Science Division	
For information	

Weston Aluminium Thermal Waste Processing Project (SSD 15_7396): C&R Review of August 2016 Human Health Risk Assessment	**SF16/53337; DOC16/608193**
	1 December 2016

Purpose

Office of Environment and Heritage, Contaminants and Risk Team comments in relation to the August 2016 Human Health Risk Assessment for the proposed Weston Aluminium Thermal Waste Processing Project (SSD 15_7396).

Analysis of issues / sensitivities

The Department of Planning & Environment has requested the Office of Environment and Heritage, Contaminants and Risk Team (C&R) provide comments in relation to the Human Health Risk Assessment (HHRA) for the Weston Aluminium Pty Ltd (WA) proposal to thermally process certain wastes, application reference SSD 15_7396 (the Project).

The Project consists of the construction and continuous operation of a waste processing facility that will thermally treat up to 8,000 tonnes per annum of medical and other generally problematic wastes at WA's existing facility in Kurri Kurri (the Site).

C&R has undertaken a detailed review of the Project HHRA (AECOM, 26 August 2016)[1]. The HHRA considers potential chronic and acute impacts on human health from Project related changes to air quality, noise, vibration, soil and water. The HHRA finds the estimated health risks to off-site residents, recreational users and commercial workers from exposure of air pollutants from all exposure pathways are low and acceptable.

However C&R has identified a number of issues with the HHRA that require amendment or clarification in order to ensure the assessment is robust, and consequently that potential human health risks associated with the operation of the facility are acceptable. Details of the issues identified from C&R's review of the HHRA are provided in **Attachment 1**.

C&R also notes the assessment of risks to human health is dependent on the accuracy of information and data provided in the Project Environmental Impact Statement (EIS), in particular the Project Air Quality and Odour Assessment (AQIA). C&R has not reviewed the AQIA in detail however notes this assessment has been reviewed by the Environment Protection Authority (EPA) – who identified numerous issues with the AQIA that prevented the EPA from recommending Project approval conditions. Consequently any amendment to the AQIA that changes information or data required to conduct the HHRA, based the EPA's review or otherwise, will also require amendment of the HHRA.

Recommendations

Prior to Project approval, Weston Aluminium address the issues identified in **Attachment 1**.

Approvals

CC:	Keith Osborne, Senior Team Leader - Contaminants and Risk	Click here to enter a date.
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[1] *Human Health Risk Assessment, Weston Aluminium, Thermal Waste Processing Project* (AECOM, 26 August 2015).

Attachments

A.	Attachment A – Weston Aluminium ThermalDetailed review of August 2016 Human Health Risk Assessment

ATTACHMENT A: WESTON ALUMINIUM THERMAL WASTE PROCESSING PROJECT (SSD 15_7396): DETAILED REVIEW OF AUGUST 2016 HUMAN HEALTH RISK ASSESSMENT

1. The HHRA does not clearly consider and assess all potential Project health risks

The HHRA considers impacts to human health from potential impacts associated with the Project, specifically those associated with air quality and odour, noise and vibration, and soil and water.

Other potential impacts to human health are considered in the Project Hazard Analysis (HA) component of the EIS, such as impacts associated with:

- produced waste material (ash product and baghouse dust); and
- the transport, receipt and processing of wastes including infectious and pathogenic substances, quarantine and pharmaceutical wastes, flammable liquids, toxic substances, corrosive substances, pitch sludge residues and other dangerous/hazardous substances.

The HA assesses the above risks qualitatively against the risk criteria for land use safety planning in *Hazardous Industry Planning Advisory Paper No 4* (DP&E, January 2011). The HA notes the greatest potential for far field effects is associated with the evolution of toxic gas, though states this is not considered a credible scenario for the facility. In addition the HA notes that scenarios for potential toxic gas releases have been considered in the Project AQIA and HHRA, and that these studies found that consequences due to toxic releases were not significant.

However C&R notes that the toxic gases assessed in the AQIA and HHRA are associated with stack emissions from the proposed incinerator, rather than (as noted in the HA) the toxic gases in the air resulting from for example:

- vapours from toxic liquids;
- reaction of materials giving off toxic vapours or gases;
- other scenarios listed in Section 7.2 of the HA; or
- the transport, handling and processing of the hazardous materials included in Section 7.1 of the HA.

Recommendation: The HHRA and HA should be revised to clarify and demonstrate that all potential risks associated with the Project have been appropriately considered and assessed.

