

2014

ACT NOWaste
MRF Audit Report



A.Prince Consulting
ABN 96 077 504 226
TH 4 / 28 West Street
Nth Sydney NSW 2060
P: +61 2 9907 0994
F: +61 2 9907 0330
E: admin@aprince.com.au
W: www.aprince.com.au

This report was researched and prepared by



A.Prince Consulting Pty Ltd
ABN 96 077 504 226
Email: admin@aprice.com.au
Web: www.aprice.com.au

SYDNEY
TH 4/28 West St
North Sydney NSW 2060
Phone: (02) 9907 0994
Fax: (02) 9907 0330

for:

Kim Harris
Senior Contracts Officer
ACT NOWaste
GPO Box 158, Canberra, ACT, 2601
Phone: 02 62054792
Mobile: 0417 498 820
Email: KimM.Harris@act.gov.au

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EXECUTIVE SUMMARY

In October 2014 A.Prince Consulting (APC) undertook a composition audit of residual material at the Hume Materials Recovery Facility (MRF) operated by Remondis Australia Pty Ltd. APC has undertaken previous residual material audits at the Hume MRF in May 2005, June 2006, November 2007 and May 2009.

The same sample methodology, sample size and sampling period (2.5 tonnes audited over five days) used in previous audits was also applied in 2014. A total of 2,381kg of material was sorted for this audit. Supplementary audits were undertaken of large, heavy, dangerous, long or bulky items that could possibly impede the operation of the sorting line and create breakdowns. Staff sampled bulky items from the material-receival hall prior to processing. These specific items were counted, weighed and photographed.

Just over half the MRF's residual material (51%) is contamination placed in the recycling bin by residents. The main unacceptable items are contaminated paper, bagged garbage and plastic bottles containing liquid. Long items, large and heavy items, textiles and electrical appliances are also found in the MRF residual. A significant change between 2009 and 2014 is a decrease in food and kitchen waste in the residual material – from 8% in 2009 to 2% in 2014. This suggests that education about food waste in the recycling bins has been effective during this period.

Overall, however, 19% more problematic items were counted in 2014 when compared with 2009. There has been a huge increase in black items. Electrical and large plastic items have increased significantly, while long items have decreased. APC counted 778 items in the residual material, the most common being black plastic items, long items (which may cause machinery breakage) and electrical appliances (these are non-recyclable at the MRF and have environment impact in residual). In addition, over four days staff intercepted 68 problematic items in the receival hall prior to processing. Overall, 11% of problematic items are intercepted prior to processing.

The ACT implemented a ban on single-use, lightweight shopping plastic bags in November 2011. This is the first audit since then to determine the impact of this policy decision. In total, 145 plastic shopping bags were counted in the residual material, weighing a total of 3.4kg. Plastic bags represent 0.2% of the MRF's residual material by weight. About half are low-density barrier bags and half are lightweight shopping bags. Although plastic bags represent a very small proportion of the MRF's residual material by weight, 145 shopping bags per week equates to about 7,500 plastic bags per year that are incorrectly placed into recycling bins.

As a proportion of total MRF input, contamination accounts for 5%. However, contamination as a proportion of MRF residual has decreased significantly since the last audit in 2009 – from 70% in 2009 to 51% in 2014 – which suggests that education programs have had an effect.

Recyclable materials comprise 25% of the MRF residual. Over half of this is mixed clean paper (including cardboard) and steel. Mixed plastic containers, glass containers, clear PET, aluminium, semi-opaque HDPE, liquidpaperboard and recyclable black plastic items are also ending up in the residual material in smaller quantities. This amount has decreased over time from a high of 78% in 2006 to 25% in 2014, reflecting improved processes and technologies within the MRF. Specifically, the proportion of recyclable plastic containers has decreased, recyclable paper has increased, and glass and metal containers have remained about the same.

Glass fines account for 24% of the residual material, which is an increase from 6% in 2009. However, this is due to changes in product specifications in the intervening years, which have resulted in the need to remove more paper from glass fines. In so doing, additional glass fines are also lost in the process. If this process was not undertaken, potentially all glass fines may need to be landfilled.

Based on the Hume MRF generating 6,000 tonnes of residual material to be disposed of to landfill each year, about 1,500 tonnes is potentially recyclable material and represents about 3% of all recoverable material received and 2.5% of total material received. This exceeds accepted best-practice standards for MRFs and is an excellent achievement. Recovering these extra materials would raise the overall recovery rate of the MRF from 90% to almost 93%.

1 INTRODUCTION

A.Prince Consulting (APC) was awarded a contract by ACT NOWaste to undertake an audit of the residual material at the Hume MRF, which is operated by Remondis Australia Pty Ltd.

The MRF audit was one component of three audits commissioned by ACT NOWaste in 2014, including a domestic kerbside, landfill and transfer-station audit.

The specific objectives of this component of the audit project were to undertake a waste composition audit and report on MRF residual material to:

1. Determine the contents of the residual waste from the MRF;
2. Identify and quantify the materials that are incorrectly placed into recycling bins and suggest actions that ACT NOWaste might take to achieve a reduction in such contamination;
3. Ascertain the content of plastics bags; count, weigh and photograph specific items; and assess material removed by staff from the receiving hall prior to the process (typically, large, heavy, dangerous and long items that may impede the operation of the sorting line and create breakdowns); and
4. Identify and quantify what recyclable material is not currently processed successfully.

