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Memorandum

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Subject	**Response to Section 22 Notice: Australian Paper EfW Project**	**Project Name**	Australia Paper Energy from Waste
Attention	Andreas Elvin Project Manager – Development Assessments Unit EPA Victoria	**Project No.**	RO097400
From	Roger Winders		
Date	23 July 2018		
Copies to	David Jettner, Australian Paper		

1. Introduction

Jacobs has prepared this Memorandum in conjunction with Australian Paper (AP) in response to a request for further information from the EPA via a Section 22 Notice received on 10 July 2018. The EPA has requested that AP provides further supporting information to respond to submissions received by EPA regarding the Works Approval Application (WAA) during the public advertisement period.

2. Response

The following sub sections provide responses to the specific elements in the Section 22 Notice.

2.1 Submissions

1. Please provide EPA with responses to the issues raised in the 115 submissions which are attached to this notice.

During the 5½ week public advertisement period for the Energy from Waste (EfW) Project, EPA received a total of 115 submissions via the Engage Victoria portal, direct email and in writing. AP hereby provides detailed responses to all of the concerns and issues raised in the 115 submissions received by EPA.

Of the 115 submissions, the following is noted:

- Support the proposal: 88 submissions
- Support the proposal subject to conditions: 9 submissions
- Object to the proposal: 15 submissions
- Submissions that were not clear on whether they support or object to the proposal: 3 submissions

Given that the vast majority of submissions were supportive of the EfW Project, AP has focussed this response on the concerns or issues raised by the submitters who support the project subject to conditions or did not support the project. The concerns and issues raised by these submitters has been tabulated and presented in the attached PDF document "*Australian Paper EfW Project_Response to submissions_Rev 0_20180723*".

2.2 Referrals

Please provide EPA with responses to the issues raised in referrals received from: Sustainability Victoria; Metropolitan Waste and Resource Recovery Group; Gippsland Waste and Resource Recovery Group; Latrobe City Council; Gippsland Water; and West Gippsland Catchment Management Authority who outline the following concerns:

1. Please provide information to support that the existing wastewater treatment system can treat the additional wastewater generated from the waste to energy plant and that no additional discharge will be released to the Latrobe River.
2. The referrals from SV, MWRRG and GWRRG identify an expected change in the waste composition of the feedstock over the life of the facility. Please provide additional detail of how ongoing investigations will be implemented to understand the waste composition and what strategies will be adopted if the waste falls outside the proposed design waste parameters.

2.2.1 Wastewater treatment

1. Please provide information to support that the existing wastewater treatment system can treat the additional wastewater generated from the waste to energy plant and that no additional discharge will be released to the Latrobe River.

Chapter 9 of the Works Approval Application provides the detailed information regarding the proposed water use and water treatment of the EfW Plant. For ease of reference, text from this chapter is used to explain the wastewater treatment details.

The existing Maryvale Mill currently uses on average between approximately 70-80 ML/day and has a variety of water management systems in place in order to manage, treat and discharge process and stormwater for the existing Mill. After extensive clarification and treatment, the Mill discharges on average between approximately 55-65 ML/day to the Latrobe River (under an EPA Licence) and on average between 15-20 ML/day to Gippsland Water as trade waste (under a Trade Waste Agreement).

During operations, it is anticipated that the EfW Project will not significantly increase the amount of water consumed or discharged. Demand for water at the Project is predicted to be approximately 5-6 ML of raw water per day, depending on the load and operating mode of the plant. It is anticipated that approximately 0.4-1.2ML per day of water (dependent on the load and operating mode of the EfW plant) will be discharged from the Project which is minor in comparison to the water discharged from the existing Maryvale Mill.

The wastewater sources from the EfW Project would be:

- Filter backwash
- Biocides from cooling tower blowdown
- Total dissolved solids (TDS) from cooling tower blowdown

2.2.1.1 Filter backwash

Section 9.5.4 details the proposed volumes and constituents of the wastewater sources from the EfW Project. The following text contains extracts from section 9.5.4 of the WAA.

It is estimated that for a typical day-to-day operating scenario the amount of filter backwash generated would be in the range of 0.3-0.5ML per day. Table 9-2 below (from the WAA) shows the estimated raw water that is required for use in the EfW Plant and the amount of total suspended solids (TSS) generated in the filters based on three different operating scenarios.

- Case 1 represents the expected nominal day-to-day operation scenario of the EfW Plant with process steam transfer to the Mill;
- Case 2 represents the scenario where the EfW Plant is operating at full load and there is no process steam transfer to the Mill. Although this operating scenario does require more raw water to be used at the EfW Plant, as no process steam is delivered to the Mill under this operating scenario, the amount of demineralised water (and hence filtered water) reduces significantly.
- Case 3 represents an operating scenario where a significant amount of process steam (approx. 220 tonnes/hour) is required at the Mill and there is no condensate being returned. This results in the need to produce a lot of demineralised water and hence uses more filtered raw water. This scenario is not a normal operating mode and is likely for approximately 5% of the year. However, although this does increase the filter backwash volume and TSS loading, the load of the existing demineralisation plant and filters at the Mill would inherently reduce as a result.

Table 9.2 : Estimated raw water and backwash volumes for the EfW Plant

Parameter	Units	Case 1	Case 2	Case 3
Incoming raw water to be filtered	ML/day	2.85	0.6	6.7
Incoming raw water TSS	mg/L	3	3	3
Filter backwash - Estimated mass emission rate –TSS	kg/day	8.5	1.8	20.1
Filter backwash – Estimated volume of water per day	ML/day	0.03	0.006	0.06
Concentrated TSS in filter backwash stream	mg/L	285	300	335

The estimated mass rate of TSS generated in the filters is based on a typical value in the incoming raw water that was obtained during periodic laboratory testing. Based on the expected operating scenario, as shown in Case 1, the expected daily loading of TSS to be discharged in the filter backwash stream is not considered to be significant compared to that produced by the Mill. In a normal operating scenario (Case 1), the volume of filter backwash is expected to be approximately 0.03 ML/day (30,000L/day) with a corresponding mass of TSS of 8.5 kg/day.