2. It is unclear if the HHRA is based on the most up to date technical reports

The HHRA states (Section 1.1) that it was written in conjunction with other technical report required as part of the EIS including the Draft Noise Impact Assessment, Draft Air Quality Impact Assessment, and Draft Soil and Water Assessment. C&R notes it is unclear if the draft assessments referred to include the most up to date data for the Project.

C&R notes that the AQIA and other assessments provide information and source data on which the assessment of health risks associated with the facility is based. Therefore the results of the HHRA depend on the data provided in the other assessments being up to date and correct.

Recommendation: The HHRA should be revised to clarify that the data used in the assessment is current and from the most up to date technical reports.

3. Critical parameters and assumptions regarding the facility and its operations are not adequately considered

A large number of assumptions have been incorporated in the HHRA to enable an assessment of potential human health risks. Critical assumptions used in the HHRA include those associated with estimating or defining: waste inputs, waste composition and processing, plant operation and performance, and to characterise emissions. Assumptions to assess maintenance, start-up, shut-down and upset conditions, where often measured data is limited, unreliable or unavailable, also require incorporation into the assessment.

C&R notes the HHRA does not provide details of the proposed facility or facility operations, or the associated factors and assumptions that must be considered to ensure the assessment is thorough and conducted properly.

C&R also notes that ongoing proper operation and maintenance of the facility will be required to ensure the assumptions incorporated into the assessment of facility impacts and health risk remain valid. Generally the assumptions used are based or depend on reliable, consistent and predictable operation and performance of the plant. Consequently all critical parameters and assumptions should be clearly identified, and potential variability and uncertainty associated with these should be comprehensively evaluated.

Recommendation: The HHRA should be revised to provide additional information:

- **on the facility and Project operations relevant to potential emissions and impacts;**
- **on the factors and assumptions used to ensure the assessment adequately addresses identified uncertainties and variability regarding the facility and facility operations; and**
- **to clarify the factors and assumptions used are robust and conservative with respect to the assessment of risk to human health.**

4. <u>It is unclear if all relevant and significant data gaps in the HHRA have been identified and appropriately evaluated</u>

Several data gaps which may impact the HHRA are discussed (Table 4). C&R notes however these do not appear to cover all the potential aspects where data is not available or complete and may significantly impact the HHRA. For example, emission data is not available that covers all likely plant operations / scenarios, and data is not available for use in assessing odour or fugitive emissions. With respect to emissions data, the HHRA notes that the assessment may need to be revised if prescribed limits or emission data become available in the future.

Recommendation: The HHRA should be revised to identify potential data gaps and their significance with respect to their impacts on the HHRA.

5. <u>It is unclear if the operating scenarios considered are appropriate</u>

The HHRA considers four operating scenarios defined as follows:

a. Scenario 1 - Normal Operating Conditions: a chronic health assessment associated with 'normal operating conditions' defined as the proposed plant operating continuously at a maximum capacity, and all existing on-site air emission point sources are modelled using average source data. Scenario 1 is stated to consider potential chronic health impacts associated with representative conservative conditions.

b. Scenario 2 - Stack Emission Limits: an acute health assessment defined as the proposed plant emitting air pollutants at Environment Protection Licence limits, and all existing on-site air emission point sources are modelled using average source data. Scenario 2 is stated to consider potential acute health impacts at infrequent maximum operating conditions at the site.

c. Scenario 3 - Battery Recycling Facility: a chronic health assessment of modelled emissions from the proposed adjacent battery recycling facility using high level design limit emission concentrations and continuous operation, added to the predicted maximum impacts in Scenario 1 to determine the cumulative impacts from both proposals. Scenario 3 is stated to consider potential chronic health impacts at worst case/unlikely operating conditions.

d. Scenario 4 – Emergency Bypass Operations: an acute health assessment that utilises the maximum discharge emission concentrations based on the design limits for the operation of the emergency bypass stack during upset conditions. Scenario 4 is stated to consider acute health impacts associated with upset operating conditions.

C&R notes in all scenarios <u>non</u>-Project site emission sources were modelled using average source emission data. The data from the non-Project related emission sources is not presented or discussed

in the HHRA and therefore it is not possible to evaluate the appropriateness of this data in the chosen scenarios for the assessment of chronic and acute health risks.

Recommendation: The HHRA should be revised to clarify the use of average source emission data for existing site emission sources is reasonable and conservative with respect to the assessment of human health risks.