APC has conducted prior audits of the MRF residual stream in 2005, 2006, 2007 and 2009.

The methodology used for the MRF audit was developed by APC for previous MRF audits conducted at the Hume MRF to enable direct comparisons to be made. Sorting categories were modified at the request of ACT NOWaste to include additional categories.

This 2014 MRF audit will provide updated data on the current composition of residual material at the Hume MRF and will complement and allow historical comparisons with prior audits, ensuring that accurate waste data and trend analysis is available to inform future planning.

The audit was undertaken over five days in late October 2014.

2 METHODOLOGY

2.1 Pre-project meeting and induction

APC convened a project-inception meeting with ACT NOWaste's Senior Contracts Officer via teleconference prior to the commencement of the project. The meeting provided an opportunity to review the purpose of the audit, discuss logistics, confirm methodology and agree on timeline.

2.2 Sample size and selection

The audit aimed to include a physical sort of 2,500kg sampled over the over five days, in line with previous audits. As all residual material is discharged from the plant via a conveyor to a compactor bin located external to the building, Remondis provided a chute that was used in previous audits to intercept the flow of the residual material.

On each of the five audit days, Remondis collected the required sample by placing a 1.5m³ bin under the chute and diverting the residual line to the bin. Samples were taken three times throughout the day over the five days – one in the morning, one in the middle of the day and one in the afternoon – with the aim of collecting a 500-kg sample each day.

APC also sampled front-end large and bulky items removed by the loader operator prior to processing. This supplementary material is provided separately to the residual material results. Contaminated materials from the MRF pre-sort are dropped to the lower line at the pre-sort station and are included in the sample of residual materials included in this audit.

The amount of material sorted during the audit is shown in the table below.

Table 1: Amounts of residual material sorted by audit

Year	Month	Smallest daily amt (kg)	Largest daily amt (kg)	Total amount (KG)	Daily average (kg)
2014	October	337.8	544.2	2,381.3	476.3

As can be seen for the 2014 audit, an average daily sample size of 476kg was sorted, with a total weight of 2,381kg. This is slightly lower than the 2,500kg sample size objective due to the nature of the material and the samples taken by the MRF operator.

2.3 MRF residual sorting

Sorting commenced after 3pm each day when the MRF ceases daily operations till 9pm each night when the MRF closes.

The list of material categories was developed in conjunction with ACT NOWaste based on the previous audits and modified taking into account requests from the client.

In 2014 the audit was required to measure plastic bags by type, count and weight. Supplementary data was also collected on pre-sorted material.

APC provided all auditing and sorting equipment apart from MGBs for material sorting; these were organised by Remondis and provided by ACT NOWaste.



Residual waste to be sorted

2.4 Problematic contaminants

ACT NOWaste identified a number of problematic contaminants within the recycling process. Each of these issues is summarised in the table below and accompanied by an acknowledgement or explanation of APC's approach.

Table 2: Problematic contaminants

Issues	APC action
Long, stringy items causing impacts on machinery	Visual item count, recording by weight and photographs of separated items
Presence of electrical and compound items	
Large plastic items causing breakdowns	
Presence of large, heavy items	
A presence of black items where optical sorting is used	A secondary sort of plastics could identify the number and weight of black items
Items in plastic bags	Store separately, weigh and then sort at the end of the main sort into the agreed categories

2.5 Analysis

The table below indicates how materials found in the audit have been categorised during the analysis phase of the project.

Table 3: Classification of material

Material	Class	Category
Mixed clean paper and cardboard	Recyclable	Recyclable paper
Liquidpaperboard	Recyclable	Other containers
Glass containers	Recyclable	Other containers
Aluminium	Recyclable	Other containers
Steel	Recyclable	Other containers
PET (1)	Recyclable	Plastic containers
HDPE (2)	Recyclable	Plastic containers
Mixed rigid plastic containers	Recyclable	Plastic containers
Glass fines (<50 mm diameter) (3)	Recyclable	Glass fines
Plastic bags (4)	Contamination	Other material
Plastic film	Contamination	Non-recyclable plastic
Food and kitchen waste	Contamination	Other material
Green waste and timber	Contamination	Other material
Non-recyclable glass and crockery	Contamination	Other material
Nappies	Contamination	Other material
Expanded polystyrene	Contamination	Non-recyclable plastic
Textiles	Contamination	Other material
Hazardous	Contamination	Other material
Electrical appliances	Contamination	Other material
Automotive parts	Contamination	Other material
Other miscellaneous	Contamination	Other material
Contaminated paper	Contamination	Contaminated paper
Glass dust and small scraps of paper	Contamination	Other material
Other plastics	Contamination	Non-recyclable plastic

Notes

1: Empty PET containers

2: Empty HDPE containers

3: Fragments of glass smaller than 50 mm diameter – excluding glass dust

4: Plastic bags with material packed inside (removed at pre-sort)

2.6 Data entry and analysis

Data was entered into a Microsoft Excel spread sheet and entries have been randomly checked for accuracy.

3 RESULTS

Data has been presented by volume, weight and count. The results of the audit have been graphically represented in charts and tables, which show the various characteristics of the waste stream with explanations. Some percentages have been rounded to the nearest whole number and therefore some figures and descriptions may not add up to 100%.

Definitions of the material categories are provided in **Appendix A**.

