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Absorbent Hygiene Products Waste Review of South Australia

Report funded and commissioned by:

Government of South Australia
Zero Waste SA

Acronyms

AHP – Absorbent Hygiene Products

AHPRGSA – Absorbent Hygiene Products Recycling Group of South Australia

% wt – percentage by weight

kg/m3 – kilograms per cubic metre

MUN – Municipal

COM – Commercial

SAN – Sanitary

MED – Medical

tonnes/yr – Tonnes per Year

CO2-e – Carbon Dioxide Equivalent

WtE – Waste to Energy

Front Cover – Images from iswa.org, rabco.be and thecleanzine.com

Executive Summary

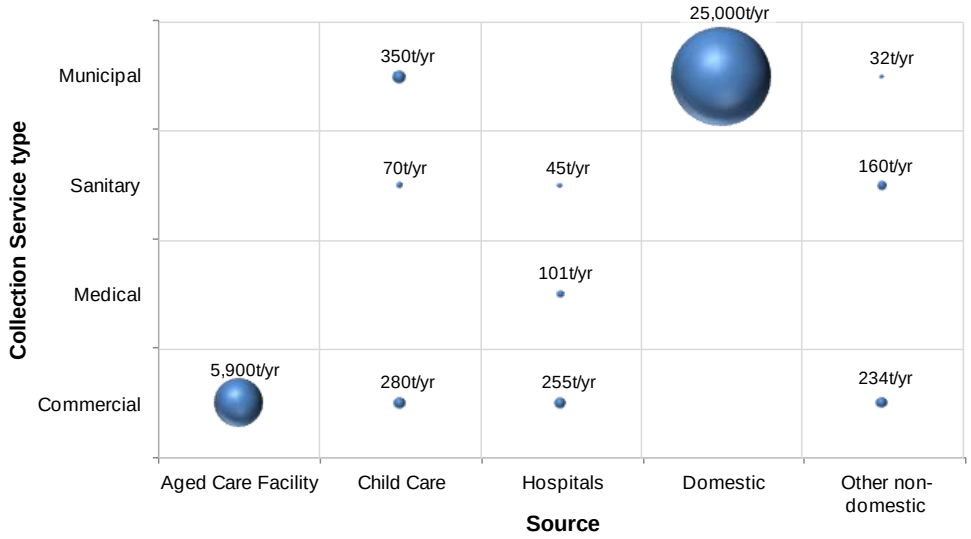
This report presents market intelligence for Absorbent Hygiene Products (AHP) Waste being generated in South Australia. The report was funded and commissioned by Zero Waste SA as a member of the AHP Recycling Group of South Australia (AHPRGSA).

The purpose of this market intelligence is to provide reliable information that could assist potential waste-to-resources investors with considering and developing a viable resource recovery solution for AHP Waste in South Australia.

It is estimated that between 29,000 and 36,000 tonnes per year of AHP waste is disposed to landfill per year, this equates to approximately 3% of total waste to landfill.

This material is highly biodegradable and generates significant greenhouse gases in landfills. There is significant potential to reduce landfill associated greenhouse gas liabilities through recycling opportunities[1].

The figure below provides estimates of how South Australia's AHP Waste is split between different sources and collection-service types. Domestic (or residential) sources constitute the majority (78%) of this AHP Waste material. These domestic sources include AHP used for Adult Continence and Infant/Child nappies. Domestic AHP Waste is normally mixed with general waste disposed via municipal kerbside collection services. This AHP Waste could therefore be challenging and costly to separately collect for resource recovery. The other significant source (18%) of AHP Waste is aged care facilities.



[1] Greenhouse gas benefits would need to be independently verified using accepted protocols

The aged care AHP Waste is source separated in line with industry practices, and logistically, would be easier and more cost-effective to collect for resource recovery. It is believed aged care and health service providers also provide a motivated potential customer base for alternative AHP disposal providers. Market intelligence for other AHP Waste sources and generation rates in South Australia is also presented in this report.

AHP Waste landfill collection and disposal costs in South Australia are estimated to be between $5 and $7.5 million annually, paid by individuals, businesses and local government.

This review identifies there is an opportunity for resource recovery of AHP Waste that should be considered in further detail. Collection for resource recovery could reduce current AHP Waste disposal costs. Depending on the type of resource recovery process, there is potential to extract valuable resources from AHP Waste, including plastics and by-products suitable for composting and/or waste derived fuel. Carbon credits might also be generated from avoided landfill gas emissions.

Future changes in South Australia's population could increase AHP Waste quantities (by 15-20%) to between 35,000 and 40,000 tonnes per year by 2022. The demographics of this population change suggest that the aged care sector will disproportionately contribute towards this increase. For instance, AHP Waste from aged care facilities could rise by nearly 40% to approximately 9,000 tonnes per year (by 2020).

Costs for disposal of AHP Waste to landfill will continue to increase rapidly in the future. This is being driven by landfill levy increases, carbon price impacts, quantity increases and other collection/disposal cost increases. A resource recovery pathway for AHP Waste is a way of mitigating these disposal cost rises.

In summary, this report has demonstrated that significant quantities of AHP Waste are currently being disposed to landfill in South Australia. This creates an environmental burden and is a substantial cost to individuals, businesses and local government. This presents an opportunity for the waste and recycling industry to provide a recycling or recovery solution.

Contents

1 Introduction

1.1 Project Background

Zero Waste SA commissioned and financed this project as a member of the Absorbent Hygiene Recycling Group of South Australia (AHPRGSA) in 2012. AHPRGSA (www.ahprgsa.org) has been recently formed out of growing interest from numerous industry stakeholders. The purpose of AHPRGSA is to assist with finding a local recycling solution for disposal of AHP Waste in South Australia.

In particular it was believed that there could be substantial segregation and logistical advantages for this local recycling solution with the aged care sector. This material is easily and/or already source separated enabling cost effective collections.

The purpose of this project is to provide reliable data on current and projected AHP quantities and disposal costs to assist potential AHP recycling investors consider AHP as a commercially viable local recycling opportunity.

It has been estimated that Australia generates up to 500,000tonnes/yr. of AHP Waste. Based on South Australia's proportion of the national population, this could suggest AHP Waste quantities generated in South Australia are in the order of 35,000tonnes/yr. This quantity is equivalent to a volume of 260,000m^3 per year[2] or 104 Olympic swimming pools.

The majority of this AHP Waste generated in South Australia is currently disposed to landfill. This makes up approximately 3% (by weight) of total waste sent to landfill. This material is highly biodegradable and can generate significant greenhouse gas emissions from landfills.

There are already successful international examples of AHP Waste being recycled instead of disposed to landfill – including AHP Waste from both commercial and municipal sources. For example, in 2011 Knowaste opened a treatment facility in the UK to handle 36,000 tonnes of AHP waste material per annum. There is commercial interest currently in Australia in building similar AHP recycling facilities interstate for processing and resource recovery of AHP Waste, (e.g. Relivit is opening a nappy and sanitary waste recycling plant using Knowaste technology in Sydney in late 2013).

[2] Based on an assumed average density of 133kg/m^3. It should be noted that the density of AHP Waste can vary substantially between different product types, waste materials and on how the waste is aggregated and collected.

1.2 Project Aim and Scope

The key purpose of this project is to provide reliable market intelligence for AHP Waste in South Australia. This may assist potential waste-to-resources investors in developing a local recycling solution.

This market intelligence was to be provided in the form of a report which could be used by Zero Waste SA and the AHPRGSA to inform, guide and promote opportunities for recycling of AHP Waste in South Australia.

The scope of this project included the following.

(1) Establish the current annual SA AHP quantities and disposal costs and/or trends by type.
(2) Develop AHP Waste demand projections for likely future scenarios.
(3) Briefly consider the resource recovery options of AHP Waste.

2 AHP Waste Quantities

2.1 Current quantities

The estimated current AHP Waste being collected for disposal in South Australia is summarised in Table 2.1 (below).

The AHP Waste source classifications used and collection service types are detailed in Appendix 1. The methodology used to prepare these estimates and more detailed metrics underpinning these estimates for each source classification is detailed in Appendix 2 and Appendix 3 respectively.

Table 2.1: Summary of AHP Waste quantities currently (2011 reference year) being disposed of in South Australia by source classification. This table includes: mean value and range of estimated quantity; assumed relevant waste disposal collection service(s)

Source Classification	Estimated Quantity (tonnes/yr.)		Collection Service(s)
	Mean	*Range*	
Adult Continence			
Residential Aged Care	6,000	4,900 - 7,000	COM
Hospitals	300	220 - 390	MED, SAN, COM
Mental health/disability facilities	200	150 - 260	MUN
Adult domestic/residential	3,800	2,700 - 4,900	MUN
Community care (at home)	4,800	3,800 - 5,700	MUN
SUB-TOTAL	15,000	13,400 - 16,800	
Feminine Hygiene			
Domestic/Residential	1,200	1,000 - 1,400	MUN
Commercial - retail	25	21 30	SAN, COM, MUN
Commercial - workplaces	190	150 - 240	SAN, COM, MUN
Hospitals	10	9 - 12	SAN
Schools	35	28 - 41	SAN
Higher education facilities	13	10 - 15	SAN
SUB-TOTAL	1,400	1,200 - 1,700	
Infant/Child			
Child care	700	600 - 860	MUN, SAN, COM
Domestic/Residential	15,100	12,500 - 17,800	MUN
Supported accommodation	6	5 - 7	MUN
Hospitals	90	70 - 110	MUN, SAN, COM
SUB-TOTAL	15,900	13,300 - 18,700	
TOTAL - All Source Classifications	**32,400**	**29,300 - 35,600**	

Table 2.1 Key: COM - Commercial, MED - Medical, SAN – Sanitary , MUN – Municipal/Council

Key findings:

1. Current total AHP Waste quantities in South Australia are between 29,000 and 36,000 tonnes/yr.
2. Infant/Child and Adult Continence sources at 96% (by wt.) constitute the majority of this AHP Waste stream – see Figure 2.1 (below).
3. The majority source of AHP Waste, 25,000tonnes/yr or 75-80% (by wt.) is generated from domestic/residential sources – see Figure 2.2 (below).
4. The Residential Aged Care component of the AHP Waste stream, is estimated at 6,000 tonnes/yr. or 15-20% (by wt.) of the total AHP Waste stream.

