Technical Note

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Project title	Eastern Creek Energy from Waste Facility	Job number	239880-03
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Subject	EIS Review - Key Technical Queries		

The Next Generation NSW Pty Ltd ('the Proponent') submitted an amended Environmental Impact Statement (EIS) in November 2016 for their proposed Energy from Waste Facility at Eastern Creek ('the proposed facility').

Arup have undertaken a review of the amended EIS ('the EIS'). The purpose of this review is to assess the adequacy of the EIS in light of the three Arup reviews previously undertaken of the application documentation provided by the Proponent. The previous reviews

- The Next Generation (NSW) Energy from Waste Facility, Eastern Creek EIS – Merit Review, 3 August, 2015, Arup.
- The Next Generation (NSW) Energy from Waste Facility, Eastern Creek EIS – Response to Agency and Company Submission, Urbis, November 2015 and Additional Urbis Submission of 22 February - Arup review.
- The Next Generation (NSW) Energy from Waste Facility, Eastern Creek EIS - EIS Additional Information Gap Review, 14 June, 2016, Arup

The review of the amended EIS submitted in November 2016, has raised **ten essential key queries** which need to be addressed as a priority as they are fundamental to assessing how the proposed facility meets the requirements of the NSW Energy from Waste Policy Statement and the Terms of Reference of for the EIS[1].

The queries raised can be grouped under four main headings:

- The need to demonstrate the technology being used is proven, well understood and capable of handling the expected variability and type of waste feedstock

[1] Director-General's Environmental Assessment Requirements Application number SSD 6236

- Material availability throughout the life of the project in accordance with the EfW Policy criteria
- Material composition
- Proof of Performance

It should be noted that the key queries detailed here are not presented as an exhaustive list of queries raised during the review process, however these queries relate directly to the adequacy of the proposed facility and are presented as the most fundamental that need to be addressed by the Proponent.

Reference facilities

NSW Energy from Waste Policy statement policy requires proponents to demonstrate that the technology being used is proven, well understood and capable of handling the waste feedstock proposed stating:
'Energy recovery facilities must use technologies that are proven, well understood and capable of handling the expected variability and type of waste feedstock. This must be demonstrated through reference to fully operational plants using the same technologies and treating like waste streams in other similar jurisdictions'.
This is a key requirement of the EfW Policy and underscores the criteria philosophy of the Agency. Therefore, the inability to provide a clearly defined demonstration facility treating like waste streams in a similar jurisdiction means that the proponent needs to consider carefully the composition and characteristics of the waste streams it is proposing to accept and how they compare to the waste streams being accepted in comparable overseas facilities.

The EIS acknowledges that the design fuel mix comprises 28.69% C&D waste and 23.27% chute waste i.e. approx. 50% C&D waste in total (figure 24 of the EIS). The EIS references the Ramboll Memo dated 26 October 2016 (Appendix DD.1). The EIS acknowledges (Section 4.4.1) that there is no reference plant accepting approx. 50% C&D waste. The EIS then continues to make the argument that there is potential uncertainty to the composition of feedstock being received in European facilities due to material being pre-processed prior to acceptance at the EfW facility: The EIS states:
'European experience with EfW has been that pre-processed waste materials received from external sources has been sorted prior to arriving at the facility and information relating to its waste declaration/identification is "lost" and cannot be tracked back to its origin.'

This statement implies there is uncertainty relating to the type and source of waste treated at the reference facilities stated (that are all in Europe), and that therefore reference facilities could be treating less or more C&D waste than stated potentially casting doubt on the data presented.

However, referring to the United Kingdom as an example, classifying waste with a List of Waste code / European Waste Catalogue code is a legal requirement under Duty of Care (i.e. chain of custody), and each batch of a particular waste requires a description, LoW/EWC code as well as a quantity on the waste transfer note that accompanies its transfer. Businesses are required to keep waste transfer notes for two years. Therefore, an EfW facility receiving pre-processed waste directly from a UK waste processing facility will know the EWC code and description for each

delivery of waste / RDF it receives. There are LoW/EWC codes specifically for C&D waste (the ‘17s’).
Arup acknowledge that waste that is processed through a RDF or recovery facility, may be reclassified under different LoW/EWC codes e.g. ’19.12.XX’ (waste / RDF from waste management facilities) and therefore at face value the information on the original source of the waste would appear to be ‘lost’. However, the RDF or recovery facility will still be required to hold information on where waste was sourced from. Therefore by following the chain of the custody it is possible to obtain information relating to waste origin – furthermore this should provide a more robust evidence base against which to compare the proposed facility.

Regardless, Arup are in agreement that there is no known comparable facility treating approx.50% C&D waste. There is insufficient explanation on how the proposed facility will cope with processing this high percentage of C&D waste in the absence of a fully operational reference facility.

Query 1: There is insufficient evidence that the proposed technology can operate successfully given the proposed levels (approx. 50%) of C&D feedstock waste. If a representative facility cannot be established, the proponent needs to clearly define and articulate the differences the proposed feedstock will cause in both process and emissions and demonstrate that any difficulties can be mitigated to ensure successful operation of the proposed facility.

Of note - Section 4 of Appendix J states ‘*no two EfW plants would have “identical feedstock” as the feedstock always depends on the region and the waste fractions delivered to the plant’.* The EIS goes on to state that that the comparison with reference facilities in terms of operation of emission behaviour is largely consistent irrespective of location and feedstock. This statement could be considered to be misleading at the emission behaviour of EfW plants is primarily driven by the requirement to meet the IED emission limits.

