JACOBS

Memorandum

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Subject	**Reference plant waste composition**	**Project Name**	AP EfW Project
Attention	Roger Winders	**Project No.**	RO097400
From	David Harridge		
Date	16 May 2018		
Copies to	Greg Hannah, David Jettner		

1. Background

Australian Paper (AP) submitted a Works Approval Application (WAA) to EPA Victoria on 24 April 2018 for an Energy from Waste (EfW) Project to be constructed at AP's Maryvale Pulp and Paper Mill. On 10 May 2018, EPA requested further information with regard to the composition of waste processed at reference plants in order to compare that to the proposed EfW Plant. The following paragraph is the EPA's request for further information:

"Category specific composition and chemical composition of the waste that is processed at reference plants. As per the response to #4, #6 and 7#, AP have indicated that the waste cannot be collected in Victoria in time to support the application. However, the application needs to include information from the reference facilities that can be compared to the modelled waste composition and the design waste. That will give the authority confidence that the plant can process the Victorian MSW. This was asked from AP in the response to the draft works approval."

This Memo provides a response to EPA's above query regarding reference plant waste composition and contains information provided by Suez Environment.

2. Waste input composition – Suez Suffolk EfW Plant, UK

Reference plant information has been obtained from Suez, particularly referencing their Suffolk EfW Plant in the UK. The Suffolk plant is very similar to the proposed AP EfW Plant in terms of the plant design and also in terms of the primary input being residual MSW without pre-treatment.

MSW for the Suffolk plant is sourced from seven district and borough councils in Suffolk County. The MSW utilised by the Suffolk plant is derived predominantly from household waste collection (~85%) with the remainder being sourced from MSW-like C&I waste. This is considered to be very similar to what is expected in the Melbourne and Gippsland MSW for the AP EfW Project.

The category specific composition of the Suffolk MSW is shown in the table(s) below.

Table 1: Suffolk Waste Composition Analysis Results (General rubbish bin) 2016[1]

Material	Sub-categories	KG per Household per Fortnight	Tonnes of Suffolk Household Waste per Year	% Proportion of Waste
PAPER	Newspaper & magazines	0.13 KG	1151 T	0.81%
	Catalogues, Directories, Books	0.04 KG	324 T	0.23%
	Junk Mail, Envelopes, All Other Recyclable Paper	0.15 KG	1349 T	0.95%
	Kitchen Towels / Paper tissue	0.55 KG	4794 T	3.36%
	Shredded paper	0.03 KG	222 T	0.16%
	Other non-recyclable paper	0.12 KG	1024 T	0.72%
CARD	Tetrapak cartons	0.03 KG	292 T	0.20%
	Corrugated Cardboard	0.09 KG	796 T	0.56%
	Thin packaging card	0.18 KG	1547 T	1.08%
	Thin non-packaging card	0.02 KG	143 T	0.10%
	Non-recyclable card	0.08 KG	696 T	0.49%
PLASTIC FILM	Packaging film	0.63 KG	5526 T	3.87%
	Carrier Bags	0.1 KG	900 T	0.63%
	Refuse Sacks	0.1 KG	843 T	0.59%
	All other film	0.02 KG	139 T	0.10%
DENSE PLASTIC	All Plastic Bottles	0.15 KG	1350 T	0.95%
	All Polystyrene & Blister Packs	0.03 KG	294 T	0.21%
	Recyclable Food packaging tubs, pots, trays & punnets	0.22 KG	1951 T	1.37%
	All Other Plastic Packaging Containers	0.07 KG	642 T	0.45%
	All Other dense plastic	0.33 KG	2915 T	2.04%
TEXTILES	All clothing & Shoes	0.42 KG	3626 T	2.54%
	Accessories	0.04 KG	330 T	0.23%
	Carpet & underlay	0.1 KG	844 T	0.59%
	Clean bed linen, curtains, blankets & towels	0.08 KG	682 T	0.48%
	All other textiles & All stuffed fabrics	0.11 KG	954 T	0.67%
MISC COMBUSTIBLES	Furniture waste	0 KG	0 T	0.00%
	DIY based materials	0.12 KG	1017 T	0.71%
	All Wood	0.36 KG	3111 T	2.18%
	Disposable Nappies	0.98 KG	8566 T	6.00%

