dump sites; Waste pickers burning paper & plastic waste; Vuka Cemetery post Eskom clean-up campaign**

As previously mentioned in section 3.1 ARM met with the local ward Councillors for Sharpeville. It's noted that all the Councilors support the Eskom Sharpeville AQO waste intervention and noted: "*Its making a big difference in Sharpeville*". The recommendations from the Councillors included the following:

- ✓ The Councilors recommended that the Eskom clean-up campaign is extended to "2 weeks" as opposed to current "1 week campaign".
- ✓ The Councilors recommended that 4 skips are placed in each ward with the Municipality.
- ✓ The Councilors recommended that an engagement is held with local licensing authority (AQ) and Councilors.
- ✓ The Councilors recommended that the Eskom Clean-up campaign 5 to be done prior to May 2024 elections

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ARM held a FGI with the personal engaged in the Eskom Sharpeville AQO waste clean-up operations (section 3.2). The recommendations from the Sharpeville personal included the following:

- ✓ The personal recommended that the Eskom clean-up campaign is extended to “2 weeks” as opposed to current “1 week campaign
- ✓ The personal recommended environmental awareness and training session to be implemented at the Sharpeville schools
- ✓ The personal recommended additional vehicles to be provided to the Emfuleni Municipality to assist with waste management
- ✓ The personal recommended increased enforcement by the Emfuleni Municipality in terms of waste management

Table 9 provides a summary of the recommendations from: the ARM waste management survey; the local Sharpeville Councillors and the personal engaged in the Eskom Sharpeville AQO waste clean-up operations.

Table 9: Summary of recommendations obtained from this Study

Theme	Recommendations proposed for consideration		
	ARM	Local Councillors	Clean-up Campaign Personal
<b>1. Promoting waste minimisation, reuse, recycling and recovery of waste</b>	<ul style="list-style-type: none"> <li>▪ Eskom (together with the support of the local Councilors) to engage with the local Sharpeville scrapyards to determine the feasibility of them additionally collecting paper, cardboard and plastics.</li> <li>▪ Eskom (together with the support of the local Councilors) engage with the local waste pickers association to identify areas wherein recycling initiatives can be improved.</li> <li>▪ Eskom considers implementing a waste-separation recycling bins at the local primary school. The aim of this initiative is to promote the diversion of recyclable waste material from the school and to encourage behavioural change towards waste minimisation, which leads to a cleaner environment.</li> </ul>	<ul style="list-style-type: none"> <li>▪ It's recommended that the Eskom clean-up campaign is extended to "2 weeks" as opposed to current "1 week campaign".</li> </ul>	<ul style="list-style-type: none"> <li>▪ It's recommended that the Eskom clean-up campaign is extended to "2 weeks" as opposed to current "1 week campaign"</li> </ul>
<b>2. Environmental education and awareness training</b>	<ul style="list-style-type: none"> <li>▪ Its proposed Eskom considers a targeted environmental education and awareness training session with the waste pickers who frequently burn waste to highlight the adverse health impacts associated with burning waste, which may then reduce the frequency of waste been burnt.</li> </ul>		<ul style="list-style-type: none"> <li>▪ Its recommended environmental awareness and training session to be implemented at the Sharpeville schools</li> </ul>

Theme	Recommendations proposed for consideration		
	ARM	Local Councillors	Clean-up Campaign Personal
	<ul style="list-style-type: none"> <li>ARM noticed that community members were utilising the wheelie-bins to transport waste to the illegal dumps. Its proposed Eskom together with the Emfuleni waste department considers a targeted environmental education and awareness session with the wider community to land on a feasible solution herein.</li> <li>Its noted post the Eskom 5th clean-up campaign at Sharpeville at the Vuka Cemetery, the ARM and Eskom teams noticed one of the older local residents was guarding the entrance to the cemetery to prevent more dumping. Its proposed Eskom investigates the feasibility of employing community members on a part-time basis to act as “waste-wardens” to guard the cleaned up areas to minimize and/or prevent waste dumping.</li> </ul>		
<p><b>3. Assisting the Emfuleni Municipality to provide effective and efficient delivery of waste services</b></p>	<ul style="list-style-type: none"> <li>Its proposed Eskom considers the feasibility of providing an additional waste service truck to the Emfuleni Municipality to assist with the collection of waste in Sharpeville.</li> </ul>	<ul style="list-style-type: none"> <li>Its recommended that 4 skips are placed in each ward with the Municipality.</li> <li>Its recommended that an engagement is held with local licensing authority (AQ) and Councilors.</li> <li>Its recommended that the Eskom Clean-up campaign 5 to be done prior to May 2024 elections</li> </ul>	<ul style="list-style-type: none"> <li>It’s recommended additional vehicles be provided to the Emfuleni Municipality to assist with waste management.</li> <li>Its recommended increased enforcement by the Emfuleni Municipality in terms of waste management.</li> </ul>