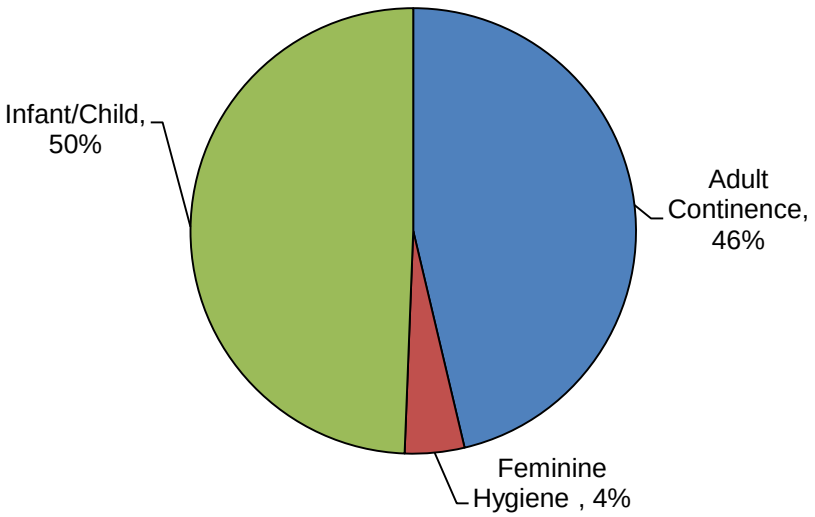


Figure 2.1: AHP Waste quantities in South Australia by source classification (% by wt.)

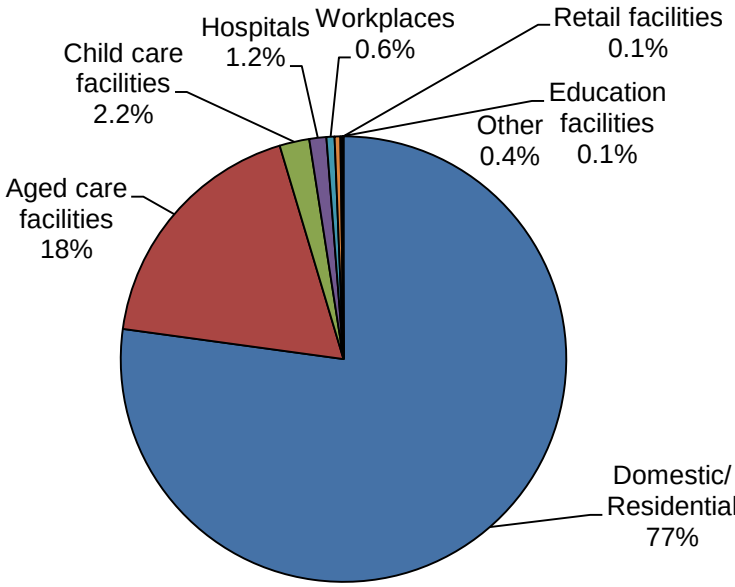


Figure 2.2: Total AHP Waste quantities in South Australia by source location (% by wt.)

Table 2.2 (below) provides an estimated breakdown (% wt.) of AHP Waste quantities by type of service in place to collect the waste from the point of disposal: municipal, commercial, sanitary and medical.

Table 2.2: Estimated breakdown (% wt.) of AHP Waste quantities by collection service.

	Adult Continence	Feminine/ Hygiene	Infant/ Child
MUNICIPAL	57%	83%	97%
COMMERCIAL	42%	2%	2%
SANITARY	<0.5%	15%	<0.5%
MEDICAL	<0.5%	-	<0.5%

In summary, Table 2.2 indicates that:

1. The majority of AHP Waste is collected through municipal services, including an estimated 57% of Adult Continence, 83% of Feminine Hygiene and 97% of Infant/Child AHP Waste.
2. An estimated 40-45% of Adult Continence AHP Waste is managed through commercial collection services, which is largely comprised of waste generated at Residential Aged Care facilities.

2.2 Future projections

Future AHP Waste quantities projections to 2022 are shown in Figure 2.3 (below). This figure suggests that by 2022 total AHP Waste quantities in South Australia could increase by up to 15-20% (from 2011) or to approximately 38,000 tonnes/yr.

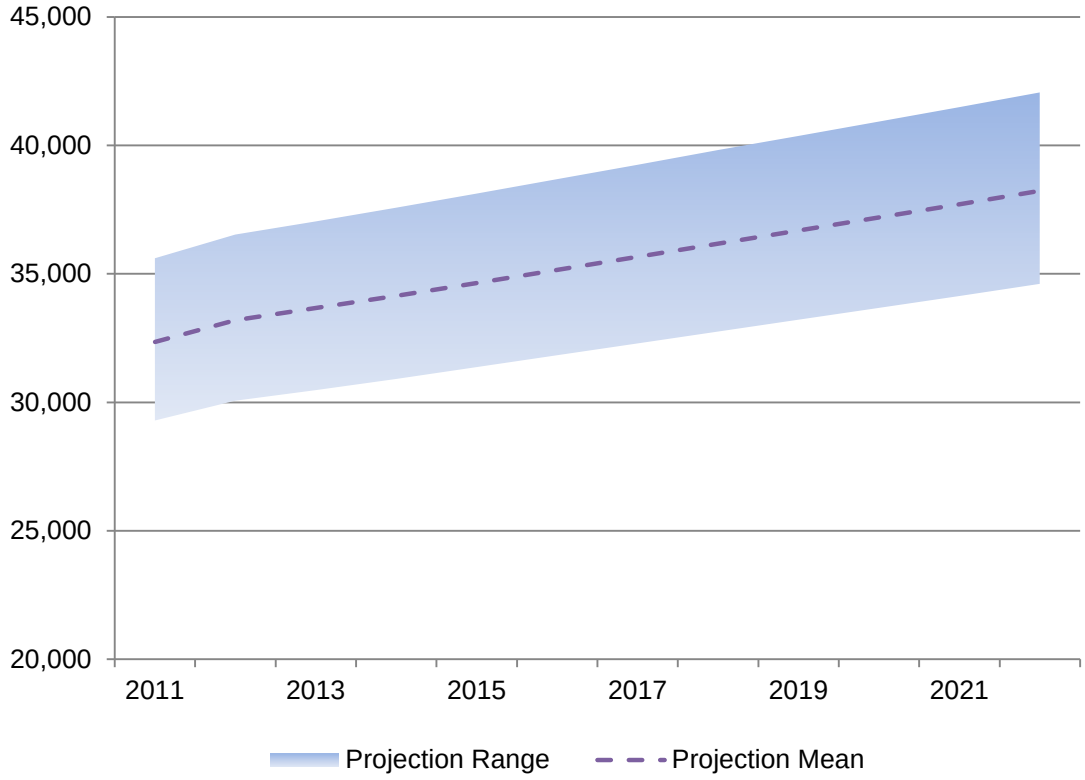


Figure 2.3: Estimated mean and range current and projected AHP Waste quantities in South Australia (2011 to 2022)

These projections take into account potential demographic changes which may influence AHP consumption and waste generation. South Australia's ageing population is expected to lead to greater consumption of Adult AHP (and AHP waste generation).

- From 2012 to 2022, SA's population aged 75+ is projected to increase from approximately 130,000 to 170,000 persons – See Figure 2.4 (overleaf)
- This growth is projected to further accelerate from 2022 to approximately 235,000 persons in 2032, which could lead to even greater AHP Waste quantities.

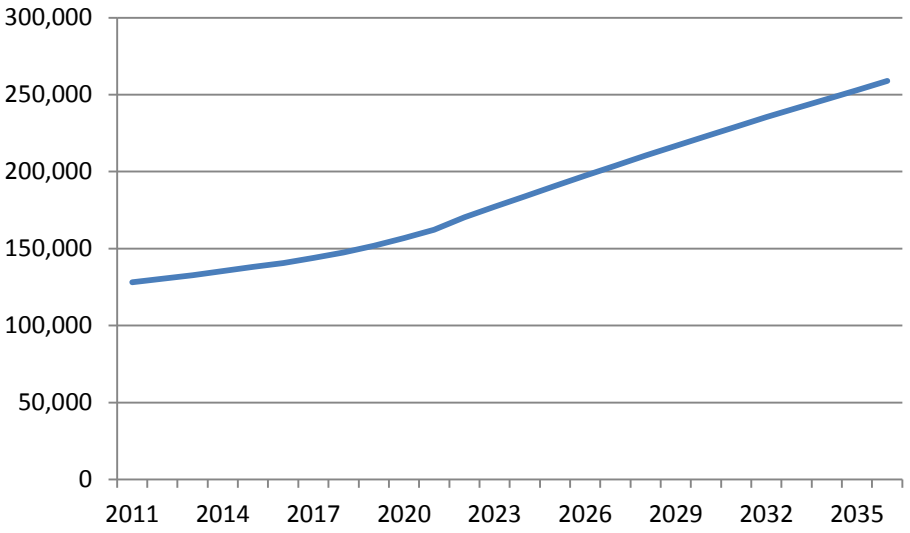


Figure 2.4: South Australia's population aged 75+ from 2011 to 2036 (Source: Abs, 2011, 3222.0 Population Projections, Australia.)