3.1 Residual composition

As shown in Chart 1 and Table 4, just over half the residual material (51%) is contamination, i.e. material that is not the target material but is placed in the recycling bin by residents nonetheless and is discussed in more detail in later sections). Recyclable materials comprise 25%, made up of recyclable paper (9%), recyclable plastic containers (7%), recyclable metal containers (7%) and recyclable glass containers (3%). Glass fines account for 24% of the residual material.

Chart 1: Residual composition – consolidated categories

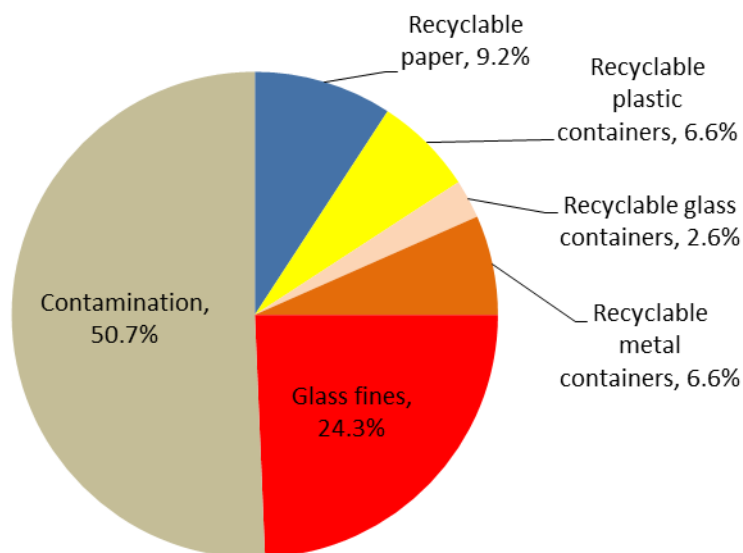


Table 4: Residual composition – consolidated categories

Material category	Total amount (kg)	Per cent
Recyclable paper	219.0	9.2%
Recyclable plastic containers	157.5	6.6%
Recyclable glass containers	61.2	2.6%
Recyclable metal containers	158.1	6.6%
Glass fines	578.8	24.3%
Contamination	1,206.7	50.7%
Total material collected	2,381.3	100.0%

The table below shows the quantities sorted by day and material. This data includes all material audited and ranked in order of amount present in the overall sample. After glass fines (24%), the materials that make up the largest proportions of the residual material are other miscellaneous items (15%), mixed clean paper including cardboard (9%), bagged garbage (8%), steel (6%) and plastic bottles containing liquid (5%).

Table 5: Residual composition – detailed categories

Material	Weight (kg)						Per cent
	Mon 27/10	Tues 28/10	Wed 29/10	Thurs 30/10	Fri 31/10	Total	
Glass fines (<50 mm diameter)	102.0	125.4	115.4	138.4	97.6	578.8	24.3%
Other miscellaneous	38.8	65.8	69.4	70.1	100.2	344.3	14.5%
Mixed clean paper including cardboard	31.2	33.8	56.4	41.4	46.4	209.2	8.8%
Bagged garbage	8.0	37.6	62.0	40.2	50.6	198.4	8.3%
Steel	20.6	16.4	43.0	15.8	38.6	134.4	5.6%
Plastic bottles containing liquid	14.2	31.0	16.6	26.4	19.4	107.6	4.5%
Mixed plastic containers	14.3	18.6	17.4	18.8	20.0	89.1	3.7%
Long items	42.4	16.6	10.4	10.6	8.8	88.8	3.7%
Large heavy items	0.0	29.0	29.6	9.4	13.2	81.2	3.4%
Textiles	9.8	19.4	24.6	12.2	12.6	78.6	3.3%
Electrical appliances	5.2	16.6	9.0	19.2	11.2	61.2	2.6%
Glass containers	10.0	6.8	20.0	13.8	10.6	61.2	2.6%
Food and kitchen waste	3.4	13.0	10.4	11.8	12.2	50.8	2.1%
Bagged recycling	4.8	5.8	2.6	14.2	18.0	45.4	1.9%
PET clear	4.8	7.0	9.0	9.6	8.4	38.8	1.6%
Film plastics	5.0	9.4	6.2	7.6	8.2	36.4	1.5%
Green waste and timber	4.2	7.0	6.2	6.6	11.0	35.0	1.5%
Large plastic items	2.2	7.6	7.2	3.8	8.0	28.8	1.2%
Aluminium	4.9	6.0	5.4	3.6	3.8	23.7	1.0%
HDPE semi-opaque	2.2	2.2	7.0	4.0	5.6	21.0	0.9%
Non-recyclable glass and crockery	2.4	2.8	5.8	1.4	6.8	19.2	0.8%
Nappies	0.6	5.0	3.6	2.2	2.4	13.8	0.6%
Liquidpaperboard	2.0	1.8	2.0	1.6	2.4	9.8	0.4%
Black plastic items – recyclable	3.6	1.0	1.2	1.2	1.6	8.6	0.4%
Black plastic items – non-recyclable	0.0	2.8	2.0	1.8	0.6	7.2	0.3%
Hazardous	0.0	3.0	0.2	0.2	0.2	3.6	0.1%
Expanded polystyrene	0.2	0.4	1.2	0.8	0.4	3.0	0.1%
Plastic bags – low-density barrier bags	0.4	0.2	0.2	0.8	0.4	2.0	0.1%
Plastic bags – lightweight, single-use shopping bags	0.6	0.2	0.2	0.2	0.2	1.4	0.1%
Automotive parts	0.0	0.0	0.0	0.0	0.0	0.0	0.0%
Total weight	337.8	492.2	544.2	487.7	519.4	2,381.3	100.0%

3.1.1 Contamination in detail

As described above, contaminants placed by residents in the recycling bin account for just over half the residual material. Table 6 shows what these contaminants are. The main contaminants are miscellaneous material (15% - much of this was contaminated paper, as well as small amounts of other materials that did not fit any other sorting categories). This is followed by bagged garbage (8%), plastic bottles containing liquid (5%), long items (4%), and big heavy items, textiles and electrical appliances (each 3%).

