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THE NEXT GENERATION NSW PTY LTD WASTE MANAGEMENT REPORT

RAMBOLL ENVIRON

THE NEXT GENERATION NSW PTY LTD
WASTE MANAGEMENT REPORT

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ACRONYMS AND ABBREVIATIONS

APC	Air pollution control
AWT	Alternative Waste Treatment
C&D	Construction and demolition waste
C&I	Commercial and industrial waste
CEMP	Construction Management Plan
CEMS	Continuous emissions monitoring system
CO^2	Carbon dioxide
CO2e	Carbon dioxide equivalents
CRW	Chute residual waste (from the MPC)
CWMP	Construction waste management plan
DADI	Dial a Dump Industries
DAP	Direct Action Plan
DCP	Distributed Control System
DECCW	Department of Environment, Climate Change and Water
DGR	Director-General's environmental assessment requirements
DSI	Detailed Site Contamination Investigation
EfW	Energy from Waste
EIS	Environmental Impact Statement
EP&A	Environmental Planning and Assessment Act 1979
EPA	Environment Protection Authority
ERA	Extended regulated area
ERF	Emissions Reduction Fund
Facility	The Next Generation Pty Ltd Energy from Waste Facility, Eastern Creek
FGT	Flue gas treatment
GHG	Greenhouse gases
GO	Garden organics
HIL	Health Based Investigation Levels
HZI	Hitachi Zosen Inova (technology provider)
IBA	Incinerator bottom ash
IED	Industrial Emissions Directive
Km	Kilometre
kV	kilovolt
LOI	Loss on ignition
M	Metre
MPC	Genesis Xero Material Processing Centre
MRA	MRA Consulting Group
MRF	Material Recovery Facility
MSW	Municipal solid waste
MW	Megawatt
MWe	Megawatt electrical
NCV	Net calorific value
NSW	New South Wales
OEH	Office of Environment and Heritage
PLC	Programmable Logic Controller
PoEO Act	Protection of the Environment Operations Act 1997
PoEO CA Reg	Protection of the Environment Operations (Clean Air) Regulation
PoEO WARW Reg	Protection of the Environment Operations (Waste) Amendment (Residue Wastes) Regulation 2005

PoEO Waste Reg	The Protection of the Environment Operations (Waste) Regulation 2014
POP	Proof of performance
Proposal	The Next Generation Pty Ltd proposal of an Energy from Waste Facility, Eastern Creek
PSC	Pre-sort Centre
RRA	Regional regulated area
SMA	Sydney metropolitan area
SCADA	Supervisory Control and Data Acquisition
SSDA	State Significant Development Application
TNG	The Next Generation Pty Ltd
TOC	Total organic compounds
tpa	tonnes per annum
UK	United Kingdom
WARR	Waste Avoidance and Resource Recovery
WSEA SEPP	Western Sydney Employment Area State Environmental Planning Policy
WTS	Waste transfer station

EXECUTIVE SUMMARY

The proposed development (the Proposal) involves the construction of New South Wales' (NSW's) first Energy from Waste (EfW) facility (the Facility) for The Next Generation NSW Pty Ltd (TNG). This report is to be submitted as part of the Environmental Impact Statement (EIS) for the Facility and aims to provide a comprehensive assessment of the potential waste management impacts of the Facility. The Waste Management Report (WMR) addresses the environmental assessment requirements of the Director-General and the NSW Environment Protection Authority (EPA), including compliance with the NSW EfW Policy Statement (**Appendix 1**).

Technology

The Proposal is a state-of-the art EfW facility based on Hitachi Zosen Inova's (HZI) well proven moving grate technology providing renewable energy at highest efficiencies while strictly complying with all environmental standards. HZI has a reference list of more than 550 facilities world-wide and is a leading EfW turn-key technology supplier worldwide. For a detailed description of the Project Definition Brief appended to the EIS.

The TNG EfW Facility will be capable of converting combustible residual waste into energy. This can be electricity, stream to heat buildings, or chilled water to cool buildings. The raw gases from the process are cleaned according to environmental standards before being released into the atmosphere.

Phase 1 (Lines 1 and 2) corresponds to the use of 552,500 tonnes per annum (tpa_ of residual waste fuel and will produce approximately 70MWe electricity supply to the grid. Phase 2 (which will require separate approav), with Lines 3 and 4 in operation, all four lines will utilise 1,105,000tpa of residual waste fuel to produce approximately 137.3MWe.

Operational Process

All of the eligible residual waste fuel required for the Phase 1 of the development (552,500tpa) is currently received and/or processed by the extensive waste and resource recovery infrastructure owned by DADI. This material is either:

- Residual waste fuel generated by the adjacent Genesis Xero Material Processing Centre (Genesis MPC) (approximately 23% of the Facility of input tonnes) which is referred to as chute residual waste (CRW); and
- Waste from other sources, which is potential fuel sources received from third party authorised facilities that would otherwise be sent to landfill.

A moving grate system offers TNG the greatest flexibility in the range of waste fuels that may be processed at the Facility. The following residual waste fuel types have been identified as the main sources of fuel for the Facility;

- Chute Residual Waste (CRW) from the Genesis MPC;
- Commercial and Industrial (C&I);
- Construction and Demolition(C&D);
- Floc waste;
- Paper pulp;
- Glass Recovery;
- Garden Organics (GO);
- Alternative Waste Treatment (AWT); and
- Material Recovery Facility waste (MRF waste) residual.

Separation machinery used at the Genesis MPC is state-of-the-art and is efficient at segregating wastes for further processing and recycling; and ensuring that recycling is maximised, whilst

residual waste is minimised, and therefore complying with the Waste Avoidance and Resource Recovery Strategy (WARR) 2014–2021.