[1] Suffolk Waste Composition Analysis Results (General rubbish bin) 2016, http://www.greensuffolk.org/assets/Recycling/Where-It-Goes/What-goes-in-your-general-bin/2016-Suffolk-Waste-Compostion-Analysis-Results-v2.pdf

	All incontinence & absorbent hygiene products	0.39 KG	3415 T	2.39%
	All other	0.69 KG	6071 T	4.25%
MISC NON-COMBUSTIBLES	Plasterboard	0 KG	0 T	0.00%
	DIY rubble & cereamics	0.68 KG	5931 T	4.16%
	All other inc Pet Litter non-organic	0.48 KG	4195 T	2.94%
GLASS	Green packaging	0.13 KG	1128 T	0.79%
	Brown packaging	0.08 KG	680 T	0.48%
	Clear bottles	0.26 KG	2249 T	1.58%
	Clear jars	0.25 KG	2168 T	1.52%
	Other glass	0.06 KG	503 T	0.35%
FERROUS METAL	Drinks cans	0.01 KG	79 T	0.06%
	Food cans & tins	0.1 KG	835 T	0.59%
	Aerosols	0.01 KG	117 T	0.08%
	Other ferrous packaging inc jar lids	0.01 KG	59 T	0.04%
	Other ferrous	0.13 KG	1143 T	0.80%
NON-FERROUS METAL	Drinks cans	0.05 KG	468 T	0.33%
	Food cans & tins	0 KG	22 T	0.02%
	Aerosols	0.02 KG	135 T	0.09%
	Aluminium foil & trays	0.08 KG	697 T	0.49%
	Other non-ferrous	0.03 KG	232 T	0.16%
GARDEN WASTE	Flora organics	0.84 KG	7371 T	5.17%
	Soil & turf	0.15 KG	1307 T	0.92%
PUTRESCIBLES	All fully packaged & unopened Home Compostable food waste	0.58 KG	5091 T	3.57%
	All fully packaged & unopened Non-Home Compostable food waste	1.65 KG	14443 T	10.12%
	All Loose Home Compostable food waste - Unused	1.99 KG	17404 T	12.20%
	All Loose Non-Home Compostable food waste - Unused	1.39 KG	12103 T	8.48%
	All Mixed unsortable Food Waste	0.24 KG	2131 T	1.49%
	Herbivorous Pet Straw & Sawdust Bedding	0.14 KG	1263 T	0.89%
	Consumable Liquids, Fats & Oils	0.16 KG	1370 T	0.96%
FINES	Particles passing a 10mm screen	0.26 KG	2251 T	1.58%
HHW	Household Batteries	0.01 KG	104 T	0.07%
	Other Separately listed	0.08 KG	708 T	0.50%
WEEE	Separately listed	0.11 KG	990 T	0.69%
TOTAL		16.33 KG	142691 T	

The elemental composition of the Suffolk MSW is shown in the table below.

Table 2: Chemical composition of Suffolk MSW

Chemical component	Percentage of waste (wt % as received)
Ash	23.56
Water	27.39
Carbon	25.71
Hydrogen	3.68
Oxygen	18.48
Nitrogen	0.61
Sulfur	0.16
Chlorine	0.41
Total	100

3. Pollution control system – Suez Suffolk EfW Plant, UK

The pollution control system in operation at the Suffolk Plant consists of the following key plant items:

- Selective non-catalytic reduction (SNCR) of oxides of nitrogen
- Reactor system with lime and activated carbon dosing
- Bag house for ash and particulates
- APCr collection
- Bottom ash collection

The control of emissions to air starts in the furnace with good combustion control to make sure the correct proportion of air is supplied and temperature is maintained. This aids a consistent combustion process that produces a steady energy output and minimises pollutant generation.