The breakdown of projected mean value for AHP Waste quantities by each major source classification (tonnes/yr) over time is illustrated in Figure 2.5 (below). Adult Continence is predicted to be the major contributor to this growth in South Australia's AHP quantities.

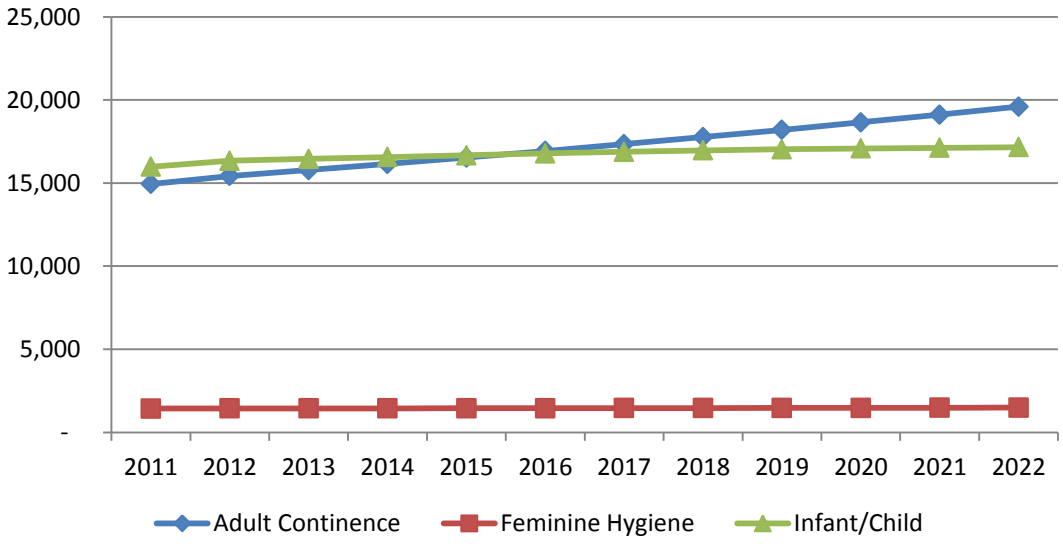


Figure 2.5: AHP mean waste quantities (tonnes/yr) in South Australia by source classification (2011 to 2022)

Figure 2.6 (overleaf) illustrates that the Community Care (at Home) and Residential Aged Care sectors are likely to be the key contributors to the growth in Adult Continence AHP Waste quantities.

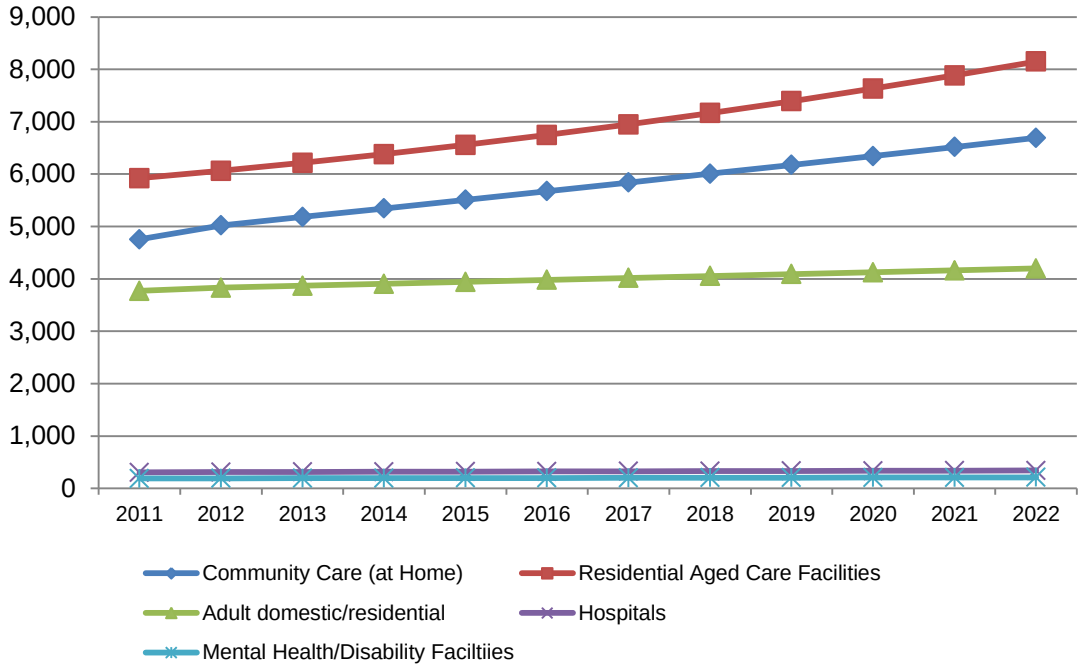


Figure 2.6: Adult Continence AHP mean waste quantities (tonnes/yr) in South Australia by source classification (2011 to 2022)

Figure 2.7 (below) illustrates that Residential sources will continue to constitute the majority of Infant/Child Waste quantities.

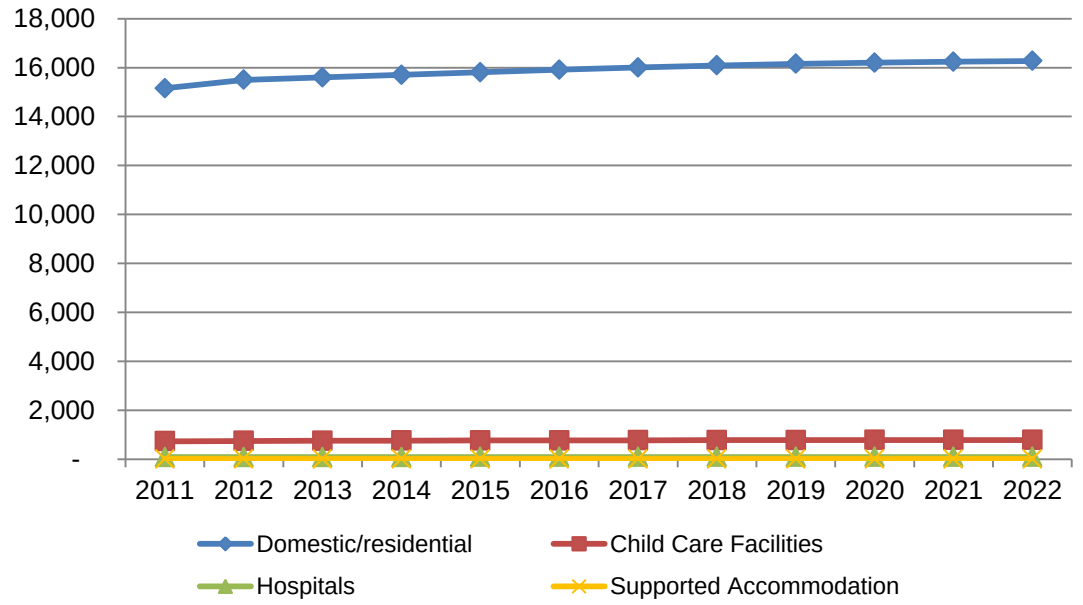


Figure 2.7: Infant/Child AHP mean waste quantities (tonnes/yr) in South Australia by source classification (2011 to 2022)

The projected South Australian AHP Waste quantities by each source classification are detailed in Table 2.3 (overleaf).

Table 2.3: Summary of mean AHP Waste quantities being disposed of in South Australia by source classification (2011 to 2022).[3]

Source Classification	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Adult Continence												
Residential Aged Care	5,920	6,060	6,220	6,380	6,560	6,750	6,950	7,170	7,390	7,630	7,880	8,150
Hospitals	310	310	320	320	320	320	330	330	330	340	340	340
Mental health/disability facilities	190	190	200	200	200	200	200	200	210	210	210	210
Adult domestic/residential	3,770	3,830	3,870	3,910	3,940	3,980	4,020	4,050	4,090	4,130	4,160	4,200
Community care (at home)	4,750	5,020	5,180	5,340	5,510	5,680	5,840	6,010	6,170	6,340	6,520	6,690
SUB-TOTAL	14,940	15,420	15,780	16,150	16,530	16,930	17,340	17,760	18,200	18,650	19,110	19,590
Feminine Hygiene												
Domestic/Residential	1,200	1,200	1,200	1,200	1,210	1,210	1,210	1,220	1,220	1,230	1,230	1,240
Commercial – retail	25	26	27	27	27	27	27	27	27	27	27	27
Commercial – workplaces	190	190	190	200	200	200	200	200	200	200	200	200
Hospitals	10	10	10	11	11	11	11	11	11	11	11	11
Schools	34	34	34	34	34	34	34	34	34	34	35	35
Higher education facilities	11	11	11	11	11	11	11	11	11	11	11	11
SUB-TOTAL	*1,430*	*1,440*	*1,440*	*1,440*	*1,450*	*1,450*	*1,460*	*1,460*	*1,470*	*1,470*	*1,480*	*1,490*
Infant/Child												
Child care	730	750	750	760	760	770	770	780	780	780	790	790
Domestic/Residential	15,150	15,500	15,600	15,700	15,810	15,910	16,010	16,090	16,150	16,200	16,240	16,270
Supported accommodation	6	6	6	6	6	6	6	6	6	6	6	6
Hospitals	87	88	88	89	90	90	91	91	91	92	92	92
SUB-TOTAL	15,980	16,340	16,450	16,560	16,670	16,780	16,880	16,960	17,030	17,080	17,120	17,160
TOTAL - All Source Classifications	**32,400**	**33,200**	**33,700**	**34,100**	**34,600**	**35,200**	**35,700**	**36,200**	**36,700**	**37,200**	**37,700**	**38,200**

[3]AHP Waste values table are rounded to more significant figures than corresponding values presented in Table 2.1 in order to more realistically illustrate changes in projected waste quantity with time

3 AHP Waste Collection & Disposal Costs

3.1 Current collection & disposal costs

Waste collection & disposal costs for AHP Waste are strongly dependent on the type of collection service. Figure 3.1 (below) provides an estimate of how much AHP Waste in South Australia is disposed of via different collection services (Refer Appendix 1 for definitions).