The feedstock for the EfW is the residual waste sourced from commercial and industrial (C&I), construction and demolition (C&D) and other source separated wastes. The waste inspection procedure will follow a similar process to the CRW from the Genesis MPC outlined in **Section 5.1**. **Figure 2** provides an outline of the process that will be taken upon arrival of waste to the Facility originated from other sources.

In general the process will involve:

- Vehicles providing the appropriate waste docket and waste classification;
- Vehicle inspected at **Checkpoint 1** - CCTV inspection and weighing of vehicle to identify if there is any ineligible materials identified;
- Vehicle inspected at **Checkpoint 2** - Spotter station, waste physically inspection to identify if there is any ineligible materials identified; and
- Vehicle inspected at **Checkpoint 3** - Waste is physically unloaded and final inspection carried out to identify if there is any ineligible materials identified.

TNG will develop a Waste Inspection Procedure prior to the commencing of operation in a similar vein to Waste Inspection Procedure attached in **Appendix 2**.

Based upon the fuel types listed above, a design fuel composition has been developed. This is based on typical values for each of the proposed fuels and an estimated fuel mix. Input fuel will always be mixed as part of the normal operational process to produce a homogenous input.

In addition to proven industry practice in inspecting and sorting incoming waste at the Genisis MPC, TNG will expand these practices to the proposed Facility and will conduct independent audits using the Green Star criteria for assessment to ensure that all waste streams sent to the Facility comply with the EfW Policy Statement resource recovery criteria. This will apply to both CRW and fuel originating from other sources.

The Facility will generate the following solid, liquid and gaseous waste streams:

- Bottom ash;
- APC residue;
- Boiler ash;
- Liquid effluent from the boiler water treatment system and from the boiler blow-down;
- Ferrous material residue;
- Gaseous emissions (pyrolytic gas); and
- Staff waste.

The main types of waste the Facility will generate from the EfW process are summarised in the table below.

Estimation of Ash residue and recycle / disposal options

Type of Ash	Estimated amount generated (tpa)	Worst Case amount generated (tpa)	Waste Classification	Disposal Option(s)
Bottom ash (dry)	237,456	324,000	General Solid Waste	Transported to the adjoining landfill facility for disposal
Bottom ash (wet)	293,166	400,000	General Solid Waste	Transported to the adjoining landfill facility for disposal
APC ash / Boiler	43,800 tpa	51,700	Restricted Solid Waste	Transported off-site by a licensed contractor and taken to a waste

Estimation of Ash residue and recycle / disposal options

Type of Ash	Estimated amount generated (tpa)	Worst Case amount generated (tpa)	Waste Classification	Disposal Option(s)
ash				treatment facility licensed to treat such wastes. Implementation of stabilisation techniques such as immobilisation or verification to reduce the residue to General Solid Waste classification
Total	336,966	451,700	-	

1. Estimates based on the Facility processing 1,105,000 tonnes/year of residual waste fuel (Phase II) and an input mass flow of residual waste fuel of 34.5 tonnes/h.
2. Waste classifications were based on a chemical assessment and comparing results against the criterial set out in Table 2 – TCLP and SCC values for classifying waste by chemical assessment in the NSW Waste Classification Guidelines – Part 1: Classification of waste. Refer to Appendix H for assessment results.

Based on publicly available information, data related to key waste streams availability is summarised in the table below.

Estimated Source Separated Waste Availability

	% Fuel Mix[1]	Phase 1[2] '000'	Phase 2[3] '000'	Estimated Available Waste SMA[4] '000'
CRW	23.27%	128	257	361
C&D	28.69%	158	317	1,112
C&I	16.18%	89	178	1,430
Floc residual	14.43%	79	159	170
AWT residual	6.87%	37	75	200
Paper Pulp residual	4.81%	27	53	25
GO residual	2.06%	11	22	21
Glass residual	1.76%	9.5	19	486
MRF residual	1.20	6.60	13	17
TOTAL	**100%**	**552,5**	**1,150**	**3,822**

Note: Figures in this table are rounded up and down for simplicity. Refer to Table 7 for exact quantities.

[1] Percentages derived from the Project Definition Brief.
[2] Figures based on percentage data from Phase 1 processing capacity of 552,500 tpa
[3] Figures based on percentage data from Phase 2 processing capacity of 1,105,000 tpa
[4] Data base on estimated derived in Sections 7.1, 7.2 and 7.3

[1] Percentages derived from the Project Definition Brief.
[2] Figures based on percentage data from Phase 1 processing capacity of 552,500 tpa
[3] Figures based on percentage data from Phase 2 processing capacity of 1,105,000 tpa
[4] Data base on estimated derived in Sections 7.1, 7.2 & 7.3

This table illustrates that in the Sydney Metropolitan Area (SMA) there is adequate availability of waste at a potential fuel source that would otherwise be going to landfill from the five main waste streams (CRW, C&D, C&I, floc waste and AWT waste) to meet Phase 1 and Phase 2. This is based on the calculation in **Sections 7.1**, **7.2** and **7.3.**

The remaining waste source has not been comprehensively accounted due to limited publically availability information, however, **Table 9** and **Table 10** demonstrates sufficient evidence sourced from comparable States reporting; information from Genesis landfill; and/or DADI experience within the industry, that the quantities required will be sufficient to meet the Facility's requirements (especially Phase 1).

It is acknowledged that that not all the estimated available waste to landfill in **Table 9** and **Table 10** will be able to be used as a fuel source for the Facility. It is also acknowledged that composition may vary but the technology employed allows for significant flexibility in composition and quantity of material (see **Appendix 6**).