Table 6: Contamination detail

Material	Total kg audited	Per cent of residual material
Other miscellaneous	344.3	14.5%
Bagged garbage	198.4	8.3%
Plastic bottles containing liquid	107.6	4.5%
Long items	88.8	3.7%
Large heavy items	81.2	3.4%
Textiles	78.6	3.3%
Electrical appliances	61.2	2.6%
Food and kitchen waste	50.8	2.1%
Bagged recycling	45.4	1.9%
Film plastics	36.4	1.5%
Green waste and timber	35.0	1.5%
Large plastic items	28.8	1.2%
Non-recyclable glass and crockery	19.2	0.8%
Nappies	13.8	0.6%
Black plastic items – non-recyclable	7.2	0.3%
Hazardous	3.6	0.1%
Expanded polystyrene	3.0	0.1%
Plastic bags – low-density barrier bags	2.0	0.1%
Plastic bags – lightweight, single-use shopping bags	1.4	0.1%
Total weight	1,206.7	50.7%

3.1.2 Recyclable materials in detail

As discussed earlier, recyclable materials make up 25% of the residual material. Table 7 shows what the composition of these recyclable materials. The main recyclable materials ending up in the residual are mixed clean paper, including cardboard (9%). This is followed by steel (6%), mixed plastic containers (4%), glass containers (3%), clear PET (2%), aluminium (1%) and semi-opaque HDPE (1%). Smaller amounts of liquidpaperboard and recyclable black plastic items are also present in the residual.

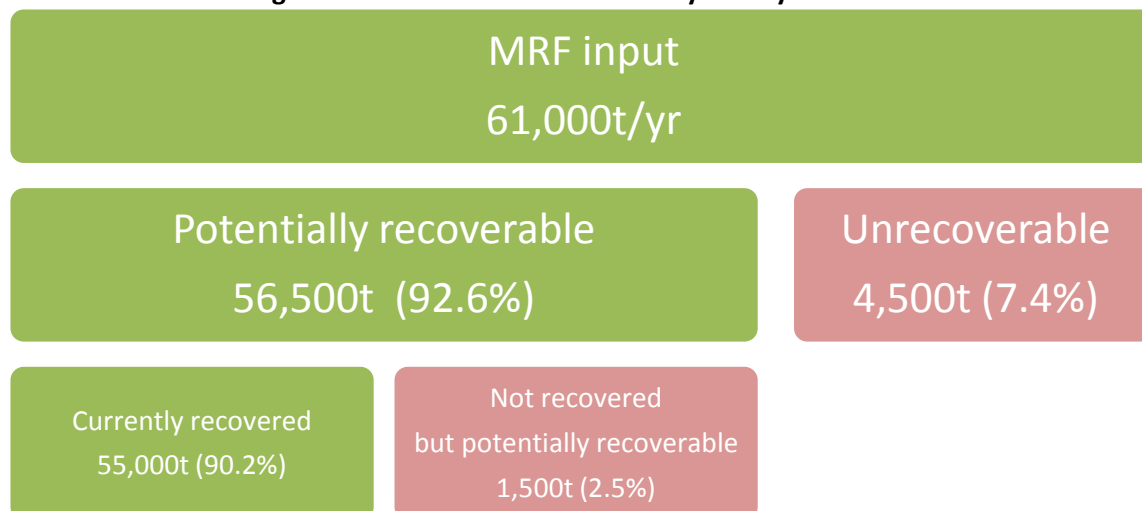
Table 7: Recyclable materials in detail

Material	Total kg audited	Per cent of residual material
Mixed clean paper including cardboard	209.2	8.8%
Steel	134.4	5.6%
Mixed plastic containers	89.1	3.7%
Glass containers	61.2	2.6%
PET clear	38.8	1.6%
Aluminium	23.7	1.0%
HDPE semi-opaque	21.0	0.9%
Liquidpaperboard	9.8	0.4%
Black plastic items – recyclable	8.6	0.4%
Total weight	595.8	25.0%

Based on the Hume MRF generating 6,000 tonnes of residual material to be disposed of to landfill each year, this analysis suggests that about 1,500 tonnes is potentially recyclable material. The 1,500t/yr of recyclable material lost to waste represents about 3% of all recoverable material received and 2.5% of total material received.

In summary, recovering these extra materials would raise the overall recovery rate of the MRF from 90% to almost 93%.

Figure 1: Potential for extra recovery of recyclables



3.2 Problematic items

Specific materials that can cause problems in the MRF were counted and weighed during the audit. The table below show materials intercepted and removed by the front-end loader driver in the receiving hall, where a total of 68 problem items were intercepted during the five days of the audit, as shown in Table 8.