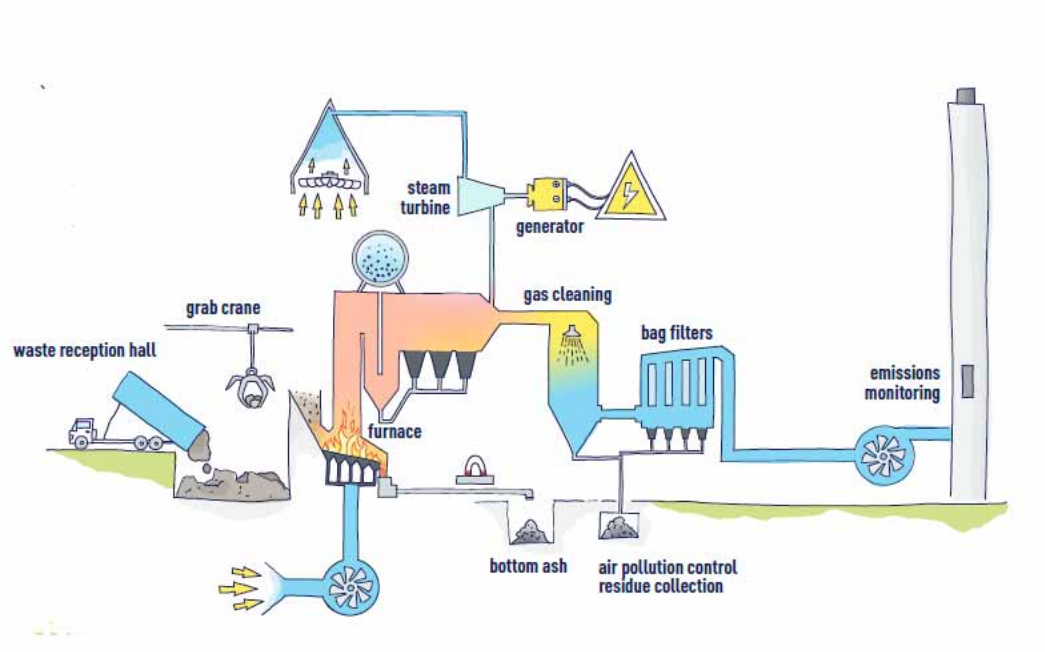
The combustion gases from the furnace are subject to a rigorous cleaning process to strip the eventual exhaust gases of the bulk of pollutants. Nearly one-third of the facility (in terms of plant size) is taken up by the cleaning process, which involves spraying urea, activated carbon and lime into the flue gases to reduce and neutralise any pollutants.

A Continuous Emissions Monitoring System (CEMS) is installed at the base of the stack and continuously checks emissions levels of pollutants being exhausted out of the stack. There are process engineering control feedback loops that help control the emissions to air where the emissions monitoring data is fed back to the overall control system. If pollutant levels start to rise towards IED limits, adjustments are made to the cleaning process. For example, dosing with urea, lime or activated carbon can be increased to remove more pollutants. In the unlikely event that pollutant levels continue to rise or if the monitoring equipment fails, the plant will automatically shut down.

The cleaned gases are passed through fine-fabric bag filters to remove solid particles. The resultant Air Pollution Control residues (APCr), also known as fly ash, contains these solid particles, excess lime, salts and carbon dust. The APCr is collected in dedicated silos within an enclosed building. It is taken away from site in sealed containers to a specialist landfill, although it is hoped in the future it will be used for low-carbon building blocks.

Bottom ash left on the grate after incineration is cooled and carried along a conveyor to an on-site processing building. Metals are removed from the ash for recycling. Metals that pass through the boiler are effectively cleaned by the combustion process as the coatings and other materials that cover the metals are volatilised in the boiler. This makes the metals easier to separate (into ferrous and non-ferrous fractions) and to recycle. This is a more efficient process than recycling metals from the MSW stream prior to combustion. The remaining aggregate from the bottom ash is graded according to size and sent for recycling in products such as road base and concrete filler for use in building and construction projects.