Energy from Waste Policy Statement

The NSW EPA produced a policy statement titled *NSW Energy from Waste Policy Statement*, *2015* (the NSW EfW Policy) to set out a policy framework and overarching criteria that apply to facilities in NSW proposing to thermally treat waste or waste derived material.

The Facility is proposing to thermally treat a combination of eligible fuels and other waste fuels waste-derived material that fall outside of the low-risk eligible fuels. As per Section 4 of the *NSW EfW Policy,* facilities using non eligible fuels must demonstrate that they will be using current international best practice techniques.

The project team has performed a comprehensive public consultation and good neighbour test as per the NSW EfW Policy. TNG has developed a stakeholder consultation strategy to engage stakeholders over the life of the project in order to keep them informed and to respond to any concerns. TNG acknowledges that different aspects of the Proposal will concern different stakeholders. TNG is committed to:

- Mitigating risks and stakeholder concerns during the planning stages of the Proposal;
- Providing information to all stakeholders and seeking feedback prior to implementation; and
- Maintaining open and transparent communication channels with all stakeholders.

The Facility has been designed to have a thermal input of 469.6MWe (117.4MWe for each incineration line) at the design point. The Facility has an assumed net electrical efficiency of 30% which is above the 25% thermal efficiency criteria rate set in the NSW EFW Policy.

EfW complements recycling programs; it does not compete with them. The project compliments NSW's target increasing waste diverted from landfill to 75% by 2021-22.

Under the current NSW waste levy it is more profitable for MPC to recycle waste as opposed to using the waste for a fuel source in the TNG Facility. Therefore, it will be the preference to promote source separation as far as reasonable practicable and not divert any recycling opportunities in favour of use at the TNG Facility.

Refer to **Section 5** of this report for further detail on separation procedures.

In relation to fuel originating from other sources refer to **Section 5.2** for waste inspection procedures and **Section 5.3** for independent auditing procedures. When procuring contractors from licenced and approved waste and recycling organisations, TNG will impose that source separation is to meet NSW recovery requirements (i.e. WARR Strategy).

The Genesis MPC operates pursuant to Environmental Protection Licence (EPL) NO. 20121. Waste materials which are received by it previously would have been landfilled. Of the waste loads received at the Genesis MPC that are classified as containing material capable of being recovered or recycled, it is estimated that, on average, 80% of materials is recovered by sorting, separating and processing, and made available for resale or reuse by other processors. This is a higher rate than the averages for NSW and exceeds the WARR Strategy criteria.

Based on NSW averages, and the fact that all waste to landfill can be used as a fuel source, TNG is confident that through robust contract procurement contacts requirements, TNG will be able to adequately ensure that fuel originating from other sources meet the conditions of Table 1 of the NSW EfW Policy and WARR Strategy.

1. INTRODUCTION

1.1 Background

The proposed development (the Proposal) involves the construction of an Energy from Waste (EfW) electricity generation facility (the Facility) for The Next Generation NSW Pty Ltd (TNG), on land adjacent to the Genesis Xero Material Processing Centre (MPC), located at Honeycomb Drive, Eastern Creek, New South Wales (NSW) approximately 36 kilometre (km) west of the Sydney Central Business District (CBD).

The Facility will recover energy from the residuals after recycling has taken place of municipal solid waste (MSW), commercial and industrial (C&I) and construction and demolition (C&D) residual waste streams that comply with the NSW EfW Policy Statement (Appendix A – NSW Energy from Waste Policy Statement). These waste streams include chute residual waste (CRW) from the MPC, floc waste, C&D residual, C&I residual, paper pulp, glass recovery, garden organics (GO), alternative waste treatment (AWT) and material recovery facility waste (MRF waste) residual waste streams that have been processed through an authorised facility and would otherwise be landfilled. The MPC and Waste Transfer Station (WTS) are located at the site adjacent to the proposed EfW Facility. A separate application to construct an undercover pre-sort centre (PSC) on its site to increase the amount of recycling achieved in particularly focused on C&I waste streams has also been approved. This is to ensure that residual waste fuels will meet the EfW Policy criteria and that recycling is not cannibalised by the introduction of the EfW.

In order to facilitate the transfer of fuel between the MPC, and TNG EfW Facilities they will be connected by an internal road and an electrically driven conveyor system that run under the precinct road (refer to **Figure 1**).

It is proposed to build the Facility in two phases:

- Phase 1 will include the complete construction of the Tipping Hall and Waste Bunker and Combustion Lines 1 and 2 comprising of two independent Boilers, Flue Gas Treatment (FGT) systems, one Stack, one Turbine and one Air Cooled Condenser (ACC), and all other auxiliary equipment;
- Phase 2 will comprise the installation of combustion lines 3 and 4 with again two independent Boilers, Flue Gas Treatment (FGT) systems, one Stack, one Turbine and one Air Cooled Condenser (ACC) and all other auxiliary equipment.

This two Phase approach has been adopted after receiving feedback from the various government agencies. Lines 3 and 4 will be constructed once the Department of Planning and Environment (DPE) is satisfied that the required amount of eligible residual waste fuel is available to the Facility.

The design fuel has been calculated based on the expected waste fractions and has a Net Calorific Value (NCV) of 12.3 MJ/kg (equivalent to 12,300 kJ/kg). Based on the design fuel NCV the Facility will have capacity to treat 1,105,000 tpa (34.53 t/h, 4 streams, 8,000 h) of fuel. In Phase 1 (lines 1 and 2 only), this corresponds to 552,500tpa.

The proposed EfW Facility, upon operation, will provide employment to a total of up to 55 new staff working over three shifts. Indirectly, the proposal will support to hundreds of workers and support businesses. During construction, the site will provide approximately 500 construction worker jobs.