Material Availability

Construction and Demolition (C&D) residual waste

A methodology is presented for how composition of C&D residual waste has been derived in Section 4.1 of Appendix J (waste management report). This methodology states that ‘appropriate resource recovery’ rates likely to be achieved for each waste stream via a C&D recovery facility or via source separation at C&D sites have been defined, but it fails to state what these rates are or how they have been included in the composition calculation. In addition, Section 4.1 references the Hyder C&D report, which does contain composition data on C&D waste (table 3-1). It is unclear how this composition has been ‘recalculated’ based on remaining residual material. There are also inconsistences in the data, for example, Table 7 in Appendix J shows 43.9% wood, whereas wood is not included in the Hyder C&D composition.

In addition, C&D waste composition has a high proportion of ‘other’ waste (20.75% from figure 24 in the EIS) which is not defined.

Query 2: A detailed, evidenced-based, fully transparent explanation of how C&D residual waste composition has been calculated, including the recovery rates used, should be provided.

An evidence based description on what 'other' waste comprises of is required.

Section 10.4.3.2 of the EIS and Appendix J, Section 7.2, states there is 1,112,150 tpa of C&D waste potentially available as a fuel source for EfW in the Sydney Metropolitan Area (SMA). This is based on the National Waste Report, 2013 (based on 2011 data) and the assumption that SMA is 65% of the NSW total population. It appears that these figures for C&D do not take into account waste materials that are not suitable for incineration (asbestos, hazardous waste etc.).

There is not a robust consideration of the potential feedstock in relation to the proposed facility size. It is not appropriate to suggest that all residual C&D waste is potential feedstock as this does not take into account the composition of the overall waste stream which includes potentially unsuitable material. There is no acknowledgement that certain fractions of the waste will not be suitable to be used as a feedstock.

Query 3: An evidence-based, transparent explanation on the actual available C&D waste tonnages suitable as feedstock that are available in the SMA area is required.

Commercial and Industrial (C&I) residual waste

Similarly, a methodology is presented for how composition of C&I residual waste (16.84% of total waste, or 93,041 tpa) has been derived in Section 4.2 of Appendix J but resource recovery rates are not stated.

In addition, C&I waste composition has a high proportion of 'other' waste (14.44% from figure 24 in the EIS) which is not defined.

Query 4: A detailed, evidenced-based, fully transparent explanation of how C&I residual waste composition has been calculated, including the recovery rates used, should be provided. An evidence-based description of what 'other' waste comprises of is required.

Section 10.4.3.2 of the EIS and Appendix J, Section 7.2, states there is 1,430,000 tpa of C&I waste potentially available as a fuel source for EfW in the SMA. This is based on the same assumptions used for C&D waste.

There is not a robust consideration of the potential feedstock in relation to the proposed facility size. It is not appropriate to suggest that all residual C&I waste is potential feedstock as this does not take into account the composition of the overall waste stream which includes potentially unsuitable material. There is no acknowledgement that certain fractions of the waste will not be suitable to be used as a feedstock.

Query 5: An evidence-based, transparent explanation on the actual available C&I waste tonnages suitable as feedstock that are available in the SMA area is required.

Waste growth

It was previously raised that the Proponent should consider if assuming a positive waste growth rate is reasonable. There is current evidence (including recent data received by Arup from the NSW EPA) that indicates waste generation of C&D and C&I waste may reducing year on year.

The evidence provided in Section 7.4 of Appendix J states that the waste generation growth rate (2006/07 to 2010) is 12% The EIS makes reference to this same statistic in Section 10.4.3.2 The EIS is silent on more recent waste generation statistics that suggests annual waste generation may be decreasing. There doesn't appear to be any acknowledgement that annual waste generation may be decreasing (although it is acknowledged that recycling rates are increasing). Best practice would be to demonstrate the available feedstock would be to provide a detailed waste forecast model for the planned operational period of the proposed facility.

Query 6: An evidence-based justification needs to be given why the Proponent is assuming a waste growth rate from data that is over seven years old. The implications of a waste reduction rate needs to be fully considered with regard to long term waste availability. This could be demonstrated through a waste forecast model, which would estimate predicted waste tonnages over the planned operational period of the proposed facility.

Material Composition

Chute Residual Waste (CRW)

No explanation is given for how the composition of CRW waste has been derived. It comprises 58.20% wood (Figure 24 in the EIS), no breakdown of the types of wood are provided in particular with regard to Treated Wood Waste (refer to Query 7).

Query 7: A detailed, evidence-based and fully transparent explanation of how CRW composition has been calculated, including the recovery rates used, is required.

A detailed compositional breakdown of wood waste is required.

Shredder floc waste

Appendix DD.6 to the EIS includes an estimation of shredder floc composition. This is based on the assumption that 75% of an End of Life Vehicle (ELV) by weight is recovered metal, which would appear reasonable. The remaining shredder floc is estimated to comprise plastics (10.5%), rubber (3.8%), metals (2.5%), textiles (2.9%), fines (3.8%), and fluids (1.6%). Fluids comprises of operational oils/fluids and water.

No detailed chemical analysis suite is provided for floc waste. 'Overall' levels of hydrocarbons are stated as 2.99%. PCB is quoted as 120mg/kg (0.012% by weight) and Bromine as 0.02g/100g (0.02% by weight). No analysis for heavy metals is presented.