In comparison with the existing Mill filter backwash and wastewater treatment systems, AP has four existing filtration water plants. The most recently commissioned plant (“FWP#4”) has an almost continuous backwash while another plant “FWP#3” operates on a one backwash per day cycle. The other two plants have two filter sets and backwash multiple times per day. The impact of the EfW Plant backwash discharges is very small compared to the existing backwashing processes on the Mill wastewater clarification system (WWC#2) and the feed flow into the clarifier being around 28 ML/day from existing Mill processes.

In this context, the backwash from the EfW (sand) filter would be hundreds of times lower than the existing Mill backwash volumes and concentrations and is considered of very minor significance. It is expected that the additional filter backwash impact from the EfW Plant (being 0.03 ML/day or 30,000L/day with a mass of 8.5 kg/day TSS) on the Mill clarifiers and settling ponds would be minimal. The EfW Plant contribution to the Mill’s wastewater treatment system would be 0.03 ML/day into the existing 28 ML/day flow (to the treatment system). The current licence limit for TSS allows for the discharge from the wastewater treatment system to the Latrobe River to be an annual median of 30 mg/L on an average discharge flow rate of 55 ML/day, which equates to approximately 1,600 kg/day of TSS. The licence limit on a maximum basis is 60 mg/L, which equates to approximately 3,200 kg/day of TSS on a basis of 55 ML/day discharge. Thus the EfW Plant’s contribution of 8.5 kg/day ***to the wastewater treatment system*** (i.e. ***prior*** to treatment and discharge to the Latrobe River) is considered negligible.

The frequency of filter backwash will be dependent on the design of the filter and the incoming quality of water from the Moondarra Reservoir, more so the amount of suspended solids in the water (sand/dirt, organic debris, etc). The figure may vary with the seasons and with significant rainfall events. It is expected that the frequency of backwash could typically be around once per day (e.g. every 24 hours).

2.2.1.2 Biocides from cooling tower blowdown

Section 9.5.4.2 of the WAA provides detailed information regarding biocides and the following text contains extracts from this section.

The cooling towers will use an oxidising biocide to control growth of algae and other biomass that reduce the cooling system effectiveness due to cooling tower nozzle fouling and surface fouling (which leads to reduced heat transfer and plant efficiency). Biocide dosing is also required to address the risk of legionella growth in the towers which must be controlled from a health and safety perspective. The most common form of biocide used in the power sector is chlorine, although some power plants use bromine dosing systems, or a combination of the two.

Blowdown from the cooling towers will contain small residuals from the biological and scale control systems. Chlorine has a short effective lifespan as a biocide and the residual free chlorine levels in the cooling water circuit will dissipate relatively quickly after exposure of the chlorine to biological matter and exposure to air, such as during the drop from spray nozzles to cooling water pond or within an aeration or open pond.

Typical industry good practice use of a chlorine biocide is proposed for the EfW Plant, which entails targeting regular ’slug’ doses of chlorine to a maintain a minimum free residual concentration of approximately 0.5 ppm and a maximum of around 1 ppm immediately after a dosing period dose. This is a common approach to ‘shock’ biological growth within the tower and cooling water circuit on a regular periodic basis (e.g. once for a few hours per day, actual frequency will be determined during operations supported by free chlorine testing and microbiological cell count monitoring)[1,2]. It is in the interest of the EfW plant operations to minimise free chlorine in the cooling water system as it will exacerbate corrosion rates of pipes and condenser tubes if not tightly controlled.

For comparative purposes, Melbourne potable/drinking water has average free chlorine levels of between 0.05 and 0.1 ppm.[3] For public swimming pools in Victoria, the Victorian Department of Human Services mandates a free chlorine level of between 1ppm (minimum) and 8ppm (maximum)[4].

The Mill currently has biological control systems on existing cooling towers as required for legionella protection. Other Mill water systems have been progressively closed to increase water re-use and consequently most of the water systems have managed biological treatment programs, especially on the five paper machines. The Bleach Plant at the Mill has two chlorine dioxide addition stages, resulting in small chlorine residuals in the bleached pulp. The chlorine residuals are minimised by the control systems and rapidly consumed when the waters are ultimately purged into the wastewater feed drains, which are biologically treated in the aeration pond after the primary clarifiers.

The free chlorine from the EfW cooling tower blowdown would be consumed prior to or when it is mixed with the other process streams being feed to the primary clarifiers (Waste Water Clarifier #2 in this case) and therefore would have no impact on the biological performance of the aeration pond (No.1A). Consequently it is expected that there will be no change to the quality of the Mill's discharge to the Latrobe River.

Under the normal operating scenario ("Case 1"), the EfW Plant will generate approximately 0.31 ML/day of blowdown water to be directed to the primary clarifiers. An infrequent operating scenario is where the EfW Plant is operating at full load and no process steam is transferred to the Mill ("Case 2"). Under this scenario, the plant will generate approximately 0.79 ML/day of blowdown water to be directed to the primary clarifiers. This compares to existing biological and chlorine containing flows from the Mill of approximately 53 ML/day being directed to the primary clarifiers.

2.2.1.3 Total dissolved solids (TDS) from cooling tower blowdown

It is noted that electrical conductivity (EC) or direct conductivity is an indicator parameter for total dissolved solids (TDS) concentration. The relationship between TDS and direct conductivity is not directly linear with the concentrations of some ions commonly found in water having exponential or logarithmic relationships between the two water quality parameters. Where there are a number of chemical ions present in varying concentrations in a water stream, such as will be the case for the EfW blowdown system, the direct conductivity meter that will be used to monitor cooling tower blowdown on a continuous basis will need to be calibrated in service against laboratory test results for TDS before it can be considered an accurate control and monitoring device for the plant.