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## 6 CONCLUSION

It's evident from this study that the bulk of the waste dumped at the Sharpeville illegal waste sites include both highly flammable paper and plastics. Furthermore, due to long duration of the smouldering fires occurring at these sites, there exists a potential for short-term elevated localised ground level concentration of pollutants near the vicinity of these sites. This hypothesis will be tested by the next phases (Figure 5) of the study wherein ARM shall conduct a subsequent dispersion modelling study to determine the nett air quality benefit for Eskom's Sharpeville AQO Project.

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## 7 ACKNOWLEDGEMENTS

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- Mr Motshewa Matimolane and Mr Bryan McCourt for their project insight, background information, technical comments, builds and support.

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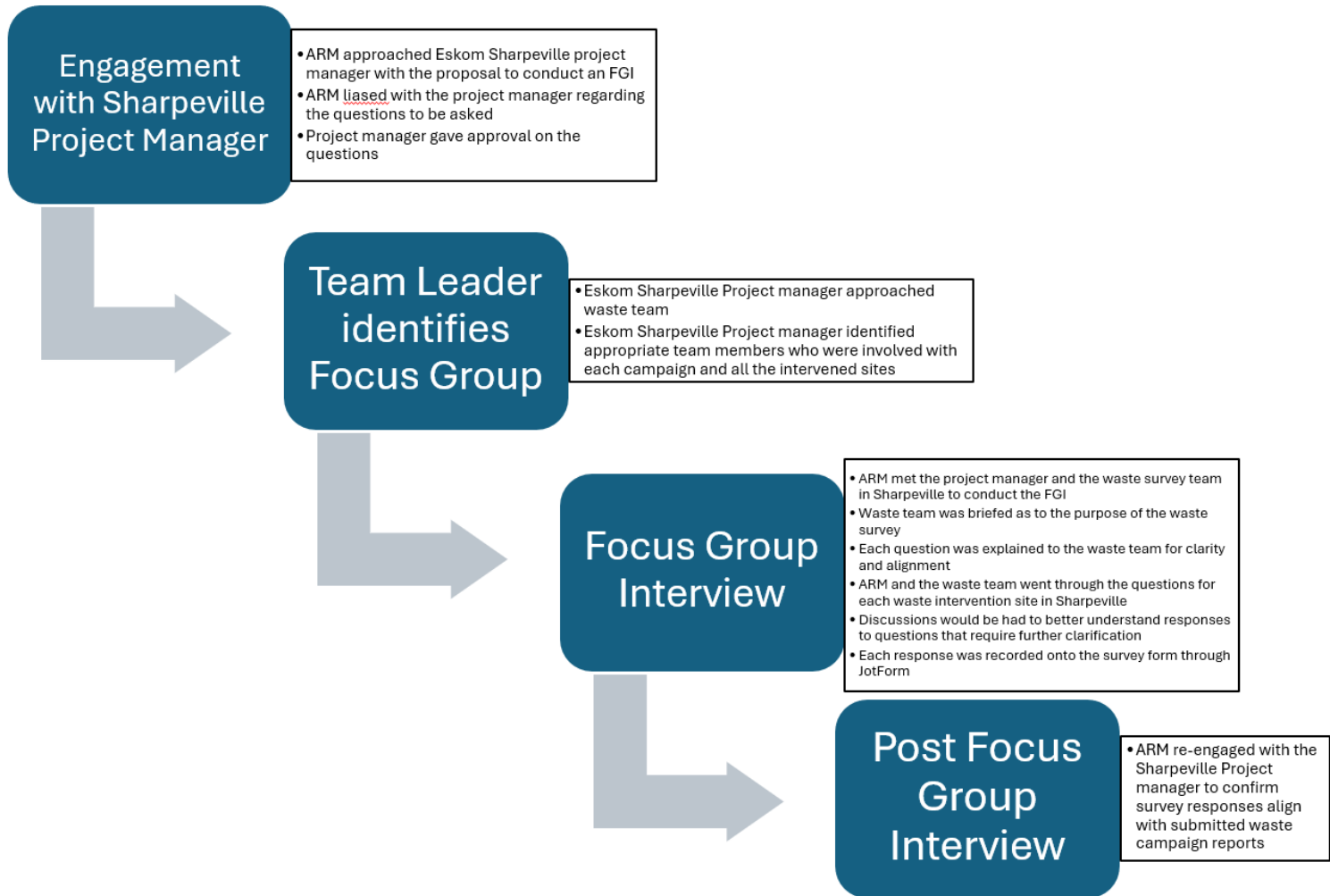
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## **9 ANNEXURE 1: THE PROCESS UNDERTAKEN IN THE FOCUS GROUP INTERVIEW**