1.2 Purpose and Objectives

The purpose and objectives of this Waste Management Report (WMR) is to:

- Review of Proposal information and documentation;
- Collation of additional information;
- Assessment of regulatory compliance capability;

- Address the Director-General's Environmental Assessment Requirements (DGRs) and NSW Environment Protection Authority (EPA) requirements in relation to waste management;
- Identification of processes, controls and procedures to address EfW Policy criteria; and
- Identification of opportunities to mitigate issues.

1.3 Director-General's Requirements (DGRs)

The relevant DGRs around waste management for the Proposal are listed in **Table 1**. The table identifies where each requirement is addressed in this report.

Table 1: Director-General's Requirements (Waste Management)

#	Director-General Requirement	Report Section
1	A description of the classes and quantities of waste that would be thermally treated at the facility.	Sections 3.3.4 & 4
2	Demonstrate that waste used as a feedstock in the waste to energy plant would be the residual from a resource recovery process that maximises the recovery of material, in accordance with EPA guidelines.	Section 4.10
3	Procedures that would be implemented to control the inputs to the waste to energy plant, including contingency measures that would be implemented if inappropriate materials are identified.	Section 5
4	Details of the location and size of stockpiles of unprocessed and processed recycled waste at the site.	Sections 2.1 & 6
5	Demonstrate any waste material produced from the waste to energy facility for land application is fit-for-purpose and poses minimal risk of harm to the environment in order to meet the requirements for consideration of a resource recovery exemption by the EPA under Clause 51A of the *Protection of the Environment Operations (Waste) Regulation 2005*.	Section 6.1
6	Procedures for the management of other solid, liquid and gaseous waste streams.	Section 6
7	Describe how waste would be treated, stored, used, disposed and handled on site, and transported to and from the site, and the potential impacts associated with these issues, including current and future offsite waste disposal methods.	Sections 2 & 6
8	Identify the measures that would be implemented to ensure that the development is consistent with the aims, objectives and guidance in the NSW Waste Avoidance and Resource Recovery Strategy 2007.	Section 6.8

1.4 NSW EPA requirements

Requirements of the NSW EPA for the Proposal are listed in **Table 2.** The table identifies where each requirement is addressed in this report.

Table 2: NSW EPA Requirements (Waste Management)

#	EPA Requirement	Report Section
1	The proposed sources, types, quantities and classification of all wastes to be treated at the facility. This must include details of how the input wastes will comply with the Resource Recovery Criteria contained in the NSW EfW Policy Statement.	Section 8.6
2	Measures to be implemented to ensure that waste used as a feedstock at the facility is the residual from a resource recovery process that maximises the recovery of material.	Section 8.6
3	How the process will meet the Thermal Efficiency and Technical Criteria in the NSW EfW Policy Statement.	Sections 8.4 & 8.5 and Appendix 4
4	The procedures for the assessment, handling, storage, transport and disposal of all hazardous waste produced by the Facility.	Sections 5 & 6
5	Provide details of the quantity and type of both liquid waste and non-liquid waste generated, handled, processed or disposed of at the premises. Waste must be classified according to the	Section 6 & Appendix 3

Table 2: NSW EPA Requirements (Waste Management)

#	EPA Requirement	Report Section
	Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes (NSW EPA, 1999). Details must include: a. The transportation, assessment and handling of waste arriving at or generated at the Premises; b. Any stockpiling of wastes or recovered materials at the site including stockpile footprints, heights and location; c. Any waste processing related to the facility, including reuse, recycling, reprocessing or treatment both on- and off-site; d. The method for disposing of residual waste from the Facility; e. The emissions arising from the handling, storage, processing and reprocessing of waste at the Facility; and f. The proposed controls for managing the environmental impacts of these activities.	
6	The quantity, type and specifications for all output products proposed to be produced from the facility. The description should include the physical, chemical and biological characteristics (including contaminant concentrations) of those output products as well as relevant accredited standards against which the products would comply. In documenting or describing the composition of output products and/or wastes generated from the proposed facility reference should be made to the relevant EPA resource recovery exemption or the EPA Waste Classification Guidelines 2008.	Section 6, Appendix 3 & Appendix 4
7	Identify, characterise and classify all waste that is proposed to be disposed of to an offsite location, including proposed quantities of the waste and the disposal locations for the waste.	Section 6
8	The procedures that will be implemented to control the inputs to the facility, including contingency measures that would implemented in the event that ineligible waste fuels are received at the Premises.	Section 5
9	Identify the measures that would be implemented to ensure that the development is consistent with the aims, objectives and guidance in the *NSW Waste Avoidance and Resource Recovery Strategy* as issued from time to time.	Sections 3.3.6,5 & 8.6
10	Provide details of spoil disposal with particular attention to: a) The quantity of spoil material likely to be generated; b) Proposed strategies for the handling, stockpiling, reuse recycling and disposal of spoil; c) The need to maximise reuse of spoil material in the construction industry; d) Identification of the history of spoil material and whether there is any likelihood of contaminated material, and if so, measures for the management of any contaminated material; and e) Designation of transportation routes for transport of spoil.	Refer to the CEMP appended to the EIS
11	Provide details of procedures for the assessment, handling, storage, transport and disposal of all hazardous and dangerous materials used, stored, processed or disposed of at the site, in addition to the requirements for liquid and non-liquid wastes. Reference should be made to the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* (NSW EPA, 1999).	Section 6
12	Provide details of the type and quantity of any chemical substances to be used or stored and describe arrangements for their safe use and storage. Reference should be made to the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes* (NSW EPA, 1999).	Sections 2.2 & 6

2. THE PROPOSAL

The Proposal is a state-of-the art EfW facility, using Hitachi Zosen Inova's (HZI) proven moving grate technology providing renewable energy at high efficiencies while complying with environmental standards and industry best available technology (BAT). HZI has a reference list of more than 550 facilities world-wide and is a leading EfW turn-key technology supplier worldwide.