Table 9-5 below (from the WAA) indicates the estimated cooling tower blowdown volumes for different operating scenarios. Case 1 represents the normal operation scenario of the EfW Plant with process

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[1] Cooling Tower Water Systems, Part 2, Ganesh Kamatkar — January 25, 2018, https://www.watertechonline.com/cooling-tower-water-systems-part-2/

[2] General Electric (GE) - Water Technologies Handbook, https://www.suezwatertechnologies.com/handbook/cooling_water_systems/ch_27_chlorine.jsp

[3] Guidance for use of recycled water by Industry, Institute for Sustainability and Innovation, Victoria University, CSIRO Land and Water Fund

[4] Pool operators' handbook, Victorian Government Department of Human Services, February 2008. https://www2.health.vic.gov.au/about/publications/researchandreports/Pool-operators-handbook

steam transfer to the Mill, whereas Case 2 represents the scenario where the EfW Plant is operating at full load and no process steam is transferred to the Mill. It should be noted that the Case 2 operating scenario is expected to an infrequent mode of operation mainly correlating to periods where the Mill is shut for maintenance. As can be seen, even under Case 2, the cooling tower blowdown would only contribute a small fraction of the allowable discharge limit.

Table 9-5: TDS discharges from the EfW Plant

Parameter	Units	Case 1	Case 2
Cooling tower (CT) blowdown	ML/day	0.31	0.79
CT blowdown – average mass emission rate of TDS	kg/day	70	178
CT blowdown – maximum mass emission rate of TDS	kg/day	110	278
Average Mill daily flow discharged to the Latrobe River after treatment (20,130 MLpa over 365 days)	ML/day	55,150	
Average Mill TDS concentration (601 mg/L) discharged to Latrobe River	kg/day	33,145	
CT blowdown % of Mill average mass emission rate of TDS	%	0.21	0.54
CT blowdown % of Mill maximum mass emission rate of TDS	%	0.33	0.84

It can be seen that the EfW Plant's TDS contribution in terms of mass rate is almost negligible. Compared to the existing Mill's TDS mass rate discharge to the Latrobe River of 33,145 kg/day, the EfW Plant will contribute a maximum of 110kg/day ***to the wastewater treatment system*** (i.e. prior to discharge to the Latrobe River) under normal operating conditions (0.21% of the existing discharge). This would only rise to 278 kg/day (0.54% of the existing discharge) under Case 2, which is an infrequent operating scenario.

In terms of TDS concentrations, the present estimates of TDS for the EfW cooling water blowdown is likely to be lower than those typically observed currently in the Mill wastewater discharge to Latrobe River, assuming a cooling tower concentration factor of around 8 or less. As such the net impact of TDS concentration (and Electrical Conductivity) from the EfW Plant is expected to be a small reduction in the overall TDS concentration from the existing Mill's discharge.

2.2.1.4 Wastewater treatment conclusion

The existing Maryvale Mill Trade Waste treatment system and Wastewater treatment systems will be sufficient to treat the 0.4-1.2 ML per day discharged from the EfW Plant without impacting on the Mill's existing water treatment systems and without impacting on the Mill's EPA licence conditions.

The wastewater from the EfW Plant will be directed to the Mill's existing wastewater treatment system – no wastewater from the EfW Plant will be discharged to the trade waste system (which eventually discharges to Gippsland Water).

2.2.2 Waste composition

2. The referrals from SV, MWRRG and GWRRG identify an expected change in the waste composition of the feedstock over the life of the facility. Please provide additional detail of how ongoing investigations will be implemented to understand the waste composition and what strategies will be adopted if the waste falls outside the proposed design waste parameters.

Information on the waste characteristics and investigations are predominantly outlined in Chapter 10 of the WAA, with additional aspects provided in numerous other sections of the WAA. Table 1 below outlines the detailed comments provided by Sustainability Victoria (SV), Metropolitan Waste and Resource Recovery Group (MWRRG) and Gippsland Waste and Resource Recovery Group (GRWWG) in relation to the WAA. The Table also provides references to where the information is contained in the WAA.

Table 1: Responses to Waste Composition Issues / Concerns

Authority	Summary of the issue / concern raised	Response
SV	• The proposal represents a better alternative than sending residual waste to landfill; however, in accord with the Statewide Waste and Resource Recovery Infrastructure Plan (SWRRIP), it is important to ensure that processes remove materials which could be viably recovered for higher order processing. • It is proposed that feedstocks will be pre-sorted prior to arriving at the facility as there is limited capacity for pre-sorting at the site to remove any materials that could otherwise be recovered. • SV further note that maximising pre-sorting opportunities with the processes identified presents challenges. • SV includes an excerpt from a table in the SWRRIP which lists opportunities to increase recovery of materials from the residual waste stream. The table acknowledges treatment of residual waste to make energy as an opportunity to further recover residual waste. It also lists the	With regard to pre-sorting of feedstocks to remove materials which could be viably recovered for higher order processing, the following response is provided: • As outlined in Section 2 of the Supplementary Information provided as Appendix B of the WAA, source separation of recyclables from residual waste by households and businesses represents best practice as it provides a higher quality of recyclate to the recycling market. Implementing a pre-sort facility (such as a dirty MRF or MBT) at the front-end of the proposed EfW facility (whether onsite or on another site) is likely to achieve 10% further separation of recyclates (primarily metals) and production of a compost-like output. However, industry experience shows that the quality of the outputs of these pre-treatment facility types receiving mixed (residual) waste is generally quite be poor, and the sale or market use of recyclate and compost-like outputs will be impacted by the quality of these materials.