Table 8: Problem items intercepted prior to processing

Category	Explanation	Number				
		Tues 28/10	Wed 29/10	Thurs 30/10	Fri 31/10	Total
Electrical and compound items	Household electrical – irons, jugs, computers, etc.	40	0	0	0	40
Large, heavy items causing breakdowns	Carpet, large textiles, car batteries	0	0	0	0	0
	Any single item weighing more than 18kg	2	2	0	9	13
	Any item measuring 2 of any 3 of its dimensions greater than 400mm or any of its 3 dimensions > 1000mm	0	0	0	0	0
Long items – that jam machinery	Large textiles, hoses, wire, rope, electrical cables or string, etc.	0	4	8	0	12
Large plastic items	20-litre drums, crates, broken furniture	0	2	1	0	3
Items in plastic bags		0	0	0	0	0
Plastic bottles containing liquid	Bottles containing liquid	0	0	0	0	0
Rigid black plastic items	Can't be distinguished by optical sorting equipment	0	0	0	0	0
Other	Other	0	0	0	0	0
Total number	Total	42	8	9	9	68

Oversized items – potential to cause breakdowns and machinery damage



Plastic tubs



Plastic items and EPS



Plastic bags containing waste



Lawnmower frame

Long items



Garden hose



Textiles

Miscellaneous



EPS



Plastic film and sheeting

Other items were observed in the residual stream; these are either removed by staff in the pre-sort area or are processed and end up in the general waste stream. In total, 778 items were counted in the residual material, the most common being recyclable black plastic items, long items, non-recyclable black plastic items and electrical appliances. These are shown in Table 9.

Table 9: Problem items in the residual material

Material	Number					Total
	Mon 27/10	Tues 28/10	Wed 29/10	Thurs 30/10	Fri 31/10	
Black plastic items – recyclable	37	23	37	29	45	171
Long items	52	37	19	31	25	164
Black plastic items – non-recyclable	0	23	43	36	24	126
Electrical appliances	31	39	0	20	16	106
Plastic bags – low-density barrier bags	29	16	16	18	0	79
Plastic bags – lightweight, single-use shopping bags	28	18	11	9	0	66
Large plastic items	0	14	17	9	10	50
Large, heavy items	0	8	5	1	2	16
Total items	177	178	148	153	122	778

Table 10 compares the number of problem items intercepted and the number in the residual. These numbers are for Tuesday to Friday, as intercepted materials were not counted on Monday. Also, it was not clear over what length of time this material had been collected.

Almost half of large, heavy items are intercepted prior to processing, and just over a third of electrical items. Only 10% of long items are intercepted and 6% of large plastic items. There is no interception of black plastic items or plastic bags. Overall, 11% of problematic items are intercepted prior to processing.

Table 10: Percentage of problem items intercepted – Tues to Fri

Problematic material	Number intercepted	Number in the residual	% intercepted
Black plastic items – recyclable	0	134	0%
Long items	12	112	10%
Black plastic items – non-recyclable	0	126	0%
Electrical appliances	40	75	35%
Plastic bags – low-density barrier bags	0	50	0%
Plastic bags – lightweight, single-use shopping bags	0	38	0%
Large plastic items	3	50	6%
Large, heavy items	13	16	45%
Total items	68	601	11%

Images from residual waste



Bagged garbage – Tuesday and Wednesday



Bagged recycling – Tuesday and Wednesday



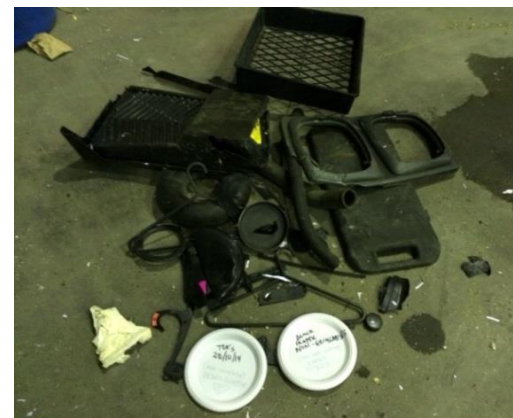
Plastic bottles containing liquid



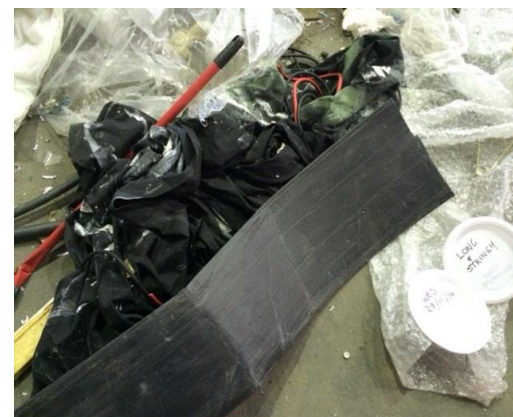
Large plastic items



Black plastics – recyclable



Black plastics – non-recyclable





Long and stringy



Textiles



Oversize – heavy



Electrical



Large plastic items

3.3 Plastic bags

The ACT implemented a ban on single-use, lightweight shopping plastic bags in November 2011. The audit revealed 145 plastic shopping bags in the residual material, weighing a total of 3.4kg. Plastic bags represent 0.2% of the MRF's residual material by weight. About half are low-density barrier bags and half are lightweight shopping bags.