For a detailed description of the Project Definition Brief is appended to EIS.

The Facility will be capable of converting combustible residual waste into energy. This can be electricity, hot water to heat buildings, or chilled water to cool buildings. The raw gases from the process are cleaned according to environmental standards before being released into the atmosphere.

The primary infrastructure components of the Facility will be:

- Weighbridges;
- Tipping hall – Waste fuel will be delivered by truck or conveyor underpass to the tipping hall;
- Waste fuel bunker – Storage and supply of fuel to the combustion process;
- Boiler and flue gas treatment (FGT) – Energy recovered from the combustion of fuel, steam generation and the associated flue gases treated;
- Bottom Ash Bunker– for the storage and handling of residual combustion ash;
- Sealed silos for the storage and handling of Air Pollution Control (APC) residue ash;
- Turbine hall – Houses turbine for the conversion of steam to electricity;
- Air Cooled Condenser (ACC);
- Substation; and
- Stacks.

Figure 1 shows the proposed Facility site layout.

As the NCV of waste fuels vary depending on type, the facility will operate within a range of NCVs to support operational flexibility.

The Facility is designed to operate at maximum thermal load and thus power production between a net calorific value (NCV) of 10 and 16.5 MJ/kg. At an NCV of 10, the Facility will process the maximum of 1,105,000 tpa. At a NCV of 16.5 MJ/kg, the Facility will only require 820,000 tpa to generate maximum power output. At the nominal design NCV of 12.34 MJ/kg this will correspond to 552,500 tpa in Phase 1 or 1,105,000 tpa in total for Phase 1 and Phase 2.

TNG proposes to delay the construction of the lines 3 and 4 until eligible material inputs for these lines can be confirmed to the satisfaction of the DPE and the EPA. As lines 1 and 2 operate independently from lines 3 and 4, they can be successfully operated as per the 'tried and tested' approach adopted and operating at similar facilities in the UK and Continental Europe.

TNG has identified and quantified the number of eligible tonnes that are received currently at DADI's facility at Eastern Creek from third party "authorised facilities", in addition to the residual from the MPC. The design fuel mix has been determined using the waste sources that would be available to TNG today, however the technology employed allows for significant flexibility in composition and quantity of material. The design fuel mix is summarised in **Table 7**.

2.1 Operational Process

All of the eligible residual waste fuel required for the Phase 1 of the development (552,500tpa) is currently received and/or processed by the extensive waste and resource recovery infrastructure owned by DADI. This material is either:

- Residual waste fuel generated by the MPC (approximately 23% of the facility of input tonnes); and

- Residual waste fuel received from third party authorised facilities that meet the eligibility criteria.

Residual waste fuel from the MPC will be delivered to the EfW Facility by two methods: via a covered conveyor system or by vehicle through the integrated underpass.

All incoming fuel from the MPC entering via conveyor will be pre-weighed and its details recorded at the MPC before being transported to the TNG EfW Facility. Refer to **Appendix B** for the Waste Inspection Procedure.

Waste fuels from external transfer stations and recycling facilities will be delivered via road vehicle. These will enter the Facility through the main entrance and will proceed to the weighbridge where the quantity of incoming fuel will be checked and recorded (refer to **Section 5**). Inspections of all vehicle loads will be undertaken at the weighbridge to confirm the nature of incoming fuel and only approved fuel will proceed to the tipping hall of the Facility. Once reaching the tipping hall a second and third checking procedure takes place at which point the loads not meeting the eligible criteria will be rejected. The tipping hall is large enough to quarantine any suspect loads if required.

Approved incoming waste will be delivered to the Facility tipping hall and then discharged into the waste bunker. The bunker has the capacity to store five to seven days' worth of residual waste fuel. Waste in the bunker is first mixed before being loaded into a hopper using overhead cranes. The hopper then feeds the waste fuel onto the continually moving grate below the furnace. This continuous movement promotes mixing of the waste with the combustion air.

Ash from the grate is discharged into a water filled quench and is moved by conveyor to the enclosed bottom ash storage bunker prior to being transported off-site. All bottom ash will be taken to landfill for disposal or sent to the adjoining MPC for aggregate and road-base production. Air Pollution Control (APC) residue ash will be collected into sealed storage silos and transported off-site in sealed tankers for further treatment or disposal.

Boiler ash is also generated by the Facility. Its chemical composition falls between that of bottom ash and APC. The characterisation of boiler ash is dependent on which boiler pass it is accumulated within. The boiler ash from all passes will be conservatively disposed of with the APC residues.

Hot gases from the combustion of the waste will pass through a heat recovery boiler. The energy from the hot gases will be transferred to the boiler to produce high-pressure steam. This steam will be fed to the steam turbine driven generator. In the first phase, the facility will be capable of generating approximately 79MW of electricity, which, after supplying the site electrical load, will be exported to the grid providing a net supply of approximately 70MW. In the second phase, this will increase to 158MW of electricity and a net supply of 137.3MW.

The facility will operate 24 hours a day, seven days a week, with occasional offline periods for maintenance. Over the entire year, it is assumed that the facility would be operational for approximately 8,000 hours. A fully automated Distributed Control System (DCS) manages the Facility. The DCS is used to operate the plant and ensures the safety of personnel and equipment.

In addition, to the DCS, the Plant Operation Outline details the supervisory control and data acquisition (SCADA) system. They also detail the setup of the control system, process monitoring and automation degree as well as safety precautions within the DCS and safety Programmable Logic Controller (PLC). This includes start-up and shutdown of the plant and emergency operations.