6. It is unclear if all significant potential emission sources have been considered in the assessment

The HHRA identifies (Table 6) eight emission stacks as sources of potential contamination at the site, and states site operations including emission sources, air emission controls and potential emission concentrations are described in detail in the Project AQIA. However C&R notes that the AQIA does not clearly define or discuss the existing emission sources or emission controls at the site, or the potential new emission sources associated with the Project.

The project will comprise the construction of a new building which will accommodate waste material storage and primary combustion chamber inlet plant and equipment (EIS 6.1). In addition the Project will include installation and operation of a waste treatment system comprised of elements such as: waste shredder, waste handling facilities, solid waste ram loader system, and rotary kiln and associated plant and equipment. Wastes will be appropriately segregated and stored in dedicated locations within the building, with no waste stockpiles or waste stores in the open air. Storage is generally proposed to be in sealed delivery bins. The bin tippler and soil waste loader are located inside the building (EIS 6.4.6), and the loading hopper includes a lid to minimise air exchange between the hopper and open air environment.

C&R notes that the Project HHRA (or AQIA) does not consider odour generation or the potential for odour impacts associated with the materials proposed to be processed at the facility. In addition fugitive air emissions associated with the transport, receipt, handling and processing of waste are also not considered in the HHRA (or AQIA).

The EIS does not provide sufficient information to evaluate the potential for facility activities to result in significant impacts, such as waste preparation and shredding to generate odour or other fugitive emissions, or impacts associated with waste wash water of which up to 250 litres per hour will be generated during peak processing times (EIS 6.4.8 and 6.4.10).

Recommendation: The HHRA / EIS should be revised to clarify the potential significant emission sources associated with Project operations have been identified and assessed where appropriate.

7. It is unclear if the emissions considered in the assessment are appropriate

The EIS notes (Section 6.4.1) the Project is proposed to process a wide variety of wastes generally considered problematic due to their potential to cause harm to human or environmental health. The EIS provides a list of the proposed types of waste to be accepted at the facility (Table 6-3), however does not include a breakdown of the potential associated chemicals of potential concern (COPC) or hazardous substances that may be emitted either prior to or after the waste is incinerated.

The estimated waste volumes derived from known industry generation rates, though subject to demand and market factors, have been broken down to give an indicative estimate of: medical wastes 75%, quarantine wastes 15%, and other 10%. C&R notes however that insufficient information is provided in the EIS to be able to undertake further estimates or evaluations to better characterise the nature and amounts of COPC that will result from the waste received.

The EIS states the operation will have a maximum throughput of 800 kilograms per hour (kg/hr), based on the processing capacity of the plant. C&R notes that the EIS (Table 6-5) includes a maximum yearly waste throughput figure of 8,000,000 kg, which is approximately 14% higher than the value calculated based on the maximum throughput of 800 kg/yr. A total annual throughput value of 8,000 tonnes/year is utilised elsewhere in the EIS, for example in estimating the amount of ash generated each year (800 tonnes, based on a 10% waste to ash conversion ratio). C&R presumes this is a calculation error.

Recommendation: The EIS/HHRA should be:

1) **revised to clarify and include additional information to assist to demonstrate the emissions considered in the HHRA and EIS are representative of those that will result from the Project; and**
2) **reviewed and amended as appropriate, to address the yearly waste throughput value in Table 6-5 and elsewhere in the EIS.**

8. <u>The Project HHRA relies on information and data in other EIS documents being accurate</u>

The assessment of risks to human health is dependent on the accuracy of information and data provided in the Project Environmental Impact Statement (EIS), in particular the Project AQIA. Consequently any change to the EIS that changes information or data required by the HHRA will also require amendment of the HHRA.

For example, the Project AQIA and dispersion model outputs are used in the HHRA for the estimation of exposure point concentrations and to estimate health risks to residents and other receptors. The HHRA is critically dependent on this information being accurate.

C&R has not reviewed the Project AQIA in detail however notes a review of the HHRA will be required if the AQIA is amended, in order to incorporate and update the HHRA of any relevant changes.

Recommendation: The HHRA should be reviewed and revised as appropriate if an amendment is made to Project or EIS that is relevant to the assessment of risks to human health.