Authority	Summary of the issue / concern raised	Response
	following considerations associated with EfW with respect to waste composition: - Able to use mixed contaminated feedstocks that are difficult to sort - Consistent feedstocks (quantity available, contamination levels, calorific value) will assist viability	For example, metals recovered are typically contaminated with plastic and other coatings which are likely to impact on ease of recycling and commodity price of this material. The EfW facility proposal seeks to recycle metals post combustion to achieve greater recovery and higher quality of metals contributing to greater realised value. Furthermore the lack of viability for dirty MRF's is evidenced by the fact that no dirty MRF's currently operate in Victoria. Also, contamination of the dirty MRF organic stream by glass precludes its use in composting, as experienced in the UK. The proposed EfW facility will target residual (red top bin) waste disposed of by households and businesses that would otherwise be disposed of to landfill, as well as selected non-prescribed industrial wastes collected from specific industries that have limited realistic potential for recycling (refer to Section 10.2.5 of the WAA). This is consistent with EPA Victoria's Energy from Waste Guideline Publication 1559.1 which states "*EfW should be considered for 'residual waste' and other wastes for which energy recovery represents the most feasible option, due to the absence of a market for the waste. 'Residual waste' is the waste that is left over after suitable materials have been recovered for reuse and recycling. This generally means the environmental or economic costs of further separating and cleaning the waste are greater than any potential benefit of doing so*." • As outlined in Section 2 of the Supplementary Information provided with the WAA, it is considered that the current proposal offers the most optimum solution from a cost and waste management perspective. It is considered to be a council policy decision to assess the amount of processing of the residual waste stream they require. Councils can select to send collected residual waste to a pre-sort facility prior to the residual waste output being received by the EfW facility. Councils will assess this option based on the recycling targets they wish to achieve, value for money opportunities and proven technologies. • As outlined in Section 10.4.7 of the WAA and Section 3 of the Supplementary Information provided with the WAA, the moving grate technology chosen for the plant can operate and remain viable with a wider range of fuel

Authority	Summary of the issue / concern raised	Response
		(feedstock) parameters than traditional power generators. This has been proven in the EfW industry internationally for 30+ years. It is not like a gas or coal-fired generator situation where the gas/coal composition is well known and well defined. The EfW plant will be designed to be flexible in utilising a wide range of waste feedstock and will be designed to handle a waste feedstock calorific value (CV) of between 7 and 13 MJ/kg, and a waste throughput between 25.7 and 42.8 tonnes per hour.
	The viability of large-scale EfW plants is likely to depend on large amounts of feedstock committed for long periods of time. While it may not be viable to recover some of these materials now, over the life of the SWRRIP, or EfW facility, this may change.	We acknowledge that waste composition will change over time (refer to Section 10.4.8 of the WAA). We have modelled changes in feedstock composition to review impacts on projected waste tonnes given changes to waste collection systems and changes to mass flow due to different waste service compositions and varying proportions of waste provided by individual councils. Scenarios reviewed include the roll out of food and garden organics collections in the Gippsland and Metropolitan regions, the introduction of a container deposit scheme and improvements to recycling Expected outcomes of such changes have been (and continue to be) reviewed. Australian Paper has incorporated the outputs of this modelling into its business planning so that it is aware that it will need to manage and monitor these changes in the future, and adapt as required. In addition the effects of population growth are forecast to generate a further 500,000 tpa of MSW for Metropolitan Melbourne over the decade to 2026. This growth is likely to counteract any growth in recycling or alternative diversions away from landfill or EfW facilities.
MWRRG	Nil for Waste Composition	
GWRRG	<u>Waste Characteristics and Composition</u> Proponents need to consider an expected change in the volume and composition of source material over the proposed life of the plant given the following information: • Waste audits carried out by GWRRG indicate a high proportion of food and organic waste in the residual waste (garbage) collected at kerbside. • Improvements to source separation systems as implemented in Bass Coast Shire Council (Food Organics and Garden Organics) are proven in reducing the weight of residual waste by approximately 50%.	We acknowledge that waste composition will change over time (refer to Section 10.4.8 of the WAA). We have modelled changes in feedstock composition to review impacts on projected waste tonnes given changes to waste collection systems. Scenarios reviewed include the roll out of food and garden organics collections in the Gippsland and Metropolitan regions which would lead to a reduction in overall tonnages but also a potentially greater net CV outcome given a reduction of low CV materials. Australian Paper has incorporated the outputs of this modelling into its business planning so that it is aware that it will need to manage and monitor these changes in the future, and adapt as required.

Authority	Summary of the issue / concern raised	Response
	• A change to material composition if these systems were to be applied to all Gippsland Councils would result in a reduction of around 25,000 tonnes per annum and will also change the physical properties of the waste. • It is believed that population increases in Gippsland will not account for this reduction in waste mass over the life of the proposed project.	As outlined in Section 10.4.8, projections of waste generation tonnages to the 25-year time horizon are supported by SV waste model projections for the State of Victoria up to 2045-46. However, changes to projected waste tonnes given variations in population growth have also been modelled to better inform Australian Paper. It is noted that the design of the EfW plant is capable of accommodating for these changes and are able to operate at a range of CV and waste throughputs. This is evidenced in the firing diagram in the WAA (Figure 4.11 in Chapter 4) and "Design Waste Proximate Analysis Diagram" (Section 3, figure 2 in the Supplementary Information to the WAA). If the CV of the feedstock waste is lower than 9.4 MJ/kg, more waste will be required to achieve Australian Paper's desired steam and electricity production rates. If the CV is higher than 9.4, then less waste would be required. The efforts of Bass Coast Council are recognised and to be congratulated. The program has included both garden and food organics (so called FOGO) and the effects are likely to be less striking in Councils that already have garden organics managed into separate "green" bins.
	<u>Contingency Planning</u> GWRRG considers that contingency planning should the proposed plant be inoperable beyond 10 days be addressed in more detail for the following reasons: • The significant reduction in the volume of material entering local Gippsland landfills would further reduce the economic viability of operating these facilities, ultimately resulting in closure, or at the very least an amendment of their license to Type 3 landfills accepting only solid inert wastes. • The currently available landfill airspace in Gippsland is supplied on a needs basis which in effect limits the capacity to accept non-routine deposits through unforeseen events. • Accelerating the availability of airspace is difficult due to issues relating to landfill construction imperatives and the approvals process.	The proposed EfW facility includes two boiler lines with separate Flue Gas Treatment systems that provides an inherent level of redundancy. Australian Paper has conducted an extensive review of the leading technology options. The chosen technology is Moving Grate thermal combustion and this technology is the dominant technology due to its proven and reliable history of demonstrating satisfactory performance. In the event that plant maintenance or an unexpected event requires a shutdown period of longer than 10 days, Australian Paper will ensure alternative arrangements are made, and are part of waste agreements with collection contractors, so that waste loads are diverted from the facility during this time (refer to Section 10.5.4 of the WAA). It is expected that the partnership with Suez will particularly allow for the diversion of waste to Suez-operated landfills.
	<u>Post Process Residual Waste</u> Greater assurance of bi-product options, in addition	Assuming bottom ash is categorised as an Industrial Waste, trucks will transport bottom ash to an