Figure 1: Schematic of the Suffolk EfW Plant and pollution control system



4. Emissions (air and solid waste) – Suez Suffolk EfW Plant, UK

Emissions to air and management of solid waste are regulated by the IED limits and the site's Operating Licence. The Environment Agency and SUEZ monitor the facility to ensure it operates within the conditions set out by the licence. The emissions to air are monitored on a continuous basis and reported publicly on a periodic basis. The discharge limits compared to the licence limits are shown in Table 3.

Table 3: Suffolk EfW Plant emissions performance for 2016[2]

	Licence limit Daily average per line (mg/m³)	Line one Daily average (mg/m³)	Line two Daily average (mg/m³)
Particles	10	1.46	2.00
Carbon monoxide	50	5.35	6.20
Sulphur dioxide	50	22.00	16.75
Hydrogen chloride	10	4.43	4.31
Oxides of nitrogen	200	162.00	164.00
Total organic carbon	10	0.43	0.59

The table shows that the daily average licence limits for all parameters are met comfortably for both lines of the plant.

A Bottom Ash Recovery Facility cleans the resulting bottom ash (on site), which is then exported as raw materials for sale or reuse as road base and building products. In 2016, over 10,500 tonnes of metal was extracted for recycling and 49,830 tonnes of bottom ash was recycled as aggregate for building projects. With this bottom ash reuse and recycling, the Suffolk plant was able to process, reuse or recycle 97.5% of the incoming MSW.

5. Comparison with the AP EfW Plant

5.1 Waste composition

The AP EfW Project Team has sourced waste composition data from all available public information sources to obtain an indication of the composition of Melbourne and Gippsland MSW. This is described in section 10.4.5 and in Table 10.5 of the WAA (table shown below).

[2] Suffolk energy-from-waste facility annual report 2016, Suez and Suffolk County Council, http://www.sita.co.uk/wp-content/uploads/2017/12/SuffolkAnnualReport2016-1712-web.pdf

The waste composition data presented in the WAA compares reasonably well with the Suffolk waste composition data presented in section 2 of this Memo.

Table 4: Melbourne and Gippsland expected composition, from Table 10.5 of the WAA

Primary Category	Secondary Categories	MSW (%)	
		Gippsland	South East Melbourne
Paper	Newspaper, Magazines/Brochures plus 11 more.	13.92	14.69
Plastic	PET #1, HDPE #2 plus 11 more.	12.65	12.63
Glass	Glass Packaging / Containers Clear, Glass Packaging / Containers Green plus 4 more.	4.62	2.82
Ferrous	Composite (mostly ferrous), Steel Packaging Food and Pet Cans plus 5 more.	2.18	1.54
Non-Ferrous	Aluminium (food cans), Aluminium beverage cans plus 5 more.	0.64	0.56
Organic (Compostables)	Food/Kitchen, Garden/Vegetation plus 2 more.	46.30	48.08
Other Organic	Textile/Rags/Carpet (Organic), Leather plus 4 more.	2.25	2.42
Earth Based	Cat Litter, Soil plus 4 more.	3.20	3.67
Miscellaneous	Miscellaneous Combustible, Miscellaneous Non-Combustible plus 1 more.	6.43	6.04
Waste Electronic	Electrical Items: Large, TV's & Monitors plus 4 more.	1.27	0.93
Hazardous	Asbestos / Building Materials, Paint plus 8 more.	2.02	1.96
Liquid	Liquid	0.00	0.00
Fines	Fines < 10mm (break out)	4.54	4.66

5.2 Pollution control equipment

The pollution control equipment for the proposed AP EfW Plant would be very similar to the Suffolk plant, consisting of the following:

- SNCR system for oxides of nitrogen reduction to N_2, using urea as a reagent
    - Same as for Suffolk
- Reactor system with lime and activated carbon dosing:
    - Same as for Suffolk
- Bag house for ash and particulates
    - Same as for Suffolk

- APCr collection
    - Composition of APCr expected to be similar to Suffolk
- Bottom ash collection
    - Similar composition to Suffolk. Bottom ash from the AP EfW Plant would be sent to landfill for the first 1-2 years of operation. In the meantime, AP will look for recycling and reuse opportunities with various aggregate and construction companies in Australia. AP is hoping to mimic the bottom ash reuse and recycling that exists in the UK and Europe in order to find a beneficial reuse for the material.