9. <u>It is unclear what modelling was undertaken for the considered operating scenarios</u>

C&R notes the HHRA states (Section 4.1.1) that only three of the four scenarios were modelled as a part of the AQIA, however it appears modelling was involved in all four scenarios:

1) modelling of project and other site emissions using average source emission data;
2) modelling of project emissions at EPL limits and other site emissions using average source emission data;
3) modelling of emissions from the proposed adjacent battery recycling facility; and
4) modelling of emissions at the design limits of the emergency bypass stack.

Recommendation: The Proponent clarify if three or four scenarios were modelled for use in the HHRA.

10. <u>It is unclear what ground level concentrations were used to assess chronic and acute impacts</u>

The HHRA adopts 24-hour maximum annual average ground level concentrations in the chronic health assessments (Scenarios 1 and 3). 1-hour maximum annual average ground level concentrations are adopted for acute health assessments (Scenarios 2 and 4) and in the sensitivity analysis of a chronic health assessment (of Scenario 1) to assess worst-case conditions.

C&R notes the HHRA does not clarify what is meant by 1-hour maximum annual average or 24-hour maximum annual average concentrations, however presumes this refers to the maximum value of the 1-hour (or 24-hour) averages that were predicted over a whole year. Overall the chosen exposure point concentrations to assess each scenario and relevant potential health impacts lack clarity.

Recommendation: The HHRA should be revised to clarify and justify the exposure point concentrations used to assess potential chronic and acute health effects.

11. <u>Dust deposition details are not provided</u>

The HHRA uses estimated annual average dust deposition rates for non-volatile COPC to determine what concentrations may deposit onto soil, relevant to the assessment of non-direct inhalation exposure pathways.

Limited details of the deposition modelling or deposition estimates are provided in the HHRA (Section 4.3). The deposition modelling assumed dry deposition only. The HHRA states that wet

deposition was not included as dust emissions from the site are expected to be low and the area does not receive high amounts of rainfall. C&R notes information to support this conclusion is not provided.

C&R also notes the HHRA refers to Appendix C for deposition rates, however Appendix C does not appear to include deposition information.

Recommendation: The HHRA should be revised to provide further information to demonstrate the deposition estimates are robust.

12. <u>The selection and characterisation of COPC is not adequately justified</u>

The COPC considered in the HHRA were sourced from the Site's EPL, US EPA emission factors AP 42 Compilation of Air Pollutant Emission Factors, and those measured from a 'similar' plant at Silverwater in NSW run by Daniel's Health Pty Ltd (formerly SteriHealth Pty Ltd).

C&R notes that details of the selection process for COPC are not provided. Due to variation in waste composition the characteristics of emissions may differ between waste management facilities despite similar plant or operational conditions. In addition due to the variability and uncertainty of waste materials and their composition, a wide range of potential contaminants and classes of contaminants requires consideration. Consequently a detailed and robust analysis of potential wastes and contaminants within these wastes, plant and operational processes, and related information (such as emissions data from other 'reference' plant or the literature – where available), is required to justify the identification and selection of potential chemicals of concern for the Project.

C&R notes the HHRA does not refer to potential COPC such as barium, silver, tin, zinc, molybdenum, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), hexachlorobenzene and individual volatile organic compounds, or other hydrocarbons or chlorinated compounds that may be present within the wastes to be processed, or that may be generated and emitted during the incineration process.

C&R notes a waste screening process is proposed to be implemented to avoid acceptance of waste containing for example radioactive materials, however the EIS does not clarify the effectiveness or demonstrate the adequacy of such screening processes.

Numerous COPC were not assessed for the four scenarios due to the absence of emissions data, or there being no prescribed limits for the relevant plant in the Protection of the Environment Operations (Clean Air) Regulation 2010. C&R notes that this generally does not represent a conservative approach to the assessment of potential health risks associated with human exposure to these COPC.

In addition it is unclear if the air pollution control process will utilise NOx control measures such as selective non-catalytic reduction (SNCR) which is commonly used to meet best practice requirements. If this is the case the generation and potential emission of ammonia should be considered.

Recommendation: The HHRA be revised to:

1) **clarify the potential chemicals and hazardous substances associated with the proposed wastes and those that may be emitted from processing these wastes;**
2) **provide details and further justification how the COPC were identified and selected;**
3) **justify why COPC were excluded from further consideration or assessment;**
4) **include discussion on the implications of uncertainties in COPC and COPC emission concentrations; and**
5) **demonstrate the HHRA has been conducted conservatively with respect to the COPC and emission concentrations used.**

13. <u>Transport pathways excluded from the assessment are not adequately justified</u>

The potential transport pathways for off-site migration of COPC considered in the HHRA are:

- release of vapour to ambient air from the facility stacks; and
- release of particulates to ambient air from the facility stacks.