A Focus Group Interview's (FGI) intention is to collect high-quality data to understand specific goals through the viewpoint of participants closely related to the goal. For ARM to understand the waste profile and waste burning characteristics, it is important for ARM to utilise FGIs as a tool to have a glimpse into the past and present and possibly future behaviours of waste in Sharpeville.

Hence, as part of the Focus Group Interview process, careful steps were taken between ARM and the Eskom Sharpeville team to ensure the correct information was captured and to reflect what was observed by the waste collection teams in Sharpeville. The interview process for the FGI is illustrated in Figure 15.



**Figure 15: Focus Group Interview Process Utilised for the 2024 Sharpeville Waste Survey**

**10 ANNEXURE 2: COMMUNITY WASTE SURVEY QUESTIONNAIRE FOR SHARPEVILLE 2024**

**Community Waste Survey Questionnaire For Sharpeville 2024**

**Introductory note (read to respondent):** Hello, my name is ..... I am a researcher from Air Resource Management/Eskom’s Masibambisane Project.

**We are conducting a survey for Eskom about waste burning in Sharpeville. The burning of waste in Sharpeville results in air pollution. We are interested in learning more about how waste is brought to the site; what types of waste are present here and how long these waste fires normally burn. The information you provide us will help us to understand:**

- 1) how bad the air pollution is from waste burning in Sharpeville**
- 2) and also help to show how the air quality is improving by Eskom collecting waste in Sharpeville.**

**We ask that you help us by participating in a short interview, which should only take about 30 minutes. The information you give us will be kept confidential.**

**1. Details of Waste Site**

<b>Name of Eskom Waste Collection Site</b>	
<b>GPS Location of site</b>	
<b>Street Name</b>	
<b>Photo of site</b>	(To be taken in application)