Authority	Summary of the issue / concern raised	Response
	to "establishing a new market" would provide greater confidence that the proposal is not creating a waste management issue, albeit for a smaller volume of material, for the region to manage.	appropriate landfill with sufficient capacity. Metals will be recovered from the bottom ash. Suez currently is in partnership with a C&D recycling facility in Hallam. Development of a viable beneficial re-use market will depend upon approvals, capability to process, and market outlets. For the interim disposal of bottom ash to landfill (at about 10% by volume of the original waste material) is seen as a viable option. If Boiler Ash and APC residues, as expected, are categorised as a prescribed industrial waste, they will be transported to the Suez Lyndhurst Landfill located at 890 Taylors Road in Dandenong South for appropriate disposal.
EPA	Please provide additional detail of how ongoing investigations will be implemented to understand the waste composition and what strategies will be adopted if the waste falls outside the proposed design waste parameters.	As noted in Section 10.2.7 of the WAA and in the Response to EPA comments on the Draft WAA, Australian Paper is currently conducting waste sampling, testing and characterisation analyses on suburban and metropolitan Melbourne and Gippsland waste that will obtain specific properties of Municipal Solid Waste (MSW) for these regions over a 12-month period. It is important to conduct sampling and testing over the four seasons to understand climatic and population behavioural variances, For Industrial Waste (i.e. from the Commercial and Industrial [C&I] sources), because C&I contracts are short term (typically around 1 to 2 years), it will be difficult to get a representative sample for this waste. However, the project will be targeting wastes of similar nature to the residual (red top bin) Municipal Solid Waste (MSW). For example, C&I waste sourced from shopping centres, office blocks and schools. Sampling and monitoring of wastes during the operational phase will be undertaken and will be taken to be representative of the final waste composition to be processed by the EfW plant (refer to Section 10.2.7 of the WAA). As outlined in Section 12.9 of the WAA, monitoring of environmental performance of the project will be conducted through online monitoring and regular sampling (air, water, noise and waste) and details of compliance with the EPA Licence will be reported annually. Australian Paper will commission a suitably qualified independent auditor to conduct audits on a regular

Authority	Summary of the issue / concern raised	Response
		basis during the first 3 years of operations to ensure that waste streams sent to the facility comply with the EfW acceptance criteria and EPA waste categorisation requirements (refer to Section 10.5.2.3 of the WAA). Beyond this period AP will consider establishing internal auditing protocols following sufficient knowledge transfer or continue with independent auditing. Non-conformities and corrective actions issued by the auditor will be addressed according to established timeframes and confirmed through re-audit of the action area. During operation, changes to relevant legislation and council services will be closely monitored, and the potential impacts of these potential changes planned for as part of contingency arrangements through sourcing of additional compliant input feedstock to re-establish the required waste tonnage and composition to meet with the facility design (refer to Section 10.4. 8 of the WAA). As previously outlined, the plant design will be able to meet the variability in the waste stream. Waste data modelling (refer to Section 10.4.4, 10.4.5 and 10.4.8 of the WAA) has been undertaken to determine how improvements to household recycling rates and food organics collections in the Gippsland and Metropolitan regions will impact the waste input feedstock over a 25-year time horizon.

2.3 Best practice monitoring of emissions

You must provide EPA with responses to the following issues:

1. As part of the best practice assessment, there needs to be investigation of semi-continuous monitoring of PCDD/PCDF. This assessment must refer to section *2.8.3 Experiences with continuous sampling of dioxin emissions* of the *Reference Document on the Best Available Techniques for Waste Incineration* (European Commission, 2006) and investigate if it is best practice for environmental, economic and social benefits.
2. Please provide additional evidence supporting the assessment of how Selective Non-Catalytic Reaction (SNCR) can be considered best practice in comparison with Selective Catalytic Reaction. This assessment must clearly outline best practice in terms of environmental, economic and social benefits.

2.3.1 Semi-continuous monitoring of PCDD/PCDF

1. As part of the best practice assessment, there needs to be investigation of semi-continuous monitoring of PCDD/PCDF. This assessment must refer to section *2.8.3 Experiences with continuous sampling of dioxin emissions* of the *Reference Document on the Best Available Techniques for Waste Incineration* (European Commission, 2006) and investigate if it is best practice for environmental, economic and social benefits.

AP understands the importance of environmental monitoring to ensure the proposed EfW Plant remains compliant with environmental regulations. As part of the technical specification to the Engineer, Procure, Construct (EPC) contractor, there is a strict requirement to supply a robust Continuous Emissions Monitoring System (CEMS) for the EfW Plant. The system would monitor and record gaseous emissions via the flue gas as well as water based emissions via waste water discharged from the facility.

Each of the 2 combustion lines would have a separate CEMS for the measurement of stack emissions. The CEMS would be designed for maximum availability, including a “hot spare” stand-by CEMS which can be rapidly and automatically entered into service in the event of a fault or shutdown of any line duty CEMS. The Contractor is required to base the siting of the CEMS in compliance with the requirements of AS 4323.1 - Stationary source emissions Selection of sampling positions.