The HHRA assumes that:

- all COPC are release as a vapour to assess the cumulative risk associated with emissions; and

- particulates released are deposited during dry conditions only.

The HHRA does not assess other transport pathways, such as leaching from soil to surface or groundwater, transport of leached contamination within groundwater, and volatilisation and vapour migration from subsurface media, as these are not considered to be significant.

Recommendation: The HHRA should be revised to include further information or references to support the exclusion of other potential contaminant transport pathways.

14. Unclear if future receptors have been appropriately considered

The potential off-site receptors identified, based on the surrounding land uses were:

- off-site residents;
- off-site commercial workers; and
- off-site recreational users of open space.

The modelled receptor locations are provided (Appendix A, Figure 5) however C&R notes it is unclear if emissions were modelled at and beyond the boundary of the facility where future sensitive receptors may be located.

Recommendation: The HHRA should be revised to clarify it has used input values relevant to:

- **future commercial receptors at relevant locations adjacent to the facility boundary; and**
- **future residential receptors around the facility.**

15. Assumptions used to evaluate and quantify exposure should be clearly presented and robustly justified

a. Assumed fruit and vegetable intakes

Off-site residents, due to the low density area around the site, were assumed to consume less than 10% of their fruit and vegetable intake from produce derived from their properties. However C&R note this value is not justified in the HHRA (Section 4.6).

b. Assumed poultry intakes

Off-site residents were assumed to keep poultry and ingest eggs from the kept poultry. However the consumption of poultry was considered unlikely and therefore this was not assessed.

Recommendation: The HHRA should be revised to include justification for assuming residents consume less than 10% of the fruit and vegetable intake from home grown produce. Other assumptions used to evaluate and quantify exposure should also be clearly presented, discussed and robustly evaluated and justified.

16. All COPC that are persistent and/or bioaccumulative should be considered in the multiple pathway assessment

Bioaccumulative and/or persistent chemicals are listed in Table 8, however not all the chemicals listed have been appropriately considered. For example all metals are persistent, however Table 8 does not include the metals antimony, beryllium, cobalt, copper, manganese, nickel, tin and vanadium as bioaccumulative and/or persistent.

C&R notes that apart from dioxin and furans, the COPC considered do not include other semi- or low-volatile organic compounds that are also persistent and/or bioaccumulative and that may be emitted from incinerator operations, such as PCBs, hexachlorobenzene and PAHs.

In addition, ATSDR notes COPC such as nickel and vanadium can bioaccumulate in some plants, however the HHRA does not provide any comment on whether there is any potential for this to be significant and therefore require further assessment.

Recommendation: The HHRA should be revised to include the correct information in Table 8 and provide additional information on the selection of COPC for the multiple pathway assessment, in particular semi- or low-volatile organic compounds other than dioxins and furans, and metals that bioaccumulate in some plants.

17. It is unclear if all relevant exposure pathways were considered and assessed

The multiple pathway assessment does not include risk from acute exposure such as resulting from upset conditions due to the infrequent and short duration of acute/upset conditions scenarios.

The chemicals present in soil around the facility have been considered for the following pathways:

- uptake by edible plants within roots and stems;
- uptake by backyard chickens who lay eggs that are consumed by residents;
- direct contact of surficial soils (and dust deposited on capped surface for commercial workers) – including both ingestion and dermal exposure; and
- uptake via all pathways detailed above by breastfeeding mothers and exposure to infants.

C&R notes the HHRA states that the assessment of potential exposure pathways has been undertaken in accordance with approaches and guidance provided in:

- Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual (USEPA, 1989);
- Human Health Risk Assessment Protocol (HHRAP) for Hazardous Waste Combustion Facilities (USEPA, 2005); and
- Health Effects of Municipal Waste Incineration (Stevens, 1991).

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 refer to or discuss air-to-leaf transfer which is noted in Stevens (1991) as potentially as, or more, important than root update as a source of plant contamination.

Recommendation: The HHRA should be revised to clarify and demonstrate appropriate exposure pathways were considered and assessed, including why air-to-leaf transfer was not considered as a means of accumulation in edible plants.