## 2. Waste Burning Details

<b>Details of area where waste burning is located</b>	<ul style="list-style-type: none"> <li><input type="radio"/> Beneath Eskom Power Pylon</li> <li><input type="radio"/> Near Eskom Power Pylon</li> <li><input type="radio"/> Front of household</li> <li><input type="radio"/> Behind household</li> <li><input type="radio"/> Open field (details in comments)</li> <li><input type="radio"/> Edge of township</li> <li><input type="radio"/> Traffic Circle</li> <li><input type="radio"/> Road servitude</li> <li><input type="radio"/> Open stand</li> <li><input type="radio"/> Other</li> </ul>
<b>Proximity of waste burning to households</b>	<ul style="list-style-type: none"> <li><input type="radio"/> Near ( within 10m)</li> <li><input type="radio"/> Intermediate ( 10 to 50m)</li> <li><input type="radio"/> Far (more than 50m away)</li> </ul>
<b>Frequency of burning</b>	<ul style="list-style-type: none"> <li><input type="radio"/> Continuous</li> <li><input type="radio"/> Intermittent</li> <li><input type="radio"/> Ad hoc</li> <li><input type="radio"/> Unknown</li> </ul>
<b>Duration of burning</b>	<ul style="list-style-type: none"> <li><input type="radio"/> ___ hours</li> </ul>
<b>Time of day burning happens</b>	<ul style="list-style-type: none"> <li><input type="radio"/> Morning</li> <li><input type="radio"/> Midday</li> <li><input type="radio"/> Evening</li> <li><input type="radio"/> Night</li> </ul>
<b>Intensity of fire</b>	<ul style="list-style-type: none"> <li><input type="radio"/> Smoldering</li> <li><input type="radio"/> Faint</li> <li><input type="radio"/> Normal</li> <li><input type="radio"/> Blazing Fire</li> </ul>
<b>Colour of smoke emitted</b>	<ul style="list-style-type: none"> <li><input type="radio"/> White</li> <li><input type="radio"/> Grey</li> <li><input type="radio"/> Black</li> <li><input type="radio"/> Other</li> </ul>
<b>Odour</b>	<ul style="list-style-type: none"> <li><input type="radio"/> No odour</li> <li><input type="radio"/> Mild odour</li> <li><input type="radio"/> Strong odour</li> </ul>
<b>Complete or incomplete Combustion</b>	<ul style="list-style-type: none"> <li><input type="radio"/> All waste material burnt</li> <li><input type="radio"/> Some waste material remains unburnt (Specify % unburnt ___%)</li> </ul>

## 3. Waste Segregation

<p><b>Waste segregation and % for waste heap</b></p>	<ul style="list-style-type: none"> <li><input type="radio"/> Paper ( ___%)</li> <li><input type="radio"/> Leather/Rubber ( ___%)</li> <li><input type="radio"/> Textile/Fibre (( ___%)</li> <li><input type="radio"/> Plastic ( ___%)</li> <li><input type="radio"/> Vegetation ( ___%)</li> <li><input type="radio"/> Organic ( ___%)</li> <li><input type="radio"/> Glass ( ___%)</li> <li><input type="radio"/> Metal ( ___%)</li> <li><input type="radio"/> Ceramic ( ___%)</li> <li><input type="radio"/> Wood ( ___%)</li> <li><input type="radio"/> Electronic goods ( ___%)</li> <li><input type="radio"/> Other ( ___%)</li> </ul>
<p><b>Method of transport of waste to waste heap</b></p>	<ul style="list-style-type: none"> <li><input type="radio"/> Thrown adhoc by hand (littering)</li> <li><input type="radio"/> Wheelbarrow</li> <li><input type="radio"/> Vehicle</li> <li><input type="radio"/> Other</li> </ul>
<p><b>Size of waste heap</b></p>	<ul style="list-style-type: none"> <li><input type="radio"/> Small (radius up to 3m)</li> <li><input type="radio"/> Medium (3m to 10m)</li> <li><input type="radio"/> Large (&gt;10m)</li> </ul>
<p><b>Waste Skips Present</b></p>	<ul style="list-style-type: none"> <li><input type="radio"/> Yes</li> <li><input type="radio"/> No</li> </ul>
<p><b>Number of Waste Skips Present</b></p>	<ul style="list-style-type: none"> <li><input type="radio"/> –</li> </ul>
<p><b>Waste segregation and % for Waste Skip (if Present)</b></p>	<ul style="list-style-type: none"> <li><input type="radio"/> Paper ( ___%)</li> <li><input type="radio"/> Leather/Rubber ( ___%)</li> <li><input type="radio"/> Textile/Fibre (( ___%)</li> <li><input type="radio"/> Plastic ( ___%)</li> <li><input type="radio"/> Vegetation ( ___%)</li> <li><input type="radio"/> Organic ( ___%)</li> <li><input type="radio"/> Glass ( ___%)</li> <li><input type="radio"/> Metal ( ___%)</li> <li><input type="radio"/> Ceramic ( ___%)</li> <li><input type="radio"/> Wood ( ___%)</li> <li><input type="radio"/> Electronic goods ( ___%)</li> <li><input type="radio"/> Other ( ___%)</li> </ul>

**4. General**

**Are there any general comments, suggestions or recommendations that you have? If yes, please explain.**

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