The CEMS would monitor, time average, and report emissions in accordance with Industrial Emissions Directive 2010/75/EU (IED). The CEMS would provide indication and recording of the following corrected concentrations of gases in the stack on a continuous basis (as a minimum):

- Stack gas flow
- Temperature
- Pressure
- Gas moisture content
- Oxygen
- Carbon Dioxide
- Total dust
- Total organic carbon (TOC)
- Hydrogen chloride (HCl)
- Hydrogen fluoride (HF)
- Sulphur dioxide
- Oxides of nitrogen (NOx) as nitrogen dioxide (NO2)
- Carbon monoxide (CO)
- Ammonia

Instantaneous and cumulative values of emissions would be available from the CEMS to enable the Distributed Control System (DCS) to produce emission reports in a format suitable for use by the relevant environmental regulator. Alarms would be set up in the DCS to indicate possible exceedances in the prescribed emission limits. Any fault of the CEMS system would be raised in the Central Control Room via the DCS.

All the CEMS analyser equipment would be NATA certified in line with Australian requirements, and at a minimum meet the requirements of the Victorian EPA 'A guide to the sampling and analysis of air emissions and air quality', in particular with reference to 'TABLE 1: EPA Approved Methods for Analysis of Air Emissions'.

In relation to dioxin/furan monitoring and sampling, EPA has requested AP to investigate semi-continuous monitoring of PCDD/PCDF, taking into consideration *Section 2.8.3 Experiences with continuous sampling of dioxin emissions* of the *Reference Document on the Best Available Techniques for Waste Incineration* (European Commission, 2006).

During the development of the project, specifically the EPC technical specifications, AP has investigated methodologies for the monitoring and sampling of dioxins and furans (PCDD/PCDF). Through that process and upon further investigations, AP understands that PCDD/PCDF monitoring is conducted typically by extracting a sample of flue gas at stack on a permanent basis and to duct this extracted flue gas from the preheated line through to a specific filter. The filter is then analysed every four weeks which provides an average dioxin content over the period of extraction. As part of this process, the filter must be changed every four weeks.

While it is noted in the BREF that "*continuous sampling has proven to be useful for the assessment of dioxin emissions during unfavourable process conditions*" and "*the technique has been used to demonstrate low PCDD/F emissions over the entire range of operational conditions*", we make reference to three contemporary Energy from Waste facilities SUEZ recently commissioned in 2017 in the United Kingdom, namely Severnside EfW facility near Bristol, Wilton EfW facility near Newcastle and Cornwall EfW facility. These facilities, which are the newest EfW facilities in the UK, have demonstrated compliance with the strict requirements of the UK Environmental Agency (EA) and the IED. The PCDD/PCDF sampling and analysis in place at these facilities is conducted twice per annum, which meets the IED/BREF standard basis of 2-4 times per year, as the system would provide very limited environmental and social benefits.

From analysis of the UK reference facilities, it is concluded that there are very limited benefits to implement a semi continuous monitoring system for PCDD/F as in the EfW plant design, there is no by-pass system to the fabric filter installed upstream of each flue gas treatment line from which activated carbon is injected for dioxin removal. Moreover, the activated carbon dosing and injection system has duty / stand-by provisions to make sure the reactant is always injected. The resulting cake layer at the fabric bags' surface is then kept constant for permanent dioxin removal out of the flue gas. There is therefore very low risk of dioxin leakage at the stack. The proposed EfW Plant at Maryvale has also adopted this design configuration similar to the referenced UK EfW facilities.

AP has further considered the minor risk associated with dioxin leakage which would only exist if a fabric filter bag is damaged. Substantial safeguard is in place to detect this minor risk through installing a dust alarm at the fabric filter outlet which would be instantly triggered in case of filter bag damage, which would immediately stop the fabric filter line.

As noted in the BREF, the cost of continuous sampling and monitoring of PCDD/F is estimated as follows:

> *"Cost data for continuous sampling of dioxins (from Indaver):*

Investment: EUR 110000 - 140000

Testing of the system: EUR 4900 (estimation)

Analysis (26 samples/yr): EUR 20000/yr

Maintenance by the supplier (preventive): EUR 2500/yr"

AP has benchmarked the costs for semi continuous sampling and monitoring and notes that the reported European capital investment cost today for a semi continuous PCDD/PCDF sampling and monitoring system is in line with what is quoted in BREF for European projects. This however does not include the cost of international shipping and local installation. Operating costs associated with testing, sampling and maintenance would likely be higher, due to the AP EfW plant likely being one of the first in Australia and there are a very limited number of suppliers that could undertake this work and offer competitive pricing.

Initial investigations indicate that there could be a 50% premium to costs incurred by European EfW plants for the monitoring system itself and sampling/analysis costs. Then there are the additional design costs associated with the design and installation changes required, such as the by-pass system, piping, ducting and process controls. So the capital (capex) cost for a semi continuous system would be around $200,000 with an annual operational cost (opex) of around $100,000.

When considering best practice, it is important to note that in a similar jurisdiction like the UK, there is no requirement for semi continuous sampling of dioxin and furan emissions, and dioxin and furan emissions are typically monitored once every six months in accordance with the requirements of the EA which has the authority to vary the monitoring frequency based on the plant's performance.

We also make reference to the Suffolk EfW Facility which has been in operation since 2014. The closest residents are located less than 300 metres away from this EfW facility. The local EA has requested an increased frequency of dioxin / furans monitoring of quarterly in the first year, and through demonstrated performance overtime, the monitoring requirement has subsequently dropped to once every six months.

We therefore recommend the EPA adopt a similar approach to the UK EA, by requesting more frequent dioxin and furan monitoring during the plant's initial stages then reducing monitoring requirements once EPA is satisfied with the plant's performance, for example:

- **During hot commissioning with waste until first year of operations:** quarterly sampling
- **Post first year of operation:** subject to confirmation that PCDD/PCDF levels are low, monitoring and sampling of PCDD/PCDF to be conducted at a frequency of once every six months

The Energy from Waste process is one of the most tightly regulated industrial processes in Europe. The proposed EfW Plant at Maryvale is to be designed with similar requirements as the recently commissioned EfW facilities in the UK to satisfy the high standards set out by the European Union's current IED and Victorian SEPP requirements, using only internationally proven technology and operated by trusted operators.