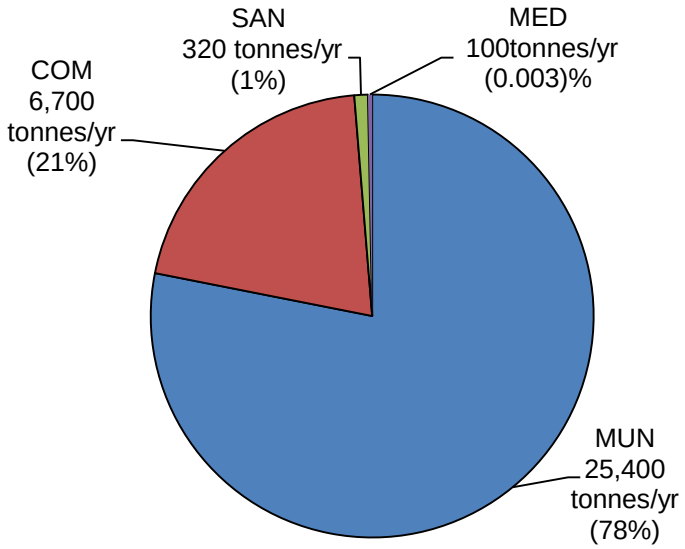


Figure 3.1: Estimated current AHP Waste quantities (mean tonnes/yr and %wt) by collection service

To note:

1. The majority (up to 75-80%) of AHP Waste is disposed of in the municipal waste stream.
2. There is a significant component (approximately 6,700tonnes/yr or 20%) of AHP Waste which is collected by commercial services.
3. Sanitary and medical collections appear to constitute a minor proportion (1-2%) of AHP Waste being collected.

The typical cost ranges (for South Australia) in $ per tonne for each of these collection services is shown in Figure 3.2 (overleaf). These costs are service provider fees for collection of the waste material for disposal (that does not involve beneficial reuse). Costs include the collection, transportation, any treatment and end-disposal costs.

Figure 3.2: Range of estimated current mean cost ($) per tonne for collection and disposal of AHP Waste by collection service. Note that the y-axis in this graph has a logarithmic scale.

To note:

1. This figure demonstrates the relatively higher cost of sanitary and medical collection, where the effective collection cost can up to $7,000/tonne.
2. Commercial and municipal collection is the most cost-efficient means of disposing of AHP Waste, with service costs usually between $150-$250/tonne.

The total disposal cost for AHP Waste in South Australia suggested in Figure 3.3 (below) is between $5 and $7.5 million per annum. For commercial collections of AHP Waste in South Australia, customers could be paying approximately $1.3million/yr. Sanitary and medical waste contribute disproportionately (up to 25%) to collection service costs for AHP Waste. This is despite their relatively small quantities but is due to their high collection costs per tonne.

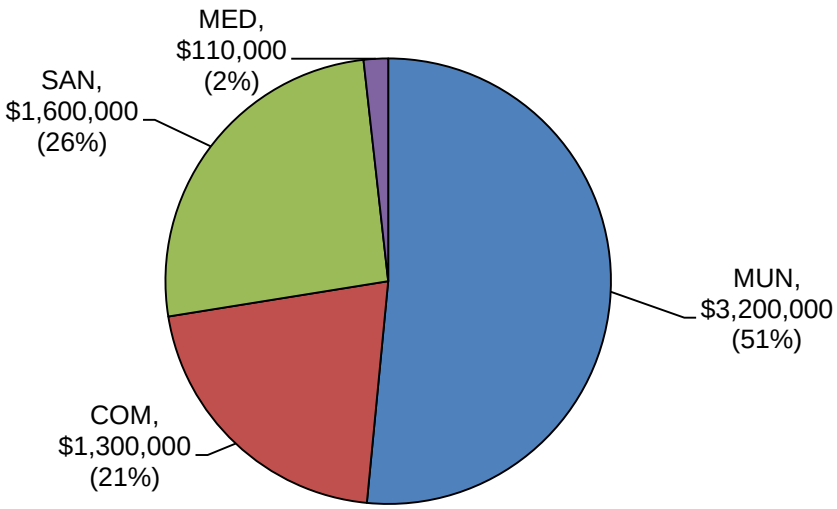


Figure 3.3: Estimated current annual cost for collection and disposal of AHP Waste (mean $ and %) by collection service

Figure 3.4 (below) illustrates how these costs are estimated to be distributed across different AHP Waste sources.

- The total cost of collection and disposal of Feminine Hygiene AHP Waste could be in the order of $1 to 1.5million per annum (or an average of $842 per tonne). This high average cost is caused by use of sanitary collection services for up to 15% of this waste stream.
- The total cost of collection and disposal of Adult Continence and Infant/Child AHP Waste could each be in the order of $2 to $3million per annum (or an average of $150 – 180 per tonne).

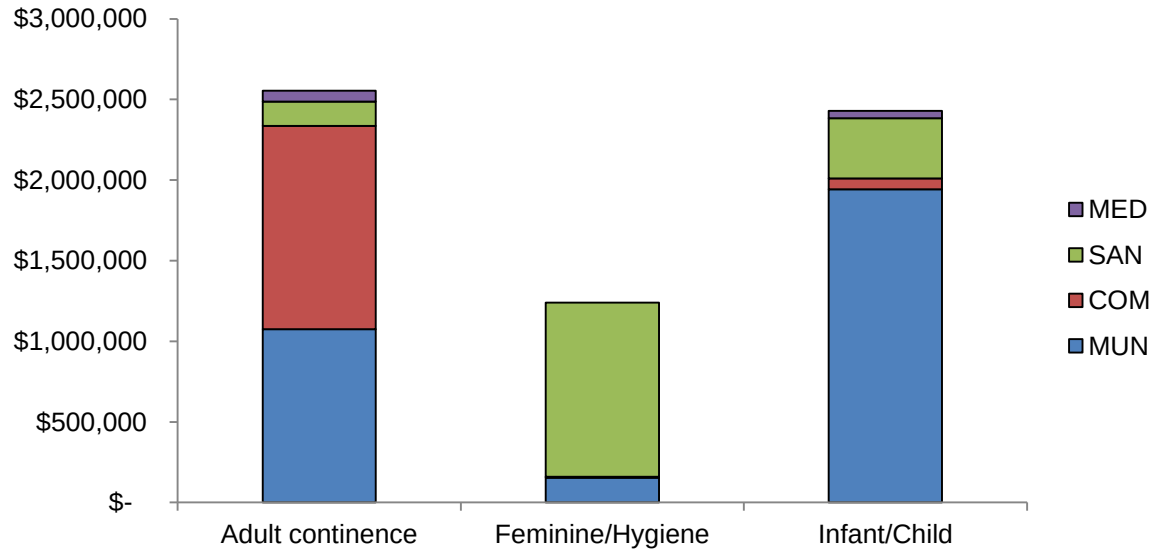


Figure 3.4: Estimated current annual mean cost for collection and disposal of AHP Waste by source classification and service type.

3.2 Future collection & disposal costs

Future collection & disposal costs of AHP Waste in South Australia will depend on the following two factors.

1. Increases in AHP Waste quantities.
    - Total quantities have been projected to increase by up to 15-20%wt (from 2011) or approximately 38,000tonnes/y by 2022 (as described in section 2.2). AHP Waste Disposal costs will rise in line with these greater quantities
2. Higher collection costs ($/tonne) which are expected to increase (in real terms) principally as a result of rises in:
    - South Australia's Solid Waste Levy; and
    - Australian Government's Carbon Price

The Solid Waste Levy is a SA State Government levy paid on all waste disposed of to landfills in South Australia. The levy rate is different for metropolitan and regional areas.

In July 2012, the Solid Waste Levy in the metropolitan area increased from $35 to $42 per tonne. This levy is expected to continue increasing in the coming years, e.g. to $50 per tonne at least by 2015.

- In the next several years, the Solid Waste Levy could add an estimated 10-15% to the current (landfill disposal) cost of Commercial collection services and up to 20% to the (landfill disposal cost) of Municipal collection. This is likely to have a negligible impact on the cost of Medical and Sanitary collection services, due to their already high non-Levy cost components.

The Carbon Price was introduced by the Australian Government and took effect on 1 July 2012. It is a price per tonne on greenhouse gas emissions, which includes such emissions of landfills (which exceed the 25,000 tonnes CO2-e per annum threshold).

Rawtec modelling suggests that the Carbon Price impact could increase landfill disposal costs in metropolitan areas of South Australia by between $12-18 per tonne[4] on current prices. This price impact will increase with time at a rate likely to significantly exceed inflation.

- The Carbon Price therefore immediately adds an estimated 10-15% to the current (landfill disposal) cost of Commercial collection services and up to 20% to the current (landfill disposal) cost of Municipal collection, but again is likely to have a negligible impact on the cost of Medical and Sanitary collection services.
- This price impact will increase over time.

[4] This rate has been calculated based on Rawtec's independent analysis of potential landfill emissions for municipal and commercial & industrial waste following the NGER methodology and analysis assumptions recommended by the Australian Landfill Owners Association (Spedding, 2012) assuming: SA metro landfill capture rates of 40-50%; and cash discount rate of 3%.

4 Absorbent Hygiene Product Resource Value

4.1 Current resource value

The resource value that could be achieved by resource recovery of AHP Waste for beneficial reuse is challenging to estimate as it depends on many factors.