Table 11: Plastic bag analysis

Type of plastic bag	Total kg audited	Percentage of total residual material	Number audited
Plastic bags – low-density barrier bags	2.0	0.1%	79
Plastic bags – lightweight, single-use shopping bags	1.4	0.1%	66
Total	3.4	0.2%	145

**Low-density barrier bags****Lightweight shopping bags**

4 COMPARISON WITH PREVIOUS AUDIT

APC has conducted four prior audits between 2005 and 2009. The amount of material sorted during the prior audits conducted and the 2014 audit is shown in the table below.

Table 12: Historical and 2014 audit parameters

Year	Month	Smallest daily amount (kg)	Largest daily amount (kg)	Total amount (kg)	Daily average (kg)
2005	May	490	614	2,623.5	524.7
2006	June	501	699	2,770.6	554.1
2007	November	161.3	537.9	2,094.7	418.8
2009	May	316.6	611.1	2,471.1	494.2
2014	October	337.8	544.2	2,381.3	476.3

4.1 Residual composition

A MRF audit was previously conducted at this location by APC in 2009. Not all categories are strictly comparable across the two audits, but many items are. There was a large increase in the proportion of glass fines across the two years, and a decrease in the proportion of contamination. There was not much change in the proportions of recyclable glass and metal containers. Recyclable paper increased and recyclable plastic containers decreased.

Table 13: Residual composition – comparison 2009–2014, consolidated

Material	Proportion by weight		
	2009%	2014%	Change
Recyclable paper	4.1%	9.2%	5.1%
Recyclable plastic containers	12.7%	6.6%	-6.1%
Recyclable glass containers	2.2%	2.6%	0.4%
Recyclable metal containers	5.1%	6.6%	1.5%
Glass fines	5.9%	24.3%	18.4%
Contamination	70.0%	50.7%	-19.3%
Total	100.0%	100.0%	-

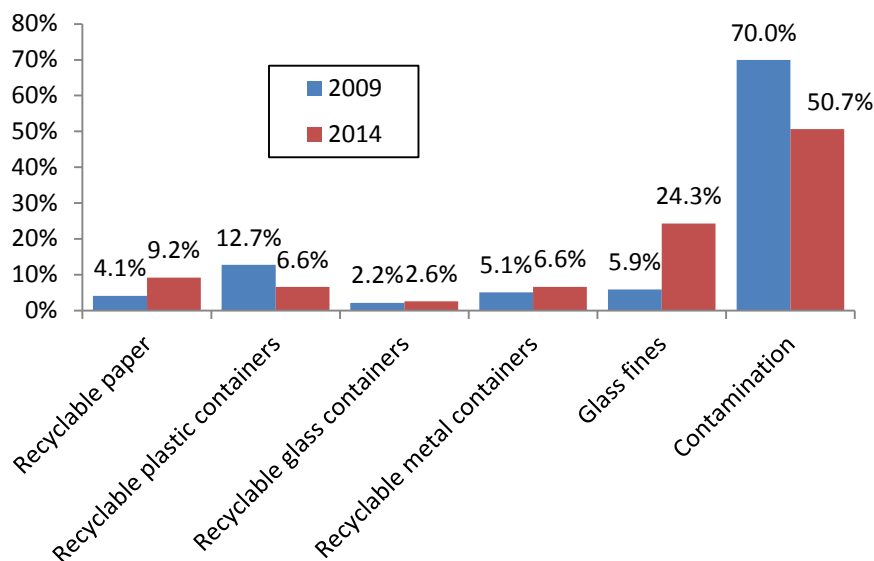
Chart 2: Residual composition: comparison 2009–2014, consolidated

Table 14 shows a comparison of each individual material category in 2009 and 2014. The largest change is the increase in glass fines (18%). The next largest increase is mixed clean paper, including cardboard (5%). Other miscellaneous material has decreased by 12%, and food and kitchen waste has decreased by 6%.

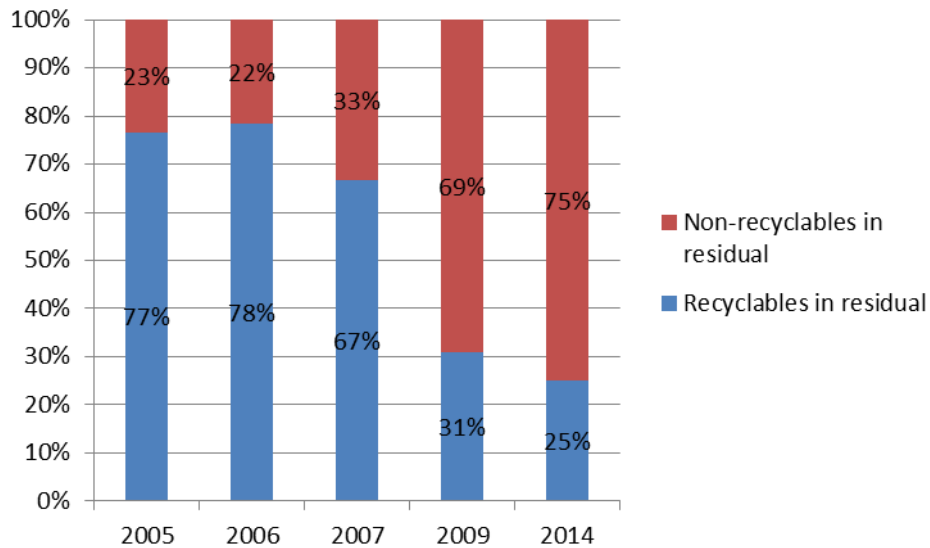
Table 14: Residual composition – comparison 2009–2014, detail