Figure 1 depicts a basic schematic diagram of the operational process of the proposed EfW Facility.

2.2 Description of Chemical Substances

The Facility will use various raw materials during operation. Primarily, these include hydrated lime, ammonium hydroxide/ammonia water, activated carbon, gas oil, diesel (for the emergency diesel generator) and water. These will be delivered to the Facility in bulk transportation vehicles (except for water). The minimum on site storage capacity is set to reflect the process requirements and local delivery capability. **Table 3** shows the approximate number of deliveries anticipated.

In addition, various other materials will be used for the operation and maintenance of the Facility including:

- Hydraulic oils and silicone based oils;
- Gas emptying and filling equipment;
- Refrigerant gases for air conditioning plant;
- Glycol/anti-freeze for cooling; and
- Boiler water dosing chemicals.

Table 3: Waste and chemical operations summary

Raw material	Process	Typical usage (tpa)	Typical delivery (tonnes)	Annual deliveries	Average weekly delivery
Hydrated Lime	Flue gas treatment – acid gas scrubbing	19,800	22	900	17
Ammonium hydroxide (24.9% solution)	Flue gas treatment – NOx reduction	2200	22	103	2
Activated carbon	Flue gas treatment – dioxins/ heavy metal	420	22	19	0.4
Low Sulphur gas oil	System firing	1,900	30	47	1
Totals by road		24,000	96	1,080	20
Water	Boiler and FGT	200,000	-	-	-

In order to minimise the risks of contamination to process and surface water, all liquid chemicals stored on site will be kept in bunded controlled areas and or double skinned tanks with a volume of 110% of stored capacity as per the *Work Health and Safety Regulation 2011* and the NSW Code of Practice for the storage and handling of dangerous goods. Gas oil will be held in a bunded storage tank and any spillages or leaks will be retained in this area and treated locally. Any spilled chemical substances from the bunded area that are required to leave site as waste will be classified and transported in accordance with the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes.*

Packaging / drums / containers will be collected by the supplier or disposed of in accordance with their waste classification.

3. LEGISLATION AND POLICY FRAMEWORK

3.1 National Framework

The Commonwealth Government has limited constitutional powers to engage directly in domestic waste management issues. This responsibility rests largely with the state and territory and through them, local governments. However, the Commonwealth has recently taken on a strategic involvement in waste policy development, releasing the National Waste Policy in 2010. **Table 4** gives a brief overview of key National policies relating to waste.

Table 4: National Regulatory Framework

Policy / Regulatory Instrument	Relevant goals and targets
The National Waste Policy	The aims of the National Waste Policy are to: *Avoid the generation of waste, reduce the amount of waste (including hazardous waste) for disposal, manage waste as a resource and ensure that waste treatment, disposal, recovery and re-use is undertaken in a safe, scientific and environmentally sound manner, and contribute to the reduction in greenhouse gas emissions, energy conservation and production, water efficiency and the productivity of the land.* A number of strategies have been identified within the National Waste Policy, which are to be pursued through a multi-jurisdictional approach. These include a national framework for product stewardship and extended producer responsibility. The product stewardship framework will provide support through voluntary accreditation of community and industry run recycling schemes. Key areas of focus will include mercury containing lights, tyres, packaging, workplace recycling, public place recycling, television and computer recycling.
Direct Action Plan	The objective of the Direct Action Plan is to help Australia to meet its emissions reduction target 5% below 2000 levels by 2020. Direct Action consists of a number of initiatives including: • A $2.5 billion Emissions Reduction Fund to support direct action by business to reduce emissions. • Boosting renewable energy, especially solar. • Support for emerging technologies through the Renewable Energy Target. Through the ERF, the Government will purchase lowest cost abatement (in the form of Australian carbon credit units) from a wide range of sources, providing an incentive to businesses, households and landowners to proactively reduce their emissions. This includes the manufacture of process engineered fuels. Subject to the finalisation of methodology determinations under the ERF, there are possible opportunities for TNG to participate in the ERF and generate carbon credits.

3.2 State Framework

The relevant NSW Framework consists of legislation, guidelines, development plans and strategies pertaining to waste management, as summarised in **Table 5**. The NSW Government's objective is to provide a clear and consistent regulatory and policy framework that minimises harm to the

environment and encourages waste avoidance and resource recovery. This framework uses a mix of legislative, policy, educational and economic tools.

Table 5: Relevant NSW Waste Controls

Legislation	Plans, Guidelines and Strategies
Environmental Planning and Assessment Act 1979 (EP&A Act)	Energy from Waste Policy Statement 2015
Protection of the Environment Operations Act 1997 (POEO Act	Waste Avoidance and Resource Recovery Strategy (WARR) 2014 – 2021
Protection of the Environment Operations (Waste) Regulation 2014	Waste Classification Guidelines (EPA, 2014) Resource recovery orders and exemptions
Waste Avoidance and Resource Recovery Act 2001 (WARR Act)	Waste Avoidance and Resource Recovery Strategy 2007

The Sections below provide further detail to the legislation, Plans, Guidelines and Strategies listed in **Table 5** and how they relate to the Proposal.

3.3 NSW Energy from Waste Policy Statement

In 2014, the NSW EPA released its finalised *Energy from Waste Policy Statement 2015* (NSW EfW Policy) to replace the 2005 Guidance Note: Assessment of Non-Standard Fuels. The statement sets a framework for the operation of purpose-built facilities to recover energy from residual wastes that are not able to be recycled and would otherwise be disposed of to landfill.

The policy also facilitates the use of certain low-risk wastes as fuels which, due to their origin, have low levels of contaminants, homogeneity and consistency over time, and are considered by the EPA to pose a minimal risk of harm to human health and the environment.