For this study resource recovery end products assumed to estimate resource value are plastics and the residual AHP material. Plastics included separated individual polymers of Polyethylene (PE), Polypropylene (PP) and Poly ethylene-terephthalate (PET); or Mixed plastics stream for additional resource recovery of individual polymers or as a feed stream for Waste-to-energy (WtE). Residual AHP Material was considered as recycled through the composting process or as a feed stream for waste-to-energy (WtE).

Table 4.1 (overleaf) summarises the resource value estimates of these end products which could potentially be resource recovered from AHP Waste in South Australia for the following two scenarios. In addition to the resource recovery value, the landfill disposal and collection costs avoided by the customer were estimated. The avoided cost from landfill is the significant contributor to any resource recovery opportunity.

Scenario 1: 80% of Residential Aged Care facility AHP Waste material

- The scenario assumes that 80%[5] of the available AHP Waste quantities from Adult Continence- Residential Aged Care (RAC) in South Australia could be collected for resource recovery. This was considered the main opportunity behind the conception of this study.
- Table 4.1 suggests that potentially $960,000 in landfill disposal and collection costs could be avoided by the customer under this scenario. In addition, between $40,000 to $80,000/yr of resource recovered end products could be obtained[6].

Scenario 2: All of AHP Waste Material in South Australia

- This scenario, which is not likely to be practically achievable, provides the probable maximum resource value in the AHP Waste material being disposed of in South Australia.
- Table 4.1 suggests that potentially $6.2 million in landfill collection & disposal costs could be avoided by the customer under this scenario. In addition, between $500,000 to $800,000/yr of resource recovered end products might be achievable 6.

This table also includes the costs of landfill disposal for residual material from the plant.

[5] This is a high level estimate of the proportion of this waste stream which could be successfully targeted for resource recovery in SA.

[6] This net resource value includes the cost of paying for disposal of organics for compost.

When considering the feasibility of beneficial reuse of AHP Waste, it would be important to also consider the additional costs involved with transport and collection, plant operation and capital investment. The facility may also be able to generate income from carbon credits for greenhouse gas emissions avoided through diverting AHP Waste from landfill.

Table 4.1: Summary of estimated resource value for AHP Waste in South Australia for two scenarios

Parameter	Units	Scenario 1: AC: (1) RAC @ 80%	Scenario 2: All SA AHP Waste
AHP Waste Collected			
Adult Continence (AC)	tonnes/yr	4,800	15,000
Feminine Hygiene (FE)	tonnes/yr		1,400
Infant/Child (I/C)	tonnes/yr		16,000
End products (resource)			
Plastics			
Quantity	tonnes/yr	110	1,370
Market value			
Individual polymers	$/yr	$36,000	$465,000
Mixed plastics - Resource recovery	$/yr	$16,000	$205,000
Mixed plastics - WtE	$/yr	$14,000	$180,000
AHP Residual Fraction			
Quantity	tonnes/yr	510	3,700
Market Value			
Organic matter for composting	$/yr	-$15,000	-$110,000
WtE	$/yr	$26,000	$190,000
Landfill disposal cost of plant residuals			
Quantity	tonnes/yr	100	870
Market Value	$/t	-$100	-$100
Cost	$/yr	$10,000	$87,000
Landfill collection and disposal cost avoided by customer			
Quantity	tonnes/yr	4,800	32,400
Market Value	$/t	$200	$190
Avoided cost	$/yr	$960,000	$6,160,000

4.2 Future resource value

Future resource value of AHP Waste in South Australia will depend on the following factors.

1. Increases in AHP Waste quantities and associated landfill disposal fees.
2. Potential changes in AHP Waste composition.
3. Likely changes in resource market values.

It has already been noted that AHP Waste quantities are projected to increase by up to 15-20%wt (from 2011) from 2011 to 2022 (refer in section 2.2). Assuming that the resource recovery facility and process was capable of increasing its capacity in line with this growth, the resource value recovered would also rise accordingly.

The composition of AHP Waste is expected to change with introduction of new AHP technology and also competing products such as compostable AHP. It is difficult to accurately predict how these changes in composition will occur.

For example, new AHP technology could reduce the amount of plastics needed for structural integrity or improved superabsorbent materials could decrease organic compostable fraction and/or calorific value for Waste to Energy (WtE).

There is little public information on such new technologies and AHP manufacturers/suppliers were unable to provide their proprietary information on potential new product developments at the current time. Nevertheless, compostable AHP technologies may eventually gain growing traction in the market. Industry seems to define compostable AHP as fully compostable products and hybrid technologies.

Data on market penetration of compostable AHP is not easily identifiable and therefore cannot be reasonably quantified in this study. Based on anecdotal information from AHP manufacturers/ suppliers, market share of compostable AHP is believed to have potential to capture a significant part of the total AHP market between now and 2022, e.g. 30-50%. The majority of this market share will be hybrid-type technologies with fully compostable AHP achieving a minority share (e.g. 5-10%).

This type of technology change could substantially change the average composition of AHP Waste material and its probable resource value. The extent of change in this resource value cannot be predicted with certainty at this time.

Outside of changes in waste composition, the market value of recoverable materials ($/tonne) is likely to change more substantially and quickly.

The value of recycled plastic is expected significantly increase over the next five years as it is petroleum derived material. The value of the organic residual may also improve as the demand for compost increases as a result of climate change impacts. The value of AHP Waste as an alternative fuel source via WtE would also be expected to rise as a result of demand for renewable energy.

Again these future changes cannot necessarily be predicted with certainty at this time but should be factored into the evaluation of any prospective commercial opportunity for beneficial reuse of AHP Waste.

5 Key findings and Next Steps

Current and Future AHP Waste Quantity Summary

1. Current AHP Waste quantities in South Australia are estimated to be between 29,000 and 36,000 tonnes/yr.
2. Infant/Child and Adult Continence sources at 96% (by wt.) constitute the majority of this AHP Waste stream.
3. The majority source of AHP Waste, at approximately 25,000tonnes/yr or 75-80% (by wt.) is generated from domestic/residential (or municipal) sources.
4. The Residential Aged Care component of the AHP Waste stream, is estimated at approximately 6,000 tonnes/yr or 15-20% (by wt.) of the total AHP Waste stream.

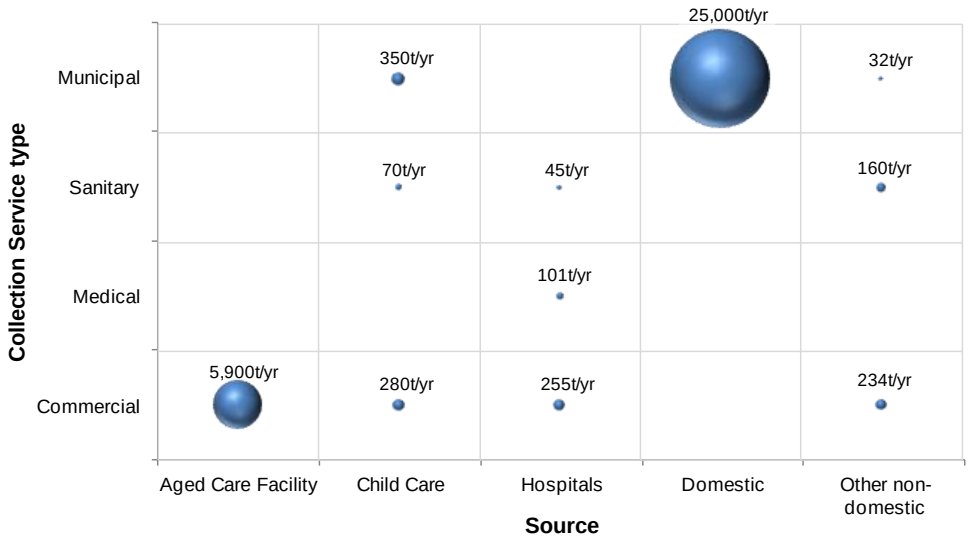


Figure 5.1: Estimated quantities (tonnes per year) by classification and collection service

5. By 2022 total AHP Waste quantities in South Australia are projected to increase by up to 15-20% (from 2011) approximately 38,000tonnes/yr.
6. Adult Continence is predicted to be the major contributor to this growth in South Australia's AHP quantities. Community Care (at Home) and Residential Aged Care sectors are likely to be the key contributors to the growth in Adult Continence AHP Waste quantities.

Collection & Disposal Costs Summary:

1. The disposal route of AHP Waste depends on the type of collection service;
2. The majority (up to 75-80%) of AHP Waste in South Australia is disposed of in the Municipal waste stream via Council kerbside collections.
3. The other significant disposal route of AHP Waste (approximately 6,700tonnes/yr. or 20%) is collected by commercial services.

4. Current collection & disposal costs for landfill disposal of AHP Waste in South Australia are estimated at between $5 and $7.5 million per year;
5. These costs are strongly dependent on the type of collection service.
6. Commercial and municipal collections are the most cost-efficient means of disposing of AHP Waste, with service costs usually between $150-$250/tonne.
7. Relatively higher costs are associated with sanitary and medical collections, where collection cost can be in the order of hundreds up to thousands of dollars per tonne.
8. These costs are expected to increase over time principally as a result of rises in South Australia's Solid Waste Levy and the Australian Government's Carbon Price
9. Over the next five years, the Carbon Price and the Solid waste Levy could each add an additional estimated 10-15% to the current (landfill disposal) cost of Commercial collection services and up to 20% to the current (landfill disposal) cost of Municipal collection

However, these factors would have a negligible impact on the cost of Medical and Sanitary collection services due to their already high cost.

Resource Recovery Value

The resource value of AHP Waste is difficult to estimate because it significantly depends on AHP composition, the resource recovery process and the type and value of end products that are obtained.

In this study, a recovery process yielding the following end products was assumed.