Appendix CC to the EIS (project definition brief) presents a chemical analysis of European floc waste in table 3, and a compositional analysis of floc waste likely to be processed at the proposed facility. Chloride concentration is quoted as 0.6 % for the proposed facility compared to 1.8% for

Europe, and Bromine 0.01% for the proposed facility compared to 0.02% for Europe (by weight). Total PAH is stated at 20 mg/kg and total PCB at 14 mg/kg (dry basis).

Appendix CC also includes a composition in figure 3 of shredder floc based on 17 samples, although no specific source for location, date, source, and the types of vehicle the floc is generated from is provided. This composition is different to the estimated composition in Appendix DD.6. A different Net Calorific Value (NCV) is also presented to the NCV in the EIS (Figure 24). 11.6MJ/kg is stated in Appendix CC and 12.59 MJ/kg is stated in the EIS.

Section 4.4.2.1 of the EIS states that *'in general floc processing in Australia is comparable to that undertaken in Europe'*. The EIS also states that (*floc waste in Australia is typically) 'brought to landfill for disposal as limited further resource recovery is possible from this shredded material. The metal industry has successfully secured landfill levy exemptions to assist with the costs of disposing of this difficult waste stream'*.
Specific reference facilities processing floc waste through EfW facilities in Europe has not been provided. If floc waste is processed through EfW facilities in Europe, and as floc waste is landfilled in Australia the assertion that floc waste processing in Australia is comparable to that undertaken in Australia is unfounded.

Query 8: Robust, evidence-based data is required to give a definitive detailed floc waste composition for Australia to allow for a comprehensive comparison to European floc waste.

A detailed comparison of the process used in Australia and Europe to treat ELV is required including clear identification of any differences and the impact this may have on the generated floc.

Identification of EfW facilities in Europe processing floc waste is needed, including composition, quantity and percentage floc waste in the overall waste stream. Consideration of any special operational or handling procedures employed at facilities accepting floc waste should also be articulated.

Treated Wood Waste (TWW)

Wood can be treated with a number of compounds including PCB (Polychlroinated biphenyls), CCA (Copper Chromated Arsenate), paints, and fire retardants. Therefore TWW is a potential source of contaminants of concern for EfW plants. The NSW Energy from Waste Policy statement requires a temperature of 1,100 °C for two seconds if waste has a content of more than 1% of halogenated organic substances, expressed as chlorine.

In addition, The PAS 111:2012 Specification for the requirements and test methods for processing waste wood, Annex A (Grades of recycled wood) indicates TWW (Grade 4 waste) must be processed as hazardous waste. The specification states that waste wood containing CCA preservation treatments and creosote, which is typically fencing, transmission poles railway sleepers, "requires disposal in a process as a hazardous waste incinerator". CCA treated TWW must therefore be treated with the increase temperature of 1100 °C for two seconds. It is common practise in the UK and other EU Countries for CCA TWW to be handled as hazardous waste and treated in an a hazardous waste incinerator.

Appendix DD.5 to the EIS includes a calculation that concludes for a given size of wood treated with PCB (Polychlorinated biphenyl) containing varnish, the chlorine concentration would be less than 0.01% by weight. Therefore the EIS states that there is no need for an increased combustion temperature of 1,100 °C for two seconds from the processing of TWW.

However, the design fuel mix (figure 24 in the EIS) states 0.88% of the design fuel will be Cl. This could include dense plastic such as PVC (Polyvinyl Chloride), and could increase the potential for the formation of dioxins. 0.88% is close to 1% Cl limit in the policy, and any fluctuations in input waste fuel could result in higher concentrations despite proposed mixing of waste in the feed hopper. Section 2.3.1 of Appendix CC (project definition brief) cites that waste mixing will overcome this, however this is stated as being done during 'low delivery' inferring it may not be done all the time. A guarantee of continual thorough waste mixing as a minimum would be required.

Regarding timber treated with Copper Chrome Arsenic (CCA), there does not appear to be any specific assurances there will procedures and processes in place to specifically ensure removal of CCA treated materials. In addition the calculation in Appendix DD.5 only focuses on PCB containing varnish and CCA is not given consideration.

Section and 4.9.2 and 5.4.1 of Appendix J (waste management report) to the EIS states that all treated timber will be monitored from general screening, waste composition audits and analytical analysis of ash residue. It is questionable how effective these measures will be at preventing treated timber from being burned in the facility, as the general screening is not adequately detailed for those waste streams (C&D, C&I) not originating from the Genesis MPC, and waste composition audits and analytical analysis are retroactive measures.

Given that a clear argument has not been provided that can justify that all TWW will be removed from the incoming waste streams, provision of an increased combustion temperature of 1,100 °C for two seconds should further be considered and justification of the proponents preferred position based on scientific modelling or evidence to reference facilities is required. Scenario modelling of varying concentrations of TWW should be undertaken to demonstrate if TWW does enter the feedstock the threshold levels it will not have a significant negative impact in accordance with the EfW Policy.

Query 9: A definitive, evidence-based estimation of the percentage of different types of TWW in the waste feedstock is required.

Detailed acceptance procedures that will be employed at the facility to remove TWW from all waste sources that will be accepted are required.

If adequate removal of TWW cannot be guaranteed, provision of a combustion temperature of 1,100 °C for two seconds operation needs be re-considered.