Chapter 4 (EfW process description) of the WAA provides more details on the proposed AP EfW pollution control system.

The Suffolk EfW Plant's boiler and flue gas treatment plant was designed and constructed by the German company Martin Gmbh (reporting to CNIM as EPC Contractor, from France). Martin Gmbh are also one of the three EPC tenderers for the AP EfW Project. The other two EPC tenderers for the AP EfW Project have very similar pollution control technologies. So it can be expected that the pollution control technologies of the AP EfW Plant would be effectively the same as the Suffolk Plant.

5.3 Emissions

Emissions to air for the AP EfW Plant will need to meet IED and EPA SEPP AQM limits and requirements. The IED requirements are the same for the Suffolk plant.

Table 5: IED limits applicable to the AP EfW Plant and the Suffolk plant

Pollutants	Emission Limit (mg/Nm³) 100th percentile	Emission Limit (mg/Nm³) 97th percentile	Averaging time
Pollutants (general)			
Total dust	10		24 hour
Total organic carbon (TOC)	10		24 hour
Hydrogen chloride (HCl)	10		24 hour
Hydrogen fluoride (HF)	1		24 hour
Sulphur dioxide (SO_2)	50		24 hour
Oxides of nitrogen (NOx) as nitrogen dioxide (NO_2)	200		24 hour
Carbon monoxide (CO)	50		24 hour
Total dust	30	10	0.5 hour
Total organic carbon (TOC)	20	10	0.5 hour
Hydrogen chloride (HCl)	60	10	0.5 hour
Hydrogen fluoride (HF)	4	2	0.5 hour
Sulphur dioxide	200	50	0.5 hour
Oxides of nitrogen (NOx) as nitrogen dioxide (NO_2)	400	200	0.5 hour
Carbon monoxide (CO)	100		0.5 hour
Carbon monoxide (CO)	150		10-minute
Pollutants (heavy metals)			
Cd + Tl	0.05		0.5 hours
Hg	0.05		0.5 hours
Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V	0.5		0.5 hours
Pollutants (other toxic)			
Dioxins / furans (D/Fs)	0.1 (ng/Nm³)		6 hours

Note: Cd = cadmium plus its compounds, Tl = thalium plus its compounds, Hg = mercury and its compounds, Sb = antimony and its compounds, As = arsenic and its compounds, Pb = lead and its compounds, Cr = chromium and its compounds, Co = cobalt and its compounds, Cu = copper and its compounds, Mn = manganese and its compounds, Ni = nickel and its compounds, V = vanadium and its compounds

Given that the proposed AP EfW Plant would use the same technologies as the Suffolk plant and would have to abide by the same IED limits, it is expected that the IED limits would be met by the AP EfW Plant.

6. Conclusion

The waste collected in Suffolk County being sent to the Suffolk EfW Plant is a reasonable representation of MSW that can be expected in the Melbourne and Gippsland MSW streams. The Suffolk waste is approximately 85% MSW with the remainder being MSW-like C&I waste, compared to the expected 80%/20% MSW/C&I split for the AP EfW Plant waste feedstock. The Suffolk waste composition data (both the category specific data and the chemical data) is quite similar to the known Melbourne and Gippsland waste data and also the expected modelled waste data.

The proposed AP EfW Plant would be very similar to the Suffolk plant with regard to the engineering and pollution control system. Given the similarity of the wastes and the EfW Plant processes, it is likely that emissions from the AP EfW Plant would be similar to the Suffolk plant. The Suffolk plant boiler and flue gas treatment design was undertaken by Martin Gmbh, one of the EPC contractors

bidding for the AP EfW Plant. Thus it is reasonable to expect that the AP EfW Plant would have a similar performance and would meet IED and SEPP requirements for emissions.

The Suffolk plant can be considered a reasonable reference plant to compare to the proposed AP EfW Plant. Given that the Suffolk plant has been operating below IED limits, it can be reasonably expected that the operation of the proposed AP EfW Plant would also be below IED limits.