- Plastics for recycling and/or WtE;
- AHP organic residual for composting and/or WtE.

In addition to the resource recovery value, the landfill disposal and collection costs avoided by the customer were also estimated for two scenarios:

- Scenario 1: Resource recovery of 80% of Residential Aged Care facility AHP Waste material
    - Potentially $960,000 in landfill disposal and collection costs could be avoided by the customer under this scenario. In addition, between $40,000 to $80,000/yr of resource recovered end products could be obtained.
- Scenario 2: All of AHP Waste Material in South Australia is collected and resource recovered
    - Potentially $6.2 million in landfill collection & disposal costs could be avoided by the customer under this scenario. In addition, between $500,000 to $800,000/yr of resource recovered end products might be achievable.

Any business case to support alternatives to landfill will be dependent on several key parameters and market tendencies- factors all requiring further investigation. Options which offer longer term, cost-effective and environmentally preferable methods would be expected to receive consumer support. Technologies will vary but those which extract the maximum value with the minimum investment and risk are obviously attractive.

Next Steps

In summary, this report has demonstrated that significant quantities of AHP Waste are currently being disposed to landfill in South Australia at a substantial cost to the environment, individuals, businesses and local government. Despite the obvious barriers, this situation offers an opportunity to potential solution providers from the compost, recycling or waste to energy industries. Of particular relevance is the possibility of focusing on the aged care industry initially with a view to eventually offering broader services.

These potential investors may include existing organisations in South Australia involved with collection and resource recovery of similar materials or other organisations with proven or emerging technology in recovery of AHP Waste.

6 Acknowledgements

Rawtec, Zero Waste SA and AHPRGSA would like to recognise and thank the following organisations that that contributed support, data and/or market intelligence to this study. The list below does not indicate all organisations that contributed but those that agreed to be recognised.

- Blackwood Community Childrens Centre and Preschool
- Department of Foreign Affairs & Trade
- Directed Resources
- KESAB environmental solutions
- Kimberly-Clark Australia
- Mike Ritchie & Associates
- Relivit
- Resthaven Incorporated
- SA EPA
- SCA Hygiene Australasia

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Appendix 1: AHP Waste Classifications and Types of Collection Services

Table A1.1 AHP Waste source classifications and sub-classifications

Classification	Sub classification (Waste Source)	Description
Adult Continence	Residential aged care (facility)	Adult AHP Waste produced by persons at Residential Aged Care (RAC) facilities.
	Community care (at home)	Adult AHP Waste produced by persons at home that are recipients of Home and Community Care (HACC), Community Aged Care Package (CACP), Extended Aged Care at Home (EACH), Multi-Purpose Services (MPS), National Aboriginal and Torres Strait Islander Aged Care Program (ATSI), Consumer Directed Care (CDC)
	Adult domestic/ residential	Adult AHP Waste produced by persons at home (excluding persons receiving Community Care (at home)).
	Medical facilities/ hospitals	Adult AHP Waste produced by patients at hospitals.
	Mental health/disability	Adult AHP Waste produced by persons with a disability (as defined by the ABS (Australian Bureau of Statistics, 2009)) at facility or non-private dwelling.
Feminine Hygiene	Domestic/ residential	Feminine AHP Waste produced by persons at home.
	Commercial - retail	Feminine AHP Waste produced by staff and customers at retail facility.
	Commercial - workplace	Feminine AHP Waste produced by staff at the workplace.
	Hospitals	Feminine AHP Waste produced by staff and patients at hospitals.
	Schools	Feminine AHP Waste produced by staff and students at secondary schools.
	Higher Education	Feminine AHP Waste produced by staff and students at tertiary education facilities.
Infant/Child	Child care facilities	Infant/child AHP Waste produced by persons at child care facilities.
	Domestic/residential	Infant/child AHP Waste produced by persons at home.
	Supported accommodation	Infant/child AHP Waste produced by persons at supported accommodation facilities (institution accommodation) (for homelessness).
	Hospitals	Infant/child AHP Waste produced by persons at hospital.

Table A1.2 AHP Waste Collection Service Types

Type of Collection Service	Description
Municipal (MUN)	AHP Waste generated from domestic/residential and small business sources will most likely be collected in the local government general waste kerbside collection.
Commercial (COM)	Larger businesses, including residential aged care facilities, hospitals and child care centres, will usually receive commercial collection services due to the larger quantity of waste, including AHP Waste, which is generated. The AHP Waste may have separate bins or be mixed with general waste.
Sanitary (SAN)	These are specialised services, usually for collection of feminine hygiene waste, but also used by some hospitals and childcare centres to manage some other AHP Waste streams. The specialised services can be considerably more expensive than other services due to smaller collection quantities, specialised bins and higher handling and transport costs.
Medical (MED)	These are also specialised services most commonly used by hospitals for management of medical waste, and due to convenience, also AHP waste. These services can also be considerably more expensive because disposal involves specialised treatment, e.g. autoclaving and incineration.

Appendix 2: Project methodology

This section provides a high level discussion of the methodology used for estimating current and future AHP waste quantities, disposal costs and the value of recovered materials. This approach was developed in consultation with the Project Steering Committee.

A2.1 Market intelligence & other data sources

Market intelligence and other relevant data were collected through a mix of desktop research and direct industry consultations.

Direct industry consultations included AHPRGSA members, relevant industry organisations and major product suppliers and/or manufacturers. A number of face-to-face stakeholder site visits and meetings were also undertaken for this purpose, including visits to residential aged care facilities, a hospital and a child care centre.

To facilitate data collection for this study, it was agreed with Zero Waste SA and AHPRGSA that data collected from industry and product suppliers and/or manufacturers for this project would be regarded as confidential, and therefore, would not be directly disclosed in this report.

Confidential industry data collected during the study was used to inform and develop assumptions made around AHP unit weights, quantities and compositions, and AHP consumption rates (units per consumer per day/month). Confidential market information from product suppliers and/or manufacturers on AHP sales volumes was used to verify and/or reality check our estimates. Confidential industry data was also used to inform and assess waste disposal costs and AHP Waste resource values.

Desktop research was used to source a range of other relevant data, including demographic data and prevalence of AHP consumption by certain demographic groups. This data was used to estimate the number of potential AHP consumers in various source classifications. It was also used to project future changes in AHP consumption, and therefore, AHP Waste generation. The Reference section to this report contains a complete list of relevant publicly available data and reports that were relied on for the purpose of this study.

Sources of data used in this study were separately documented in a discussion paper presented to the Project Steering Committee. (This discussion paper included confidential industry data, and thus, is not included with this report).

A2.2 Current AHP Waste quantity estimates

This section summarises the approach that was adopted to estimate current AHP Waste quantities for each source classification.

In brief the estimate of current AHP Waste quantity was determined according to the following formula.

$$AHP\ Waste\ volume = No.of\ consumers \times Consumption\ rate \times Unit\ weight \quad \text{Eq. (1)}$$

The input parameters in the above formula are briefly described below. The values for these input parameters were derived from industry and other relevant data. A list of these input parameter values for each source classification is included in Appendix 3.

Please note that the descriptions below provide only an overview of each input parameter. There was considerable analysis and assessment required to derive the values for each input parameter, including reference to industry data, which cannot or is able to be presented in this summary report.

A2.2.1 No. of consumers

No. of consumers referred either to the number of equivalent persons or events consuming the AHP. For example:

- In the case of Feminine Hygiene - Domestic/Residential AHP Waste, this input parameter was the estimated number of females in South Australia aged between 12.5 and 50 consuming feminine AHP at home.
- For Adult Continence– Hospitals AHP Waste, this input parameter was the estimated number of 'separations[7]' in South Australia that involved use of AHP for urinary and faecal incontinence.

This input parameter was usually derived and/or inferred from a diverse range of relevant published data, including the following sources.

- Demographic data
    - Australia's and South Australia's resident population by sex and age (Australian Bureau of Statistics, 2012);
    - Number of Residential Aged Care places and Community Care (at Home) places in South Australia
        - Number of Residential Aged Care places in South Australia (Australian Department of Health and Ageing , 2011)
        - Number of Community Aged Care Package (CACP), Extended Aged Care at Home (EACH), Multi-Purpose Services (MPS), National Aboriginal and Torres Strait Islander Aged Care Program (ATSI), Consumer Directed Care (CDC) places in South Australia (Australian Department of Health and Ageing , 2011)
        - Number of Home and Community Care (HACC) places in South Australia (eGovernment, 2012)

[7] Separation is the term used to refer to the episode of admitted patient care, which can be a total hospital stay (from admission to discharge, transfer or death) or a portion of a hospital stay beginning or ending in a change of type of care (for example, from acute to rehabilitation). (Australian Institute of Health and Welfare, 2010).

    - Number of separations across hospitals in South Australia (Australian Institute of Health and Welfare, 2010)
    - Number of persons in South Australia with a disability and living in a non-private dwelling (Australian Bureau of Statistics, 2009)
    - Number of children in child care in South Australia (Australian Bureau of Statistics, 2011)
    - % of children born in hospital in Australia (Homebirth Australia, 2009)
    - Number of female persons in South Australia that are employed (Australian Bureau of Statistics, 2012)
    - School attendance rates for females in Australia (Australian Bureau of Statistics, 2011)
    - Number of female persons (FTE) employed at a secondary school in South Australia (Australian Bureau of Statistics, 2011)
    - Number of female persons enrolled in non-school qualification (Australian Bureau of Statistics, 2011)
    - Number of children in supported accommodation for the homeless (Australian Institute of Health and Welfare, 2006)
    - Number of female persons employed in retail trade (Australian Bureau of Statistics, 2012)
    - Number of female persons that work at a hospital in Australia (Australian Bureau of Statistics, 2006)
- Data on use of infant/child nappies (Environment Agency (UK), 2008)
- Data on prevalence of adult incontinence and/or use of adult AHP for the following population sectors:
    - Households (Australian Institute of Health and Welfare, 2006)
    - Persons in Residential Aged Care (Continence Foundation of Australia, 2011)
    - Recipient of CACP, EACH, HACC (Continence Foundation of Australia, 2011)
    - Persons with a disability (Australian Bureau of Statistics, 2009)
    - Persons in acute hospital care (Ryan, 2008)

A2.2.2 Consumption rates

The consumption rate refers to the average number of AHP units consumed per consumer per unit of time (which was either day or month).