Material	Proportion by weight		
	2009%	2014%	Change
Glass fines (<50 mm diameter)	5.9%	24.3%	18.4%
Other items non-comparable across years	8.9%	19.4%	10.5%
Mixed clean paper including cardboard	3.7%	8.8%	5.1%
Steel	3.9%	5.6%	1.8%
Glass containers	2.2%	2.6%	0.4%
Non-recyclable glass and crockery	0.5%	0.8%	0.3%
Liquidpaperboard	0.4%	0.4%	0.0%
Expanded polystyrene	0.3%	0.1%	-0.1%
Aluminium	1.2%	1.0%	-0.2%
Hazardous	0.5%	0.1%	-0.4%
Plastic bottles containing liquid	5.3%	4.5%	-0.8%
Nappies	1.8%	0.6%	-1.2%
Green waste and timber	2.8%	1.5%	-1.4%
Mixed plastic containers	5.2%	3.7%	-1.4%
Automotive parts	1.8%	0.0%	-1.8%
Textiles	5.1%	3.3%	-1.8%
Film plastics	3.7%	1.5%	-2.2%
PET clear	3.9%	1.6%	-2.3%
Electrical appliances	4.9%	2.6%	-2.4%
HDPE semi-opaque	3.7%	0.9%	-2.8%
Food and kitchen waste	7.6%	2.1%	-5.5%
Other miscellaneous	26.7%	14.5%	-12.3%
Total	100.0%	100.0%	-

4.2 Recyclable materials in the residual

As shown in Chart 3, the proportion of recyclable materials in the residual material has fallen over time, reflecting improved recovery due to changes in MRF processes and technologies.

Chart 3: Recyclable materials in the residual – historical comparison



4.3 Problematic items in the residual material

Table 15 shows the number of problematic materials found in the residual material between 2009 and 2014. Overall, 19% more problematic items were counted in 2014 compared with 2009. There has been a huge increase in black items. Electrical and large plastic items have increased significantly, while long items have decreased.

Table 15: Problematic items – comparison 2009–2014

Material	2009 no. of items	2014 no. of items	Change
Long items capable of jamming machinery	271	164	-39%
Electrical and compound items	51	106	108%
Large plastic items causing breakdowns	23	50	117%
Large, heavy items causing breakdowns	23	16	-30%
Black items	2	297	14750%
Other	282	145	-49%
Total	652	778	19%

5 KEY FINDINGS

5.1 Composition of residual material

Just over half the MRF's residual material (51%) is contamination placed in the recycling bin by residents. The main unacceptable items people place in their recycling bins (at home or at public bins) are contaminated paper, bagged garbage and plastic bottles containing liquid. Long items, large and heavy items, textiles and electrical appliances are also found in the MRF residual. As a proportion of total MRF input, contamination accounts for 5%.

Contamination as a proportion of MRF residual has decreased significantly since the last audit in 2009 – from 70% in 2009 to 51% in 2014 – which suggests education programs have had an effect.

Recyclable materials comprise 25% of the MRF residual. Over half of this is mixed clean paper (including cardboard) and steel. Mixed plastic containers, glass containers, clear PET, aluminium, semi-opaque HDPE, liquidpaperboard and recyclable black plastic items are also ending up in the residual material in smaller quantities.

Based on the Hume MRF generating 6,000 tonnes of residual material to be disposed of to landfill each year, about 1,500 tonnes is potentially recyclable material. The 1,500t/yr of recyclable material lost to waste represents about 3% of all recoverable material received and 2.5% of total material received.

Recovering these extra materials would raise the overall recovery rate of the MRF from 90% to almost 93%.

Recyclable materials, as a percentage of MRF residual material, have decreased over time – from a high of 78% in 2006 to 25% in 2014 – reflecting improved processes and technologies within the MRF. Specifically, the proportion of recyclable plastic containers has decreased, recyclable paper has increased, and glass and metal containers have remained about the same.

Glass fines account for 24% of the residual material, despite when new glass fines recycling equipment being installed in 2009. In 2009, glass fines represented just 6% of MRF residual whereas in 2014 glass fines are 24% due to glass market specifications becoming stricter on the amount of paper resulting in more lost product.

The other significant change between 2009 and 2014 is a decrease in food and kitchen waste in the residual material – from 8% in 2009 to 2% in 2014. This suggests education about food waste in the recycling bins has been effective during this period.

5.2 Problematic items

There were 778 items in the residual material, the most common being black plastic (the optical sorter cannot recognise these), long items (which may cause machinery breakage) and electrical appliances (these are non-recyclable at the MRF and have environment impact in residual).

Smaller numbers of plastic bags (non-recyclable and banned in ACT), large plastic items and large heavy items (both may cause machinery breakage) were also found.

The audit counted 68 problematic items that were intercepted and removed by MRF staff in the receival hall prior to processing. Almost half of large, heavy items are intercepted prior to processing, and just over a third of electrical items. Only 10% of long items are intercepted, and 6% of large plastic items. There is no interception of black plastic items or plastic bags. Overall, 11% of problematic items are intercepted prior to processing.