Scenario modelling of varying concentrations of TWW should be undertaken to demonstrate if TWW does enter the feedstock the threshold levels it will not have a significant negative impact in accordance with the EfW Policy.

Proof of Performance

Appendix LL to the EIS details proof of performance tests and procedures. This includes a detailed methodology for performance guarantee testing etc. but it does not include training requirements of operational staff / competency and capabilities of operational staff. EfW on this scale is a new technology for Australia, and there needs to be assurance that staff will be trained by experienced operators in order to ensure successful operation after the commissioning period is over.

Query 10: Detailed procedures required on how the proposed facility will be run during commissioning and operational phases by operational staff, including training requirements and qualifications.

Conclusion

It is necessary for the Proponent to clearly address the queries raised, and provide evidence based responses. Without the ability to demonstrate the performance of the technology through reference plants treating a similar design fuel mix, assertions made by the proponent about the functionality and performance of their plant and process, cannot be validated. The Proponent needs to provide more detail on the composition of the proposed waste streams and specifically assess and articulate how these waste streams will be processed through the facility and how they will impact the performance of the facility.

The Proponent also needs to give further consideration to the availability of suitable material based on composition and compliance with the EfW Policy, in the Greater Sydney Area which could be utilised as fuel for the facility.

DOCUMENT CHECKING (not mandatory for File Note)

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NSW Environment Protection Authority

Review of the Human Health Risk Assessment

The EPA has reviewed the Human Health Risk Assessment (HHRA) (AECOM, 23 November 2016) on public exhibition for the proposed Energy from Waste Facility (the facility) at Eastern Creek (the site).

The HHRA includes the assessment of additional appropriate scenarios to demonstrate representative and worst case facility emissions are not likely to result in potential adverse health impacts.

According to the HHRA, the health risks to off-site residents and commercial workers from chronic exposure to air pollutants directly emitted from the facility, and chronic exposure to multiple non-direct inhalation exposure pathways, are low and acceptable. Health risks associated with acute exposure to emissions during upset conditions were also considered in the HHRA and the HHRA found them to be low and acceptable.

The EPA advises that the HHRA generally follows the requirements outlined in Environmental Health Risk Assessment: Guidelines for Assessing Human Health Risks from Environmental Hazards (enHealth, 2012) (the enHealth Guidelines) and other relevant guidance documents referred to in the HHRA.

However, the EPA has identified a number of issues with the assessment that require further clarification or justification to demonstrate the assessment is robust and that risks associated with facility are acceptable.

The EPA notes the HHRA and supporting assessments use a range of information, assumptions and data to derive estimates to qualitatively and quantitatively characterise and define critical facility operations, parameters and emissions. In general there are numerous assumptions and variables relating to the waste/fuel, plant and project operations and performance, and emissions. These have not been clearly identified, well characterised or comprehensively evaluated in the HHRA. This brings into question the thoroughness and veracity of the assessment.

The EPA advises that the Air Quality Impact Assessment, ozone and other assessments provide critical information and source data on which the assessment of health risks associated with the facility is based. Thus changes that are made to supporting assessments will require the HHRA to be reviewed and potentially amended to reflect and address the changes.

The Next Generation NSW Pty Ltd (the proponent) has submitted an amended EIS (Urbis, November 2016) in support of its proposal to construct and operate an Energy from Waste (EfW) electricity generation plant (the facility/project) at Honeycomb Drive, Eastern Creek (the site).

The EIS addresses submissions, and includes design and other changes made to the facility since the previous EIS for the project was put on Public Exhibition. The EIS includes a revised Human Health Risk Assessment (HHRA) for the project (AECOM, 23 November 2016).

ISSUES OF CONCERN

The EPA has reviewed the project human health risk assessment (HHRA) titled *Energy From Waste Facility, Human Health Risk Assessment, Honeycomb Drive, Eastern Creek* (AECOM, 23 November 2016). Details of the issues identified by the EPA are provided below.

1 The assessment of facility impacts may be unreliable as it is unclear how accurate the assumptions and input data used in the assessment are.

A large number of assumptions have been incorporated in the assessment of risk to human health from the facility and supporting EIS. Generally the main assumptions are associated with estimating or defining:

i. waste inputs, composition and processing (such as mixing/homogenisation);
ii. plant operation and performance – including to assess normal operations, periods of maintenance, start-up, shut-down and upset conditions; and
iii. emissions, particularly of air pollutants.

With respect to air emissions and their potential health impacts, the following factors are noted as especially significant sources of variability and uncertainty:

i. Fuel/waste composition;
ii. Plant design;
iii. Flue gas treatment;
iv. Start-up and shut-down; and
v. Upset conditions.

The EPA notes that numerous assumptions and input data used in the assessment of the facility are not well supported or clearly identified (see below), which brings into question the veracity of the assessment outcomes, and does not allow a comprehensive review of the EIS and its outcomes.

Further details of the main assumptions identified by the EPA are provided in the following points.

The EPA requires the proponent to revise the HHRA to ensure all parameters, input values, and assumptions used are clearly identified, described, characterised, evaluated and quantified (where possible). The assessment must demonstrate and justify that the values used are robust and appropriate for their required purpose.

1.1 Fuel/waste composition and demonstrated ability of plant to treat accepted materials. Assumptions and variability in waste inputs, chemical composition and processing.