For example:

- In the case of Infant/Child - Child Care AHP Waste, the input parameter was the average number of Infant/Child AHP units consumed per consumer at a child care facility per day.
- For Feminine Hygiene – Domestic/Residential AHP Waste, the input parameter was the average number of Feminine Hygiene units consumed per consumer at home per month.

Consumption rate values for AHP Waste classifications were derived and/or inferred from analysis of confidential industry and published data.

Note: These consumption rates are presented as an annualised average rate (i.e. the number of AHP units consumed per month or day averaged over the period of one year).

- To illustrate using the example of Infant/Child –Child Care AHP Waste provided above, the average consumption rate is equal to 1.2 nappies per day. This value should be interpreted as '*on average over the period of one year, a child attending child care will consume 1.2 nappies per day (or 438 nappies per year) at the child care facility.'*

These consumption rates were annualised based on analysis of confidential industry data and the following selected published data.

- Average hours spent in childcare per week (Australian Bureau of Statistics, 2011)
- Average length of stay for patient in hospital (Australian Institute of Health and Welfare, 2010)
- Average hours spent at work per week for female persons in Australia (Australian Bureau of Statistics, 2012)
- Average hours spent at home per week for female persons in Australia (Australian Bureau of Statistics, 2006)
- Average hours spent at educational facility per week for female persons in Australia (Australian Bureau of Statistics, 2006)
- Average hours spent shopping per week for female persons in Australia (Australian Bureau of Statistics, 2006)

A2.2.3 Unit weights

The unit weight refers to the average weight per AHP Waste unit disposed of for collection. This unit weight took into account both the raw AHP unit weight and the additional weight of human waste, which together constituted the total AHP Waste unit weight. The ratio of human waste to raw AHP unit weight was inferred from confidential product data provided by industry sources.

For the purpose of this study, these AHP Waste unit weights were assumed to be constant for each main source classification – see Table A2.1 (below).

Table A2.1: Assumed AHP Waste unit weights used to estimate AHP Waste quantities in South Australia

Source Classification	AHP Waste unit weight (g/unit)
Adult Continence	560
Feminine Hygiene	19
Infant/Child	200

A2.3 Error Analysis

The assumptions made in the above estimation realistically involved a degree uncertainty in the values of each input parameter. The likely error in each input parameter value was estimated. These error estimates were used to predict the total error in the estimated AHP Waste quantity. The method used to make this prediction was by Monte-Carlo simulation technique. This technique involved fitting a statistical (triangular) distribution to each input parameter value, then conducting multiple trials where input parameter values were randomly generated, to predict the resulting distribution in estimated AHP Waste quantity. From this distribution, the potential range of uncertainty in the estimated AHP Waste quantity was inferred (usually from the 10^{th} and 90^{th} percentile value of the aforementioned distribution).

A2.4 Projections

Future projections of AHP Waste quantity were undertaken using Eq. (1) but with input parameters adjusted according to the following assumptions.

- No. of consumers were assumed to change in line with future demographic changes according to:
    - Established projections by the Australian Bureau of Statistics (Australian Bureau of Statistics, 2008)
    - For Residential Aged Care, according to data published by the (Productivity Commission, 2008).
- Consumption rates were assumed to remain constant with the exception of Residential Aged Care where relative changes between low and high care places were taken into account.
- Unit weights were assumed to remain constant.

Error analysis was also undertaken for future projections following the same approach described in Section A2.3.

7.1 A2.5 Disposal or collection costs

Disposal or collection costs were considered an important commercial factor related to future viability for resource recovery of AHP Waste for beneficial reuse in South Australia. These costs are paid by customers to have AHP Waste collected and disposed of – currently to landfill – from their premises. Customers should otherwise seek to reduce or avoid these landfill disposal costs by instead sending AHP Waste for resource recovery.

As a consequence, the types of collection services currently in place for collection of AHP Waste from various source classifications were identified. The costs of these collection services, estimated from confidential industry data, were used to determine the total cost of AHP Waste collection to customers in South Australia.

A2.6 Recovered value

Another major commercial factor in the future viability of resource recovery of AHP Waste would be the value of the resource which could be recovered. This resource value is challenging to estimate because it significantly depends on AHP composition, the resource recovery process and the value of end products that are obtained. In order to make a rational initial estimate of South Australia's AHP Waste resource value the following assumptions were made. *Appendix 4 includes further discussion of these assumptions. These assumptions were derived from confidential industry data and Rawtec's own proprietary industry knowledge.*

- AHP Waste Composition – Compositions of AHP and ratios of AHP raw product waste to human waste for each AHP Waste classification (Adult Continence, Feminine Hygiene and Infant/Child) were based on confidential industry data.
- Resource Recovery Process – The resource recovery process was assumed to yield the following end products. *Note: not all AHP constituents would be successfully recovered in these end products and would be otherwise be disposed to sewer or landfill as by products.*
    - Plastics – Plastics constituents separated out to yield the following potential end products. It was assumed that 80% of plastic constituents in the AHP waste could be recovered as these plastic end product(s).
        - Individual polymers of Polyethylene (PE), Polypropylene (PP) and Poly ethylene-terephthalate (PET) which could be directly recycled; or
        - Mixed plastics stream, which could be sent:
            - For additional resource recovery of individual polymers;
            - As a feed stream for Waste-to-energy (WtE)
    - Residual AHP Material –Additionally processed to separate out organic fraction, remove residual plastic &/or contaminants, then dewatered, to be sent for the following potential beneficial reuses. It was assumed that up to 90% of the AHP organic components in the AHP Waste could be recovered as this Residual AHP Material.
        - Compost
        - Waste-to-energy (WtE)
- Resource value – Table A2.2 (overleaf) summarises the market value assumed for the above end products.
    - Note: For beneficial reuse of the Residual AHP Material as compost, the market value is shown as be negative because it is expected that the composter will require payment to accept this material.

Table A2.2: Summary of assumed resource market values

Resource	Value
Individual polymers	$/tonne
PE	$300
PP	$350
PET	$300
Mixed plastics	
Resource recovery	$150
WtE	$130
AHP Residue	
Organic matter for composting	-$30
WtE	$50

Appendix 3: AHP Waste Parameter Values

Table A3.1 Parameter mean values adopted to estimate current AHP Waste quantities

Waste Management System	AHP waste classification	Est. quantity (tpa)	Est. no. of units p.a. ('000)	Estimated no. of consumers	Estimated average annual consumption rate	
					units per consumer	*time period*
ADULT CONTINENCE						
COM	Residential Aged Care	5,900	10,600	12,200	2.38	*per day*
MED, SAN, COM	Hospitals	300	500	88,800	0.02	""
MUN	Mental health/disability facilities	200	300	500	1.99	""
MUN	Adult domestic/residential	3,800	6,700	18,900	0.98	""
MUN	Community care (at home)	4,800	8,500	11,700	1.99	""
	All Sub Categories	**15,000**	**26,600**	**NA**	**NA**	""
FEMININE HYGIENE						
MUN	Domestic/Residential	1,200	64,300	417,800	12.8	*per month*
	Commercial - retail					
SAN, COM, MUN	a. customers	4	240	417,800	0.05	"
SAN, COM, MUN	b. staff	21	1,100	37,000	2.59	"
	Sub total	25	1,300	NA	NA	"
SAN, COM, MUN	Commercial - offices	190	10,365	270,100	3.20	"
	Hospitals					
SAN	a. patients	3	190	125,400	0.12	"
SAN	b. staff	7	380	9,800	3.20	"
	TOTAL	10	570	NA	NA	"
	Schools					
SAN	a. students	30	1,570	55,200	2.37	"
SAN	b. staff	5	270	6,700	3.35	"
	TOTAL	35	1,840	NA	NA	"
	Higher education facilities					
SAN	a. students	10	550	78,300	0.58	"
SAN	b. staff	3	140	3,800	3.20	"
	TOTAL	13	690	NA	NA	"
	All Sub Categories	**1,400**	**77,200**	**NA**	**NA**	"
INFANT/CHILD						
MUN, SAN, COM	Child care	700	3,700	8,300	1.2	*per day*
MUN	Domestic/Residential	15,100	75,800	78,300	6.1	""
MUN	Supported accommodation	6	30	50	2	""
MUN, SAN, COM	Hospitals	90	430	19,000	0.06	""
	All Sub Categories	**16,000**	**79,960**	**NA**	**NA**	""
ALL AHP CATEGORIES						
	TOTAL - All categories	**32,400**	**183,800**	**NA**	NA	NA

Appendix 4: Explanatory Comments- Value of Recovered AHP waste

A4.1 Introduction

This appendix provides additional explanatory information related to estimates of resource value presented in this report.

A4.2 Important factors in AHP Waste material value determination

A4.2.1 AHP Waste Composition

A4.2.1.1AHP Composition

The composition of the unused AHP will principally dictate what valuable materials might be available for resource recovery.

This composition would reasonably be expected to vary depending on the AHP type, manufacturer and intended application. These compositional differences could also reflect different AHP technologies, source materials and/or product designs being used by manufacturers.

For example, Figure A4.1 (overleaf) gives examples of typical composition that were observed for (unused) Adult Continence (AC), Feminine Hygiene (FE) and Infant/Child (I/C) AHP units. There appears to be substantial differences in composition between these product categories, particularly in terms of the plastic composition.