The NSW EfW Policy Statement is designed to encourage the recovery of the embodied energy from waste while offsetting the use of non-renewable energy sources and avoiding methane emissions from landfill. It will ensure that this energy recovery:

- Has minimal risk of harm to human health and the environment; and
- Will not undermine higher order waste management options, such as avoidance, reuse or recycling.

A full copy of the NSW EfW Policy Statement has been provided in Appendix A.

Compliance to the NSW Energy from Waste Policy Statement: For compliance to the EfW Policy refer to **Section 8**.

3.3.1 Protection of Environment Operations Act (1997)

The NSW *Protection of the Environment Operations Act 1997* (PoEO Act) provides an integrated system of licences administered by the NSW EPA, to set out protection of the environment policies and to adopt more innovative approaches to reduce pollution in the environment.

The objectives of the PoEO Act include:

- To protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development;
- To provide increased opportunities for public involvement and participation in environment protection;
- To ensure that the community has access to relevant and meaningful information about pollution;
- To reduce risks to human health and prevent the degradation of the environment by the use of mechanisms that promote the following:

- Pollution prevention and cleaner production.
- The reduction to harmless levels of the discharge of substances likely to cause harm to the environment.
- The elimination of harmful wastes.
- The reduction in the use of materials and the re-use, recovery or recycling of materials.
- The making of progressive environmental improvements, including the reduction of pollution at source.
- The monitoring and reporting of environmental quality on a regular basis

- To rationalise, simplify and strengthen the regulatory framework for environment protection;
- To improve the efficiency of administration of the environment protection legislation;
- To assist in the achievement of the objectives of the *Waste Avoidance and Resource Recovery Act 2001*.

The State Significant Development Application (SSDA) Environmental Impact Statement (EIS) prepared for this Proposal, and in particular the Ecologically Sustainable Development Assessment (refer to EIS), documents that the Proposal wholly satisfies the objectives of the PoEO Act through the provision of state of the art technology for resource recovery and electricity generation operation.

Sections 48 and 49 of the PoEO Act require certain premises-based and non-premises-based activities to obtain licences for their operation. These activities and their licencing thresholds are listed in Schedule 1 to the PoEO Act.

- Clause 17 of Schedule 1 – Electricity generation triggers the criteria for a scheduled activity under this Act for general electricity works with a capacity to generate more than 30 megawatts of electrical power;
- Clause 18 of Schedule 1 – Energy recovery triggers the criteria for a scheduled activity under this Act for energy recovery from general waste involving processing more than 200 tonnes per year of waste (other than hazardous waste, restricted waste solid waste, liquid waste or special waste).
- Given the above, an Environment Protection Licence (EPL) is required for the operation of the Facility as a premises-based scheduled activity.

Compliance to the NSW PoEO Act: The Proposal satisfies the objectives of the PoEO Act, and will actively comply with its EPL requirements.

3.3.2 Protection of Environment Operations (Waste) Regulation 2014

The Protection of the Environment Operations (Waste) Regulation 2014 relates to the regulation of waste and resource recovery in NSW. It gives effect to the broad objectives and specific provisions within the PoEO Act relating to waste, including:

- The administration of the section 88 contribution (the waste levy) within the POEO Act; Provides for reporting and record-keeping requirements in relation to scheduled waste facilities and scheduled landfill sites;
- Waste tracking and transportation requirements and obligations; Makes special requirements including reporting requirements relating to asbestos waste as well as prohibiting the re-use and recycling of asbestos waste;
- Imposes requirements on brand owners and retailers to recover, re-use and recycle packaging;
- Allows the EPA to issue exemptions from certain provisions of the Act and Regulations;
- Allows the EPA to approve the immobilisation of contaminants in waste; and
- Makes it an offence to apply, or to cause or permit the application of, residue waste to land that is used for the purpose of growing vegetation, subject to any exemptions.

Compliance to the Protection of Environment Operations (Waste) Regulation 2014: The Proposal will categorise all waste streams as per the Regulation and associated guidelines as well

as meeting transportation and disposal requirements (refer to **Section 6** for great detail on waste management).

3.3.3 Resource Recovery Exemptions and Resource Recovery Orders

Resource recovery exemptions are granted by the NSW EPA where the land application or use as fuel of a waste material is a bona-fide, fit for purpose, reuse opportunity that causes no harm to the environment or human health, rather than a means of waste disposal. An exemption facilitates the use of these waste materials outside of certain requirements of the waste regulatory framework.

The EPA encourages the recovery of resources from waste by issuing resource recovery orders and exemptions. These are updated from time to time on the EPA website and in the event that a waste type is not covered by an existing resource recovery order then an application can be made to the EPA for a resource recovery order and exemption.

Resource recovery orders include conditions which processors and generators must meet to supply the waste for land application, use as fuel or in connection with a process of thermal treatment. They may include specifications, record-keeping, reporting and other requirements. All resource recovery orders are made under clause 93 of the Waste Regulation 2014.

Resource recovery exemptions contain the conditions which consumers must meet to apply waste to land, or use the waste as fuel or in connection with a process of thermal treatment outside certain requirements of the waste regulatory framework. They may include requirements on how to re-use or apply the waste, and record-keeping, reporting and other requirements. All resource recovery exemptions are made under clauses 91 and 92 of the 2014 Waste Regulation.

Compliance to the Resource Recovery Exemptions and Resource Recovery Orders NSW:
The Proposal satisfies the objectives of the Resource Recovery Exemptions and Resource Recovery Orders which include classification of waste and resource recovery hierarchy (refer to **Section 8.6** for greater detail).

3.3.4 Waste Classification Guidelines

Table 6 outlines relevant materials to the EFW facilities that are classified in accordance with the NSW Waste Classification Guidelines. Detail of waste composition is provided in **Section 5**.