Parameters such as the type, form and chemical makeup of the fuel/waste, are important with respect to ensuring the correct plant design and requirements for operation. In addition the nature of the feed material determines the air pollutants generated during and following incineration, and the operational requirements for treatment and capture of air pollutants and monitoring.

The project Waste Management Assessment and Project Definition Brief provides some details of the proposed waste sources and their composition and notes the potential variability in chemical composition within the various waste types. These assessments aim to characterise the makeup and chemical composition of the fuel/waste, and demonstrate the fuel/waste will be consistent and within the range accepted at other similar facilities operating in Europe.

The EPA notes there is a large variability in the proposed fuels/wastes and therefore likely feed material contaminants and contaminant concentrations. To accommodate this large variability, the incineration and air pollution control system must be designed to treat this large range of feed materials. This will ensure that air emissions are effectively captured or destroyed at the facility. The EPA also notes this variability of contaminant concentrations, and the acceptable range for treatment, is not well characterised or clearly presented in the HHRA.

In addition, insufficient justification is provided to demonstrate that all the fuels/wastes proposed to be accepted at the facility can be effectively processed. For example, it is unclear if emissions generated by the fuels containing significant amounts of wood treated with arsenic, or floc and construction and demolition wastes likely to contain elevated levels of heavy metals, can be effectively controlled by the proposed facility.

The EPA notes that appropriate waste selection, mixing and homogenisation is required to ensure all waste used as feedstock will be acceptable for effective combustion and emission control. However it is unclear how this process will be effectively ensured.

The EPA requires the proponent to provide additional information to demonstrate variability and uncertainties in fuel/waste composition has been robustly assessed.

1.2 Plant design, operation and performance.

The EIS generally assesses facility impacts based on reliable, consistent and predictable operation and performance of the plant. In particular, facility air emissions are assessed, in part, using emissions data from reference facilities that are assumed to provide representative emissions data that can be applied to the proposed facility.

The HHRA uses modelled emissions data and thus also incorporates these assumptions in the assessment of risks to human health.

The EPA notes that ongoing proper and efficient operation of the facility will be required to ensure assumptions incorporated into the assessment of risks to human health remain valid. Consequently, critical parameters and potential variability and uncertainty associated with these parameters must be robustly identified, evaluated, and applied or maintained.

The EPA requires that the proponent provide additional information to demonstrate assumptions and variability regarding plant operation and performance are well characterised and have been taken account of in the assessment.

1.3 Flue gas treatment

Flue gas treatment is stated to have been designed to meet best available technology, and for emissions to meet the requirements of the European Union Industrial Emissions Directive (IED).

The EPA notes that the air pollution control system must be robust and versatile so that it can effectively capture or destroy the wide range of air pollutants and emission concentrations that are likely to be generated by the feed material.

It is unclear if the flue gas treatment system will be able to effectively control all significant air pollutants to the levels required to ensure compliance with project requirements. This is due to the potential variability and uncertainty, and presence of potentially problematic wastes (such as arsenic treated wood and floc waste potentially high in heavy metals and/or chlorine), in the waste feed material.

The EPA requires that the proponent demonstrate the flue gas treatment system will be capable of effectively controlling emissions generated by the range of potential feed materials that may be used at the facility.

1.4 Start-up/shut-down and upset conditions

Start-up and shut-down periods are associated with emissions variability. Start-up and shut-down periods are stated to be infrequent and are anticipated to occur only during the Facility's annual maintenance program. To ensure adequate combustion above 850 ºC and effective flue gas treatment during start-up and shut-down periods, the project incorporates the combustion of support auxiliary fuel (low sulphur light fuel oil) and certain waste processing.

Monitoring data during upset conditions is not available from existing facilities and consequently worst case assumptions have been made based on plausible emissions during these periods (in consultation with the UK Environment Agency). In addition, the EIS commits the operation of the facility to be consistent with the European Union Industrial Emissions Directive (IED; Directive: 2010/75/EU) which requires upset conditions to occur for no more than 4 hours uninterrupted and cumulatively no longer than 60 hours per year.

The EPA notes the design and operation of the facility must be consistent with the assumptions and requirements presented in the EIS to ensure the assessment of facility impacts remain valid.

The EPA requires that the proponent revise the HHRA to clarify the assumptions regarding start-up/shut-down and upset conditions are robust and conservative with respect to the assessment of risk to human health from the facility.

2 Air pollutant emissions.

The assessment notes[1] that no two EfW plants have identical feedstock as this is region and locally specific. However the assessment states for plant with comparable feedstock and "identical" air pollution control processes the emission behaviour is largely consistent, irrespective of location and feedstock. This is due to each EfW plant having a destruction and removal process for each contaminant group (such as acid gases, organic substances, and heavy metals) and continuous process and emission monitoring to ensure proper and efficient operation of the plant. The assessment argues that because of this, "plants with comparable (not identical) feedstock are sound evidence for the suitability of the technology".

The HHRA includes additional justification and details of the selected contaminants of potential concern (CoPC) in correspondence from Ramboll in the 5 memorandums presented in Appendix I of the HHRA. However, the EPA notes there is significant variability and numerous uncertainties and unknowns associated with emissions from the facility (refer to issues below and under issue **1** above).

The EPA has identified a number of issues related to project air pollutant emissions which are summarised in the following points.