18. Clarification and justification of site conceptual site model (CSM) is required

The HHRA discusses the conceptual site model used for the site (Section 4.10) and states it has been prepared in accordance with Schedule B2 of the Assessment of Site Contamination (ASC) NEPM (2013). The ASC NEPM states that CSM can be useful to inform discussions with stakeholders regarding the investigation and management of potential and known contamination impacts, and that the complexity of the CSM should correspond to the scale and complexity of the contamination impacts. In addition, elements of a CSM include: known and potential sources of contaminants of concern, potentially effected media, relevant receptors, and potential and complete exposure pathways.

Other potential exposure pathways to those considered in the HHRA may include those relevant to farming and ingestion of drinking water.

The ASC NEPM also states that data gaps and uncertainties in the CSM should be assessed and for the CSM to address how representative the available data is, what the potential sources of variability and uncertainty are, and how important the identified gaps are to the assessment.

C&R note that Section 8 of the HHRA consists of an uncertainty and sensitivity analysis of the assumptions used in the air dispersion modelling, ingestion models, toxicity assessment, background exposure and human exposure parameters. However C&R note that although this analysis of uncertainty is relevant to the evaluation of the CSM, it is not directed specifically at the evaluation of the CSM.

Recommendation: the HHRA should be revised to provide further details of the CSM for the project, including potential pathways considered that may not be complete, or justification for pathways considered too insignificant for further assessment.

19. The screening criteria used to assess chronic exposure are not adequately justified

Table T1 in Appendix B shows the screening criteria selection process for chronic exposure. C&R notes that the selected chronic criteria is not always the criteria with the longest averaging period, as would be expected. For example the chronic criteria (for both residents and commercial workers)

selected for sulphur dioxide is the1-hour average value of 520 µg/m3, rather than the NEPM 1-year average value of 50 µg/m3. C&R notes it is unclear why this approach for screening has been taken as it does not appear to be consistent with the most conservative approach generally applied for Tier 1 screening assessment.

Recommendation: The HHRA should be revised to justify the screening criteria used for assessment of chronic exposure via the inhalation pathway.

20. Justification for the use of the selected screening criteria for lead is required

The chosen screening criteria for lead is the rather dated (1998) Ambient Air NEPM goal of 0.5 µg/m^3 as a yearly average. The HHRA (Table T1) also states the more recent (2015) US EPA RSL for residential air which is a significantly lower concentration of 0.15 µg/m^3. C&R note however the HHRA does not appear to justify the use of the higher (less stringent) value.

Recommendation: the HHRA should be revised to justify the use of the chosen criteria for lead.

21. Clarification is required regarding several specific air toxics

C&R notes hydrogen chloride (HCl), hydrogen fluoride (HF) and sulfuric acid (H_2SO_4) are not defined as criteria pollutants under the Ambient Air NEPM, however have been incorrectly included as criteria pollutants in Tables T1- T4. C&R also notes that HF is not included in Tables T3 and T4.

Recommendation: The HHRA should be revised to clarify the criteria and specific toxic pollutants listed in Tables T1 to T4.

22. Acute screening does not include consideration of appropriate criteria

The screening criteria selection process for acute exposure (Scenario 2 and Scenario 4) in Table T3 does not include the most relevant values for assessing upset condition relevant to the Project facility. For example temporary emergency exposure limits (TEELs) based on threshold concentrations below which most people experience no appreciable risk of health effects (TEEL 0) and/or other more relevant short average period criteria where available, should be considered and adopted where appropriate.

Recommendation: The HHRA should be revised to include relevant criteria for assessing upset conditions. In addition the HHRA should be revised to ensure all criteria chosen has been robustly evaluated and justified.

23. Stack concentrations used for emergency bypass operation modelling require justification

The HHRA states (Appendix B) that emission rates used for the emergency bypass stack operation scenario (Scenario 4) are based on maximum stack concentration design limits provided by Advance Combustion Engineering Pty. Ltd.

C&R notes that no performance specifications or other data are provided with the HHRA (or AQIA) to justify these design limits, and it is unclear how these concentration limits have been determined. The nature of bypass emissions will be determined by various factors including the waste types being processed and the nature of the plant upset. Due to the variability of these factors it is important to demonstrate the maximum stack concentrations are representative of worst case upset condition scenarios.

Recommendation: The HHRA should be revised to include information to justify the maximum stack concentration design limits are robust and representative of worst case emissions from the bypass stack.