Further, the modelled mass emissions rate of dioxins/furans from the proposed AP EfW facility is 0.0000000131 grams per second which is equivalent to 0.41 grams per year. From a risk based approach considering the plant design, which incorporates the experience from recently constructed UK facilities, this has been deemed to be a low risk with the cost of monitoring / sampling not commensurate to the risk.

From AP's investigations to date and preliminary advice received from EPC contractors, semi continuous monitoring does not appear warranted for the proposed AP EfW Plant in relation to cost and environmental benefit. However, AP believes that further investigation needs to be conducted to determine the feasibility of semi continuous PCDD/PCDF monitoring.

Accordingly AP proposes to conduct further investigations into semi continuous monitoring during the detailed design phase in relation to "Best Practice" and social, environmental and economic considerations. It is considered that further dialogue with EPC contractors is required, as well as further dialogue with Australian and international monitoring equipment suppliers. AP will make a commitment to consult with EPA during the detailed design phase and to come to a conclusion on the viability of semi continuous PCDD/PCDF monitoring before the completion of the detailed design phase.

2.3.2 Selective Non-Catalytic Reaction (SNCR) compared to Selective Catalytic Reaction (SCR)

2. Please provide additional evidence supporting the assessment of how Selective Non-Catalytic Reaction (SNCR) can be considered best practice in comparison with Selective Catalytic Reaction. This assessment must clearly outline best practice in terms of environmental, economic and social benefits.

The WAA details that a Selective Non-Catalytic Reduction (SNCR) abatement solution for oxides of nitrogen (NOx) will be employed for the Maryvale EfW project. The proposed SNCR process is described in Chapter 4.6.6 in the WAA and is not repeated in this memo for brevity. SNCR is a proven approach to NO_x abatement and is employed by all the UK facilities used as reference examples in Chapter 4 of the WAA. Each of those reference examples and all operating EfW plants in the EU are required to meet the European Union Industrial Emission Directive (EU IED) emission limit value of 200 mg/Nm^3 at 11 % O_2 on a daily average.

Both the SNCR and SCR techniques are acknowledged as "Best Available Techniques" (BAT) within the European Union 2017 Draft of the Best Reference document for waste incineration (WI BREF). The WI BREF also acknowledges that for new build EfW plant that the range of NOx Emission limit levels that can be achieved for SCR systems are between 40 and 150 mg/Nm^3 at 11 % O_2 on a daily average, whereas SNCR can achieve between 80 and 180 mg/Nm^3 on the same basis. SCR's principal advantage is that it has the potential to achieve lower NOx levels than SNCR.

Selective Catalytic Reduction (SCR) of NOx emissions also has a range of other advantages and disadvantages when compared with SNCR which are summarised in this memo.

Selective catalytic reduction of oxides of nitrogen is a technique that relies on the reaction of NO, NO_2 and N_2O over a catalyst bed, often a honeycomb type structure. Similar to SNCR, the use of a reducing reagent is required, generally either urea solution or aqueous ammonia, dosed into the flue gas stream immediately upstream of the catalyst in order to drive the reducing reactions of the oxides of nitrogen to molecular nitrogen (N_2, an inert gas and the major component of air).

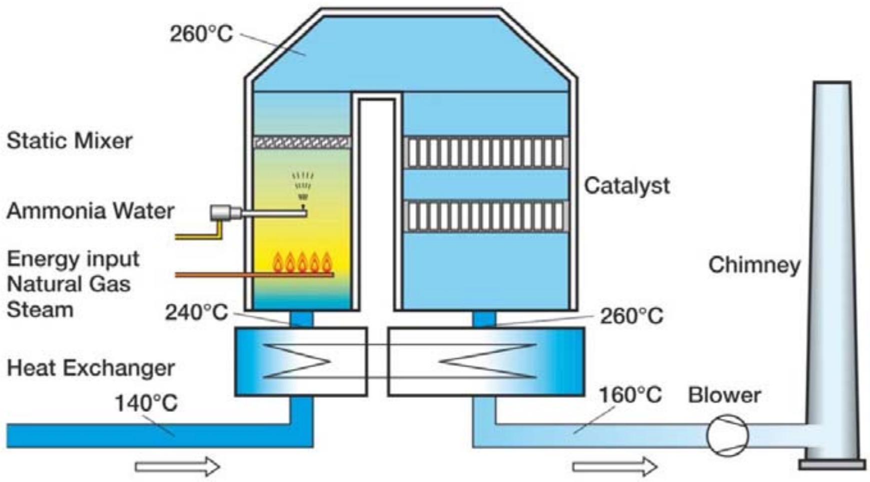
Like an SNCR, an SCR NOx abatement system is a proven approach for EfW plant, however its market penetration level[5,6] within the EfW industry is lower than SNCR and it is more typically

[5] Hutton, J. and Bulionis, P, A Case Study of the Selective Catalytic Reduction (SCR) System at the Algonquin Power Energy-From-Waste Facility, Proceedings of NAWTEC16 16th Annual North American Waste-to-Energy Conference, May 19-21, 2008.

employed where there are project specific contributing factors. These factors include sensitivities in the surrounding air shed with respect to oxides of nitrogen, or for a facility processing waste considered hazardous, thereby requiring increased residence time combustion temperature (e.g. 1,100^{0}C), which would promote higher levels of thermal NO_x formation in the furnace, thus necessitating a higher NOx abatement reduction efficiency. The WAA air quality assessment evaluates the potential NOx ground level concentrations at less than half of the allowable limits based upon worst case stack emissions and worst case background and weather conditions. Additionally the proposed EfW facility will not be processing hazardous materials requiring elevated furnace temperatures above 1100^{0}C.