2.1 It is unclear what emission concentrations were modelled and if they are representative, conservative and correct.

The HHRA considers three future operating conditions (Section 4.2):

a. Normal operating condition: Considered to be the most representative of future operation, where the facility is operating at the prescribed Industrial Emissions Directive (IED; Directive 2010/75/EU) emission rates.
b. POEO limit operation conditions: Representative of theoretical worst case impacts unlikely to be realised, where the facility is operating at the POEO (Clean Air) Regulation 2010 emissions standards except for cadmium.
c. Upset operating conditions: Considered to be the most representative of potential upset conditions, where the facility is operating at the mass emission rates provided to Pacific Environment by Ramboll (the proponent's engineers).

The EPA notes the chosen operating scenarios are generally appropriate for the assessment of facility impacts, and that the HHRA has aimed to identify and apply realistic, relevant, and potential worst case emissions in the assessment. However despite the HHRA stating the normal operating conditions scenario uses the prescribed IED emission rates, the EPA notes the modelling of emissions of CoPC were based on the significantly lower 'real world' in-stack concentration data. This in-stack data is sourced from other facilities stated to have identical air pollution control systems to the project and using 'similar' feedstocks (Ramboll, 20 October 2016). The 'real world' stack concentration data was provided by the proponent's engineer Ramboll, and the outputs of the revised air modelling have formed the inputs to the current HHRA. Consequently, it appears the revised modelling has resulted in ground level concentrations and deposition estimates (and also risk estimates) that are much lower than those included in the previous HHRA that was put on public exhibition in 2015.

If approval is given for the development, the emission limits in the Facility's licence will reflect the values demonstrated in the project EIS to not result in any adverse impacts to the environment or human health. Consequently the emission concentrations used to assess Facility impacts should be

[1] Updated Technical Design Information – The Next Generation NSW Pty Ltd (Ramboll, November 2015).

based on the proposed emission limits, rather than 'real world' (averaged or otherwise) stack concentrations, which may potentially significantly constrain facility operation.

The EPA notes AQA Appendix G includes a table of all in-stack concentrations under normal and upset conditions used in the dispersion model for air pollutants assessed in the HHRA. However the in-stack concentrations provided for some air pollutants (such as HCl, HF, SO2, NO2, CO, Hg, Cd, and Tl) are not equivalent to the IED limits stated as applied in Scenario 1 to assess normal operating conditions (HHRA Section 4.2).

In addition, the HHRA (or AQA) does not include a table of in-stack concentrations used for HHRA Scenario 2 (POEO Limit operating conditions).

Based on the above issues it is difficult to verify if the in-stack values were correctly applied in the air dispersion model and therefore that derived exposure point concentrations in the HHRA are accurate.

The EPA requires that the proponent:

i. **clarify and justify the emission concentrations used for all pollutants for each scenario, and revise the HHRA to include an assessment of risk to human health that clearly demonstrates an acceptable risk where the Facility emissions are at the proposed maximum permissible concentrations; and**
ii. **clarify the reasons why estimated emissions generally appear to have been reduced in each subsequent assessment.**

2.2 Appropriate selection and characterisation of emissions should be robustly demonstrated.

Emissions generated from the facility will be dependent on a range of factors as discussed in issue **1** above. Due to the variability of waste materials and their composition, a wide range of potential contaminants/contaminant classes and concentration ranges requires detailed consideration and assessment. Generally only limited and disjointed information is provided on the uncertainties and variability of contaminants/contaminant concentrations, and implications on potential facility emissions.

The EPA requires that the proponent revise the HHRA, to provide further comprehensive and cohesive discussion on the implications of uncertainties and variability associated with compound emissions.

2.3 The data on organic pollutant emissions is dated from the 1990's and may not be applicable to facility emissions

Ramboll (Memo 2, 19 October 2016) outlines the strategy used to demonstrate the CoPC chosen are robust for consideration and assessment of facility impacts. Ramboll notes there is little literature on the main organic components associated with total organic emissions from waste incineration plant, with most information published from the mid 1990's.

The EPA advises the HHRA generally tries to implement a conservative approach to assess possible organic compounds emitted. However, the likely speciation profile of emitted organic pollutants and their concentration at the facility is not known and likely to be highly variable and dependent on many factors including facility design, operation and wastes received.

The EPA requires that the proponent revise the HHRA to provide further discussion on the implications of uncertainties associated with organic compound emissions.

2.4 The evaluation of bromine emissions control refers mainly to a plant with an emissions control system that is of limited relevance to the facility.

Ramboll (Memo 5, 14 October 2016) evaluates the potential effect of waste with elevated bromine content such as waste containing brominated flame retardants and in particular floc waste. Ramboll notes that incineration will decompose brominated compounds to mainly hydrogen bromide and small amounts of other brominated organics such as dioxins partially or fully substituted by bromine. The memo also states there are few studies regarding incineration of waste containing brominated flame retardants at modern facilities.

Ramboll refers to a study of three incineration plant in Norway. Emissions of brominated flame retardants were detected at 14-22 ng/Nm^3 at the Klemetsrud plant in Oslo with no additional dioxin formation. However elevated carbon monoxide levels were observed in the stack gases demonstrated sub-standard plant performance. In addition the Klemetsrud plant includes a wet scrubber in addition to a fabric filter. The wet scrubber appears to reduce brominated flame retardant emissions by a significant amount (up to 150 times). The EPA notes that due to the different air pollution control system at the Klemetsrud plant, its relevance to the emission performance of the EfW project is limited.