24. The HHRA should include assessment of emissions at in-stack concentrations

C&R notes the HHRA does not appear to assess potential chronic human health impacts using the more conservative proposed in-stack concentration limits to support approval of the plant. Consequently if approval is given for the Project, the emission limits in the facility's licence would need to reflect the more stringent values assessed and demonstrated to not result in any adverse impacts to human health.

C&R recommends the Proponent revise the HHRA to include an assessment of risk to human health that demonstrates an acceptable risk where the facility emissions are at the proposed maximum permissible concentrations.

25. It is unclear if the exposure point concentrations used reflect worst case current and future receptor locations

C&R notes it is unclear if the input exposure point concentration values to the HHRA reflect worst case values with respect to current and future receptor locations. Use of the modelled grid maximum value would provide a more comprehensive and conservative assessment that would also address future receptors at non-modelled locations.

C&R recommends the Proponent revise the HHRA to clarify that the exposure point concentration used in the HHRA have considered all future potential receptor locations.

26. Representative exposure point concentrations appear to be based on Scenario 1 emissions estimates (normal operating conditions) rather than Scenario 2 (operating continuously at stack emission limits)

C&R notes that the representative exposure point concentrations (Section 6.1, Table 13) appear to be based on Scenario 1 emissions estimates which is for normal operating conditions, rather than the intended (as per text in Section 6.1) Scenario 2 emission estimates which includes continuous operation at stack emission limits.

Consequently the exposure point concentrations used to assess chronic health impacts appear to be incorrect and significantly lower than the correct values. C&R notes that some selected calculated 24-hour average values under Scenario 2 appear to be above the selected chronic tier 1 screening criteria.

Recommendation: The HHRA should be revised so the exposure point concentrations used are those derived from Scenario 2 which includes continuous operation of Stack 5 with emissions at the stack limits.

27. Chemical intakes for offsite residents use incorrect values for soil ingestion

The daily soil ingestion rates used in the HHRA (Table 15) to the assess impacts for offsite residents were those that apply to high density residential sub-populations with minimal opportunities for soil access (12.5 and 25 mg/day). However the correct ingestion rates are the significantly greater values that apply to low density residential sub-populations with garden / accessible soil (50 and 100 mg/day).

Recommendation: The HHRA should be revised so the correct daily soil ingestion rates are adopted for offsite residents.

28. Some toxicological profiles require amendment

There is not a toxicological profile for dioxins and furans, or information on the dioxin toxicity reference value chosen, despite several reports on dioxins provided in the HHRA.

Recommendation: The HHRA should be revised to include appropriate toxicological information applied to the assessment.

29. It is unclear how exposure point concentrations for chromium(VI) were estimated

The HHRA does not include information on chromium speciation or what form of chromium [total Cr, Cr(VI) or Cr(III)], exposure point calculations were estimated and based.

Recommendation: The HHRA should be revised to clarify the treatment of chromium.

30. It is unclear if the Project applies best available techniques and best environmental practices

In accordance with NSW EPA and Stockholm Convention requirements, the Project must apply best practice process design and emissions controls, best available techniques, and best environmental

practices. C&R notes that this does not appear to be demonstrated for the relevant and main elements and aspects of the Project.

C&R also queries whether proposed emergency bypass operations (EIS 6.4.6) that make provision for the bypassing of hot combustion gases directly from the plant to atmosphere during incidents such as a power failure or other emergency situations constitute best practice process design.

Recommendation: The HHRA/EIS should be revised to clarify and demonstrate the Project will apply best available techniques and best environmental practices, including for and associated with: the management and incineration of waste, combustion engineering, flue gas cleaning and residue management techniques.

31. Lack of information presented to demonstrate the Project uses demonstrated technology

The EIS states (Section 6.3.3) that the technology to be applied for the Project has been proven in many installations throughout the world and is similar to that used in Brisbane, Melbourne and Perth. In addition the EIS states the Project has utilised the same design and equipment vendor as presumably those operating elsewhere in Australia.

C&R notes however that information to demonstrate the technology is proven has not been provided in the EIS. In particular, detailed information to demonstrate the proposed technology used in these other facilities, and to be applied at the Project, is proven (in addition to being consistent with best practice) for the processing of equivalent waste streams, types and amounts as those proposed for the Project.

Recommendation: The HHRA/EIS should be revised to clarify and demonstrate the proposed technology for the Project is proven for the expected types, sources and volumes of waste the Project expects to receive.