There is also considerable variation in AHP composition within this a given product category (e.g. Adult Continence).

In short, different AHP can contain significantly more or less of certain materials, which will affect the resource value practically achievable.

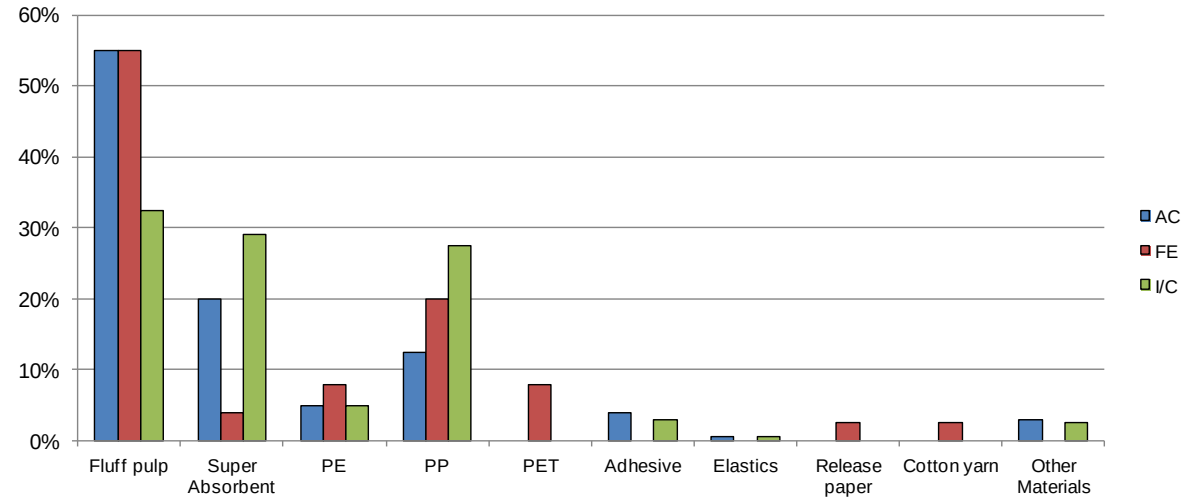

Figure A4.0.1: Example of typical variation in composition of between product categories: Adult Continence (AC), Feminine Hygiene (FE) and Infant/Child (I/C)

A4.2.1.2Human Waste Contribution

In addition to the materials in the AHP unit, AHP waste presents with substantial content of human waste after it is disposed. This human waste component of AHP waste will also vary across AHP category and the individual AHPs within a given AHP category.

Based on the information provided for this study by AHP suppliers and manufacturers and derived from analysis of data from waste audits and other sources, Figure A4.3 (overleaf) gives the percentage of human waste we have assumed as present during disposal of AHP waste relative to the weight of the unused AHP unit. These assumptions have been based on a mass balance approach. As can be observed, we have assumed ca. 80-85% human waste weight as typical Adult Continence and Infant/Child AHP, and ca. 65% for Feminine Hygiene products.

It is interesting to note that these assumptions could appear to be at odds to published data found in some sources. For instance, Figure A4.4 (overleaf) shows data from a study commissioned by Knowaste (Knowaste, 2011), which suggests the breakdown of AHP waste material into its individual constituents. It projects water composition at only 47%, which might be expected as higher if human waste constituted up to 80% of the AHP waste when disposed. However, it is unclear whether this data represents the water extractable, as some may be bound with other components when analysed, or if this is after some form of processing, where water content may have been removed.

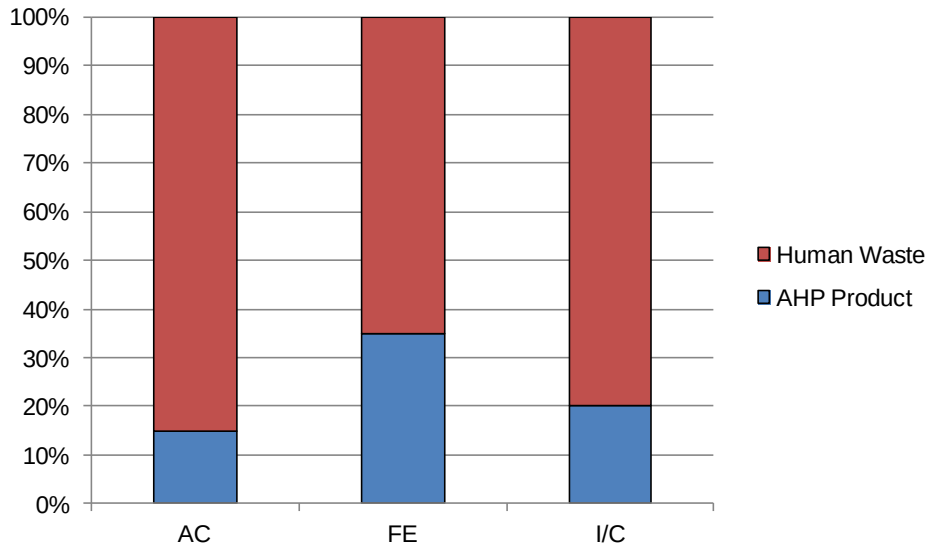

Figure A4.3: Assumed content of human waste present when AHP disposed of as a waste item

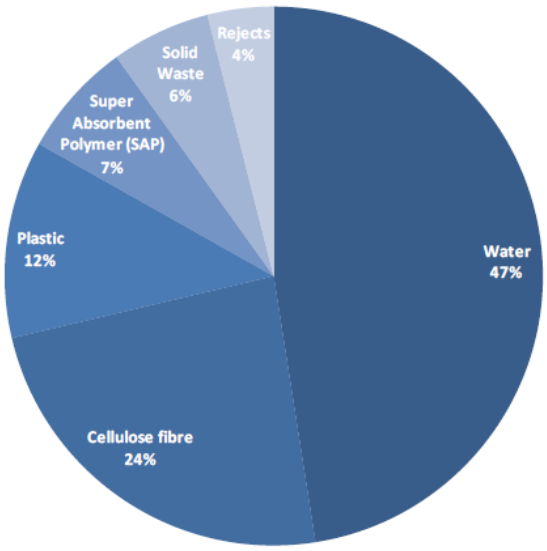

Figure A4.4: Project breakdown of AHP waste materials in AHP according to Deloitte study for Knowaste Ltd

A4.2.2 Resource Recovery Process

A4.2.2.1Process type & resulting end products

The type of re-processing will affect what form the materials are recovered in, which will in turn affect suitability for beneficial reuse and their potential market value. For example, we reasonably expect that one approach to re-processing of AHP waste could involve the following steps.

- Sterilisation by heating or autoclave
    - This will not change the composition substantially, but could lead to changes in water content and/or thermal degradation of some components

- Washing and chemical treatment
    - Washing would remove any residual organic waste and chemical treatment would help break down adhesive materials and allow material layers and/or constituents to separate
- Plastics removal and further processing
    - The plastics would be separated out and sent to further processing which may involve separation of individual polymers, filtering, washing and/or pellitisation.
    - The final end products from this step, depending on the type and extent of further processing, could include:
        - Individual polymers of PE, PP and PET
        - Mixed plastics stream, which could be sent for:
            - Additional resource recovery of individual polymers;
            - Feed stream for Waste-to-energy (WtE)
- Residual
    - The residual AHP material would be additionally processed to remove residual plastic &/or organic material, then dewatered.
    - This dewatered end product could then be used as feed streams for:
        - Compost
        - Waste-to-energy (WtE)

From the above, there are potentially various products which could have different resource values depending on the extent of re-processing undertaken.

For the purpose of this resource evaluation, we have assumed the above re-processing and type of end products. However, we also note that there are also other potential re-processing approaches for beneficial reuse which could yield other end products which would have different resource values. For example, all of the AHP waste could be subject to energy recovery by pyrolysis, yielding various liquid and gas end products which would have their own intrinsic value depending on how they were beneficially reused.

A4.2.2.2Resource recovery performance

Not all of the material present in the AHP waste will necessarily be 100% recoverable by a resource recovery process. This will reduce the quantity of material, and thus the total resource value, able to be extracted.

A4.2.3 Resource Values

Table A4.1 (below) summarises resource values adopted for the various potential end products identified for the assumed re-processing of the AHP waste in the previous section. The following provides some brief explanatory notes.

- For individual polymers and mixed plastics stream to resource recovery, these are based on market prices likely to be paid in South Australia.
- For end-product to compost, this is the gate rate for acceptance of this material by a composter.
    - As can be observed, this resource value will most likely be negative as composters will not pay or accept it for free.
- For end-product use as WtE, the resource value assumes on-site electricity generation.
    - This resource value takes into account:
        - Likely calorific value;
        - Efficiency of electricity generation from the AHP waste material;
        - Potential market value of electricity generated assuming that this activity is an eligible renewable energy source for creation of renewable energy certificates under the Australian Government's Renewable Energy (Electricity) Act 2000.

Table A4.1: Summary of assumed market resource values

Resource	Value
Individual polymers	$/tonne
PE	$300
PP	$350
PET	$300
Mixed plastics	
Resource recovery	$150
WtE	$130
AHP Residue	
Organic matter for composting[8]	-$30
WtE	$50

[8] There would most likely be a cost associated with composting AHP residue through current commercial composting processors, hence a negative resource value.

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Document Status

Revision	Date	Prepared by	Checked by	Approved by
Draft	12/11/12	K Heinrich/ C Colby	C Colby	C Colby
Draft V2	30/11/12	K Heinrich/ C Colby	C Colby	C Colby
Final	21/1/13	K Heinrich/ C Colby/M Rawson	M Rawson/K Heinrich	M Rawson