Ramboll also refers to the Energos Plant at Ranheim which, due to its small size (10,000 tpa), is also likely to be of limited relevance with respect to project emissions.

The EPA notes that facility emission controls will likely be most effective if bromine containing wastes are well mixed with other wastes, and if the bromine content in the feed material is maintained at consistent and low levels. However it is unclear how this will be ensured.

The EPA advises the comparison of the facility emissions with those from the Klemetsrud plant is unreliable due to the different air pollution control systems at each site.

2.5 <u>Clarification may be required regarding nitrogen dioxide (NOx) emissions during upset conditions.</u>

Ramboll (Memo, 29 January 2015) states no monitoring data is available from existing facilities during upset conditions. In the absence of monitoring data, plausible worst-case assumptions are used based on consultation with UK Environment Agency. The memo states ‘It would be worth consulting with HZI to ensure that they agree with the predicted NOx emissions under upset conditions”. The EPA notes it is unclear if HZI (the plant manufacturer) agrees with the predicted NOx emissions.

The EPA requires that the proponent clarify the assumed NOx emissions under upset conditions have been confirmed by HZI.

3 It is unclear if the HHRA provides an accurate assessment of potential project health risks.

The EPA has identified a number of issues that require clarification in order to demonstrate the HHRA provides a robust and accurate assessment of project variability and uncertainties, and potential health risks. The issues identified are summarised as follows.

3.1 <u>It is unclear if the predicted ground level air pollutant concentrations are accurate.</u>

The HHRA ‘conservatively’ assumes the EFW facility will operate for 8,000 hours per year (allowing 760 hours for maintenance annually). In addition, the AQA (AQA Section 2.1), Ozone Impact Assessment (OIA, Section 2.2) and Odour Assessment (OA, Section 2) state that over a year, “it is assumed the facility would be operational for 8,000 hours as an annual average”. Consequently the EPA notes it appears the AQA, OIA and OA have modelled annual emissions based on the plant operating 91% of the year (or 333 days per year).

Based on this assumption, the EPA notes that if the plant operates for longer than 8,000 hours per year the modelled annual average GLC predictions will no longer be applicable. In addition dispersion model predictions may underestimate GLCs where facility emissions are not assessed over a full year of meteorological data. Consequently it is unclear why the assessment did not conservatively assume a scenario of 8,760 hours operation per year.

The EPA requires that the proponent:

- **clarify how facility emission were modelled and advise if the modelled annual average ground level concentration predictions are based on the worst case with respect to the duration of facility operation over a year; and**
- **revise the HHRA and EIS to clarify the facility will not run for more than 8,000 hours per year or as otherwise required.**

3.2 The assessment of potential chronic health effects using Scenario 2 does not include all the relevant pollutants

The EPA notes that only four CoPC were considered under Scenario 2, the scenario which is meant to be representative of worst case impacts with the facility operating at the POEO (Clean Air) Regulation 2010 emission limits (except for cadmium). Consequently the calculated risk for this scenario is likely to be incorrect and underestimated.

The EPA requires that the proponent revise the HHRA to reassess Scenario 2 including all relevant CoPC.

3.3 The potential for fugitive and odorous emissions from the tipping hall have not been considered during upset or maintenance periods.

The HHRA notes that fugitive emissions from the tipping hall have not been included in the project air dispersion model as:

- the hall will be maintained under negative pressure; and
- the application of good dust management practices are considered to result in minimal potential for fugitive dust emissions.

The EPA notes that during upset conditions or maintenance periods, when incineration is not taking place, the tipping hall will not be maintained under negative pressure. Emissions from the tipping hall have not been modelled in the AQA or OA during these periods, despite the increased potential for fugitive and odorous emissions from the hall.

The EPA requires that the proponent further consider the potential for fugitive emissions and odour from the tipping hall during periods when incineration is not taking place.

3.4 The stack parameters provided in the HHRA are incorrect.

The EPA notes the stack parameters used for dispersion modelling in Table 7 (Section 3.4) incorrectly list the parameters used for the original AQA, not the revised current AQA (see AQA Table 7-8) and those advised by Ramboll (Memo no. 1, dated 13/09/2015).

The EPA note the summary of model (99.9th percentile) predictions reported in Section 3.4 of the HHRA correctly reflect those in the AQA (Section 9.1), which presumably were derived using the most up to date emission parameters. Consequently the EPA assumes the modelling that was undertaken uses the (correct) current emission parameters, however it is not clear this is the case.

The EPA requires that the proponent:

- **amended the HHRA the include the correct data in Table 7; and**
- **clarify the modelling undertaken uses the current and correct emission parameters.**

3.5 The meteorological data used in the dispersion model is not clearly demonstrated as representative of the long term meteorology.

Meteorological conditions used in the air quality model were data obtained in 2013 from St Mary's OEH meteorological station. This data were determined to be representative of long term meteorology at the site by an evaluation of 5 years of meteorological data between 2009 and 2013 from the Horsley Park Bureau of Meteorology automatic weather station (Section 2.10).

The AQA states that using the St Marys dataset resulted in ground level concentrations up to 64% higher than if the Horsley Park dataset was used which demonstrates the meteorology at each site differs to some extent. Despite this, the EPA notes that an evaluation to demonstrate that data from Horsley Park monitoring station is valid to determine the representativeness of St Mary's 2013 data is not presented in the AQA or HHRA.