There has been a huge increase in black items when compared with the 2009 count of problematic items in the residual. Electrical items and large plastic items have increased significantly, while long items have decreased.

Overall, 19% more problematic items were counted in 2014 when compared with 2009.

5.3 Plastic bags

The ACT implemented a ban on single-use, lightweight shopping plastic bags in November 2011. The audit revealed 145 plastic shopping bags in the residual material, weighing a total of 3.4kg. Plastic bags represent 0.2% of the MRF's residual material by weight. About half are low-density barrier bags and half are lightweight shopping bags.

Although plastic bags represent a very small proportion of the MRF's residual material by weight, 145 shopping bags per week equates to about 7,500 plastic bags per year that are put into the recycling bins.

6 CONCLUSION

Based on these results, it is essential to maintain continued, multi-pronged education initiatives to inform, educate and motivate the community about correct use of the recycling service offered. Past efforts have reduced food waste from 8% to just 2%.

Future efforts on what not to recycle should focus on these three key materials:

1. Contaminated paper
2. Bagged garbage
3. Plastic bottles containing liquid.

Supplementary messages should focus on:

1. Long items – hoses, cables
2. Large and heavy items
3. Textiles
4. Electrical appliances.

While plastic bags make up only 0.2% of MRF residual, this still equates to about 7,500 plastic bags per year. Continued enforcement of and education about the plastic bag ban in the ACT should be undertaken.

The increased amount of glass fines in the residual material – from 6% in 2009 to 24% in 2014 – is due to and modifications in end-product specifications. A greater removal of contaminants (including paper) is now a requirement and as a result there is an additional loss of glass fines despite new glass fines recycling equipment being commissioned in 2009.

Approximately 3% of recoverable material is currently being lost to waste in the MRF.

APPENDIX A - MATERIAL DEFINITIONS

Recyclable material	Definitions
Mixed clean paper including cardboard	Newspapers, newspaper-like pamphlets, magazines (glossy and non-glossy), pamphlets, brochures, wrapping paper, labels, paper packaging (no plastic or wax coatings), cardboard with corrugation, cardboard without corrugation (glossy and non-glossy), cereal boxes, business cards, A4 document paper, writing pads, letters, envelopes, books
Liquidpaperboard	Soy milk cartons, some fruit juice cartons, UHT/long-life milk
Glass containers	Recyclable (all colours) – beer bottles, wine bottles, spirit cider/fruit-based, flavoured water, fruit juice, sports drinks, plain water, sauce bottles, jam jars, vegetable oils, other food containers
Glass fines (<50 mm)	Mixed glass or glass fines < 4.75 mm
Aluminium	Beer and soft drink
Steel	Alcoholic sodas and spirit-based mixers, beer, soft drink, food cans, pet food cans, aerosols, industrial cans, clean/empty paint cans
PET clear	(Polyethylene) – soft drink, flavoured water, fruit juice, sports drinks, plain water (carbonated/non-carb), food containers, mouthwash containers, detergent bottles
HDPE semi-opaque	(High-density polyethylene) – milk and flavoured milk bottles, bleach bottles, oil containers, food containers
Mixed plastic containers	Clear cordial and juice bottles, detergent bottles
Film plastics	Plastic film
Food and kitchen waste	Vegetable scraps, meat scraps, animal food, leftover food
Green waste and timber	Grass clippings, tree trimmings/prunings, flowers, wood/timber
Non-recyclable glass and crockery	Pyrex, mirror glass, Corningware, light globes, laboratory and medical glass, white opaque glass (e.g. Malibu alcohol bottles)
Nappies	Used disposable nappies
Expanded polystyrene	Meat and poultry trays, vending cups, fragile-item packaging
Textiles	Wool, cotton and natural fibre materials
Hazardous	Paint (dry or wet), compact fluorescent lamps (CFLs), asbestos-containing products, sharps, blood-stained disposable material or equipment, gas bottles, batteries
Automotive parts	Anything from a motor vehicle
Contaminated paper	Paper not suitable for recycling, mixed and other paper, used tissues, soiled paper
Glass dust	Mixed glass or glass fines < 4.75 mm
Other miscellaneous	Composites, appliance parts, crates and boxes, toys, houseware/kitchenware, furniture, plant pots, mouldings, irrigation fittings
Plastic bottles containing liquid	Any rigid container including food and liquid heavier than the container, i.e. drink bottle containing water, takeaway container with food, vegetable oils, shampoo, liquid soaps
Bagged recycling	Recycling in a plastic bag
Bagged garbage	General waste in a plastics bag
Plastic bags – low-density barrier bags	LDPE – other bags e.g. potatoes, tomatoes, sugar, ice, bread bags, etc.
Plastic bags – lightweight, single-use shopping bags	Fully transparent, not opaque
Black plastic items – recyclable	Meat trays, flower pots and any other black containers
Black plastic items – non-recyclable	Oil containers
Long items	Rope, string, hose, electrical cable, carpet
Large, heavy items	Any single item weighing more than 18kg, any item or material with two of any three of its dimensions greater than 400mm or any one of its three dimensions greater than 1,000mm
Large plastic items	20-litre drums, crates, broken furniture
Electrical appliances	Anything with a cord – small electrical items (toaster, blender, etc.)