The optimal temperature range for the catalytic reduction process that is generally adopted for SCR systems for EfW is around 230 to 320^{0}C[7] to maximise the conversion of NOx to N_2 and minimise ammonia slippage to the flue. As reported in the WAA, the flue gas temperature after the bag filter system is expected to be around 140^{0}C. For the purposes of avoiding poisoning of the SCR catalyst with dust and other gas contaminants, it is standard practice for EfW plant employing SCR to install the catalysts after the bag filter cleaning system[7] as shown in Figure 1.

Figure 1 : Typical SCR Simplified Process Flow Diagram[6]



This operating temperature requirement adds considerable complexity to the energy recovery process, and necessitates reheating the flue gases after the bag filter before entry to the SCR process, and then, where possible, recovering some (but not all) of this heat back through a heat exchange process.

A further consideration which differentiates SCR from SNCR is the need to replace SCR catalysts at the end of the working life which is typically between 3 to 5 years[5,7]. Catalysts used in SCR systems can typical be composed of oxides of expensive metals such as titanium, vanadium and tungsten[5]. This is an expensive replacement item and on a per annum basis (assuming a 4 year replacement cycle), is expected to be around $300,000 to $350,000 per annum for the AP EfW Plant. Once the catalyst has reached the end of its working life, it is likely to also contain elements of VOCs and heavy

[6] Von der Heide, B, SNCR Process - Best Available Technology for NOx Reduction in Waste to Energy Plants, Presented at POWER-GEN Europe, Milan, 3 – 5 June 2008.

[7] EU Best reference document for waste incineration (WI BREF), Draft for consultation, 2017.

metals and require special treatment for disposal, in a prescribed waste landfill. Approximately 200 m3 of catalyst waste is expected to need disposal every 3 to 5 years.

A lower order advantage of SCR over SNCR is that there is a lower slippage rate of ammonia than for SNCR, although having a dry or semi-dry lime system downstream of the urea dosing point will absorb most of the slippage to form ammonium chloride and be captured and removed in the baghouse[7].

In the above example, additional natural gas is used to provide the non-recoverable flue gas 20^{0}C temperature increase provided by natural gas firing which is equivalent to approximately 4 MWth heat input from natural gas on a continuous basis for the proposed AP EfW Plant. Continuous natural gas firing would reduce the carbon reduction benefits of the project, add operating cost, and be detrimental to AP's goal of becoming less dependent on fossil fuel supplied energy and exposure to energy market price risk. Assuming pipeline natural gas is used at $7/GJ, then this amounts to circa $800k per annum. An alternate method of using steam for reheating purposes would reduce the electricity generated in the steam turbine, and similarly reduce carbon and energy saving benefits of the project. The additional carbon dioxide equivalent emissions that would result from extra natural gas consumption at the mill would be approximately 6,400 tonnes per annum.

There is a carbon and energy efficiency detriment to the selection of a SCR system due to the additional pressure losses that the heat exchangers, mixing system and catalyst beds will introduce in the gas flow path. An additional pressure loss of the order of 2.5 kPa[6] is reported in literature which is an approximate induced draught (ID) fan power consumption increase of the order of 25%, or around 800kWe in total over the two boilers. Annually, assuming the mill needs to import this additional power from the NEM at a cost of around $70/MWh, this represents a lost opportunity cost of approximately $450,000 per annum. The additional carbon dioxide equivalent emissions that would result from extra grid power consumption at the mill would be approximately 5,250 tonnes per annum.

The capital cost for the construction of the additional equipment, heat exchangers, catalysts vessel and static mixer would add a considerable additional cost to the project, with SCR reported in literature to be of the order of 5 times more expensive in terms of capital cost. In terms of increment cost to the overall EPC cost estimate for both boilers, this may be of the order of $20-25 million AUD additional capex.

In summary adopting SCR would add approximately $2/tonne of waste process at the facility in additional operating cost considering all the financial pros and cons above, and add around $20 million to the facility EPC Capex. The EPC Capex including a simple 10% discount rate for finance over 25 years would add a further $4/tonne to the waste processing cost. SCR would also add approximately 11,000-12,000 tonnes per annum to the annual carbon dioxide equivalent emissions of the facility.

The following Table 2 compares the main Environmental, Economic and Social differentiating factors between the SNCR and the SCR technologies.

Table 2 : Summary SNCR vs SCR Comparison of Environmental, Economic and Social Issues

Issues	SNCR	SCR
Environmental Issues		
NOx emissions @ 11 vol % O_2	80 - 180 mg/Nm^3	40 - 150 mg/Nm^3
Achieves safe IED limit <= 200 mg/Nm^3 daily avg. @ 11 vol %	Yes	Yes

Issues	SNCR	SCR
O_2		
Greenhouse gas emissions	Lower greenhouse gas emission	Additional 11,000 -12,000t CO_2e emitted per annum
Waste generation	No impact	Approx 200 m^3 additional prescribed waste generated every 3-5 years
Economic Issues		
CAPEX	Lowest CAPEX	Approx $20 million higher
OPEX	Lowest OPEX	Approx $1.35 million per annum
Social Issues	Neutral	Neutral

It is concluded that the selection of SNCR for NOx control is a better solution than SCR from an environmental and economic perspective, with no issues for either technology from a social perspective. Both technologies are considered BAT in the EU WI BREF, which is the principal EfW BAT reference document for guiding the emission limit value levels within the EU IED, which has been adopted by EPA in the Energy From Waste Guideline.

The clear outcome of this BAT assessment is to adopt SNCR for the AP EfW Project.

3. Conclusion

Since early in the project's development in August 2017 and particularly since the opening of the EfW Project Office and Information Centre in Morwell in November 2017, AP has continued to welcome comments and feedback from the local community and other stakeholders. AP has actively engaged with the community and other stakeholders in a variety of forums in order to provide information to all interested parties.

AP sincerely thanks all members of the community and all stakeholders for their input and questions on the project received to date and particularly the 115 formal submitters to the advertising of the WAA. It is hoped that the responses in this Memo and attachment provide all submitters with the answers sought. AP would appreciate additional feedback if further clarification is required and looks forward to ongoing engagement with interested stakeholders into the future.

Yours sincerely

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