The EPA requires that the proponent:

- **clarify why OEH St Marys 2010 to 2012 data was not used in the evaluation of the chosen 2013 data; and**
- **provide additional information to verify the 2013 St Marys meteorological data is representative of long term meteorology at that site and therefore suitable to use in the air dispersion model for the project.**

3.6 The HHRA does not include the dispersion modelling data used to justify the water supply at Prospect Reservoir will not be impacted.

Significant features near the facility considered in the HHRA are Minchinbury Reservoir and Prospect Reservoir (Section 2.0).

Minchinbury Reservoir is located over 1 km to the east of the proposed site and consists of 2 large tanks and pumping units. Due to the distance to the Reservoir and the fact that the tanks are covered, emissions from the site are unlikely to impact the stored water.

Prospect Reservoir, which is a lake with an area of 5.2km^2 and a catchment of 10km^2, located approximately 4.5 km ESE of the site and which is still used as a drinking water supply for Sydney, is also considered. The HHRA states Prospect Reservoir is unlikely to be impacted by the facility due to its distance from the facility, and the dispersion modelling outcomes. The HHRA refers to the Air Dispersion Modelling section regarding this issue. However the EPA notes that the Air Dispersion Modelling section of the HHRA does not further discuss or provide the dispersion modelling outcomes. These are needed to justify any impact at the water supply from deposition of air pollutants with Prospect Reservoir and catchment will not be significant

The EPA notes that significant deposition of air pollutants emitted from the proposal is unlikely to occur at a distance of 4.5 km of the site, however to demonstrate this, quantitative information should be provided.

The EPA requires that the proponent revise the HHRA to include quantitative data from the air dispersion modelling to demonstrate deposition of air pollutants within the catchment of Prospect Reservoir will not be significant enough to warrant further consideration.

3.7 The screening criteria lack evaluation.

The EPA notes the Tier 1 screening criteria for the chronic effects health assessment were generally selected based on a hierarchy of ambient air criteria listed in the HHRA and stated to be that in enHealth 2012 (Section 4.10.1).

A similar hierarchical approach was applied to the acute exposure screening approach (Section 4.13.1). However the criteria selection process does not include any evaluation of the criteria provided in the chosen hierarchy. This is despite other sources potentially being based on more recent data (for example for lead) or being set using more contemporary risk assessment methodologies.

The EPA requires that the proponent revise the HHRA to demonstrate the screening criteria used have been appropriately evaluated and applied.

3.8 The background allocation for some CoPC have not been referenced.

The EPA notes the background allocation for seven CoPC are not referenced (Section 5.2.3).

The EPA requires that the proponent comment on or include a reference for the background allocation for all CoPC.

3.9 Clarification is required why air-to-leaf transfer was not considered as a means of accumulation of CoPC in edible plants.

With respect to accumulation of CoPC in edible plants, root uptake and deposition onto outer plant surfaces have been considered, however the HHRA does not discuss air-to-leaf transfer. Stevens (1991) noted this transfer process as potentially as, or more, important than root update as a source of plant contamination.

The EPA requires that the proponent revise the HHRA to clarify a why air-to-leaf transfer was not considered as a means of accumulation in edible plants.

3.10 The location of grid maximum concentrations is different for Scenarios 1 and 2, however it is unclear why this is the case.

The HHRA presents the locations where grid maximum concentrations were reported for the modelled scenarios (Section 4.3.3). The EPA notes these maximums occur at different locations for Scenarios 1 and 2, however it is unclear why this is the case as the model parameters only differ with respect to emission concentrations.

The EPA requires that the proponent clarify why the grid maximum locations differ for Scenarios 1 and 2.

3.11 The terminology used to describe ground level concentrations is unclear.

The HHRA considers the “1-hour maximum annual average” ground level concentrations (GLCs) at each receptor to be representative of the worst case exposure scenario value. The EPA notes that the HHRA clarifies the meaning of this ambiguous term in Section 4.3.2 as ‘the maximum value of the 1-hour averages that were predicted over an entire year’. However elsewhere in the HHRA the term ‘1-hour maximum annual average’ remains.

The EPA requires that the proponent revise the terminology used to describe the ground level concentrations used in the HHRA to ensure their meaning is clear.

4 The assessment of impacts on human health relies on the provision of accurate assumptions and data in other project investigations.

The HHRA considers the following investigations with respect to potential risks to human health:

- Soil and Water Assessment;
- Ozone Impact Assessment;
- Air Quality and Greenhouse Gas Assessment;
- Noise Impact Assessment;
- Odour Assessment; and
- Preliminary Hazard Analysis and Fire Risk Assessment.

The HHRA found that outcomes from these assessments relevant to potential human health risks were such that further assessment of the respective impacts was not warranted – apart from impacts associated with ozone and air quality.

The EPA notes that these assessments provide critical information on which the assessment of health risks is based. In particular the AQA and dispersion modelling output data is critical in the assessment of facility risks to human health. The HHRA refers to the project AQA for details of the proposed operation of the facility. These include, emission parameters, emission concentrations and details of modelling used to predict input values (including dust deposition) required for the quantitative assessment of health risks utilised in the HHRA.

As the AQA provides much of the input information into the HHRA, any inaccuracy in the AQA that affects air quality model outputs will also affect the HHRA input data, and thus potentially the outcomes of the HHRA.