Table 6: Waste Classification Description

Design Fuel	Description

Construction and Demolition (C&D) Waste -Residual Fuel	C&D means unsegregated material (other than material containing asbestos waste or liquid waste) that results from:
	- the demolition, erection, construction, refurbishment or alteration of buildings other than:
	  - chemical works
	  - mineral processing works
	  - container reconditioning works
	  - waste treatment facilities
	- the construction, replacement, repair or alteration of infrastructure development such as roads, tunnels, sewage, water, electricity, telecommunications and airports and includes materials such as:
	- bricks, concrete, paper, plastics, glass and metal
	- timber, including unsegregated timber, that may contain timber treated with chemicals such as copper chrome arsenate (CCA), high temperature creosote (HTC), pigmented emulsified creosote (PEC) and light organic solvent preservative (LOSP) but does not include excavated soil (for example, soil excavated to level off a site prior to construction or to enable foundations to be laid or infrastructure to be constructed).

General waste	The following wastes (other than special waste, liquid waste, hazardous waste, restricted solid waste or general solid waste (putrescible)) are pre-classified as 'general solid waste (non-putrescible)

Table 6: Waste Classification Description

Design Fuel	Description
Garden waste	Garden waste means waste that consists of branches, grass, leaves, plants, loppings, tree trunks, tree stumps and similar materials, and includes any mixture of those materials
Wood waste	Wood waste means sawdust, timber offcuts, wooden crates, wooden packaging, wooden pallets, wood shavings and similar materials, and includes any mixture of those materials, but does not include wood treated with chemicals such as copper chrome arsenate (CCA), high temperature creosote (HTC), pigmented emulsified creosote (PEC) and light organic solvent preservative (LOSP).
Hazardous Waste	The following waste types (other than special waste or liquid waste) have been pre-classified by the EPA as 'hazardous waste': - containers, having previously contained a substance of Class 1, 3, 4, 5 or 8 within the meaning of the Transport of Dangerous Goods Code, or a substance to which Division 6.1 of the Transport of Dangerous Goods Code applies, from which residues have not been removed by washing2 or vacuuming. - Coal tar or coal tar pitch waste (being the tarry residue from the heating, processing or burning of coal or coke) comprising of more than 1% (by weight) of coal tar or coal tar pitch waste - Lead-acid or nickel-cadmium batteries (being waste generated or separately collected by activities carried out for business, commercial or community services purposes). - Lead paint waste arising otherwise than from residential premises or educational or child care institutions. - any mixture of the wastes referred to above.

Compliance to the Waste Classification Guidelines: The Proposal will categorise all waste streams as per the Regulation and associated guidelines (refer to **Section 5** and **Table 6** for greater detail on waste classification).

3.3.5 Waste Avoidance and Resource Recovery Act 2001

The waste hierarchy, established under *the Waste Avoidance and Resource Recovery Act 2001* (WARR Act), is one that ensures that resource management options are considered against the following priorities:

- Avoidance including action to reduce the amount of waste generated by households, industry and all levels of government;
- Resource recovery including reuse, recycling, reprocessing and energy recovery, consistent with the most efficient use of the recovered resources; and
- Disposal including management of all disposal options in the most environmentally responsible manner.

The highest priority, avoidance, encourages the community, industry and government to reduce the amount of virgin materials extracted and used and waste generated and to be more efficient in their use of resources.

Resource recovery maximises the options for reuse, recycling, reprocessing and energy recovery at the highest net value of the recovered material. This encourages the efficient use of recovered resources while supporting the principles of improved environmental outcomes and ecologically sustainable development. Resource recovery can also embrace new and emerging technologies.

An end-of-pipe solution, disposal, is the least desirable option and must be carefully handled to minimise negative environmental outcomes.

The waste hierarchy lists, in order of preference, the approaches needed to achieve efficient resource use with disposal being the least preferred method and waste avoidance the most preferred. The place of EfW in the hierarchy established under the WARR Act is as follows (from most preferable to least preferable):

- Avoid and reduce;

- Reuse waste;
- Recycle waste;
- Recover energy;
- Treat waste; and
- Disposal.

Compliance to the NSW WARR Act: The Proposal compiles with the principles of the WARR Act, as it only uses waste (as fuel) that is destined to be landfilled. Under controlled circumstances, recovery of energy is preferable to treatment and disposal of waste, which are the only other alternatives available for such waste.

3.3.6 Waste Avoidance and Resource Recovery Strategy

The WARR Strategy sets the following targets for 2021–22:

- avoiding and reducing the amount of waste generated per person in NSW:
  - increasing recycling rates to 70% for municipal solid waste;
  - 70% for commercial and industrial waste
  - 80% for construction and demolition waste
- Increasing waste diverted from landfill to 75%;
- Managing problem wastes better, establishing 86 drop-off facilities and services across NSW;
- Reducing litter, with 40% fewer items (compared to 2012) by 2017; and
- Combatting illegal dumping, with 30% fewer incidents (compared to 2011) by 2017.

Compliance to the NSW WARR Strategy: The Proposal is designed to convert waste that cannot be avoided, reused or recycled into electricity. As such it diverts waste from landfill and is fully consistent and assists in achieving the WARR Strategy objective of "*increasing waste diverted from landfill to 75%"*.

4. FUEL COMPOSITION

A moving grate system offers TNG the greatest flexibility in the range of waste fuels that may be processed at the Facility. The following residual waste that would otherwise be sent to landfill has been identified as the main sources of fuel for the Facility:

- Chute Residual Waste (CRW) from the Genesis MPC;
- Commercial and Industrial (C&I) waste;
- Construction and Demolition (C&D) waste;
- Floc residual from car and metal shredding;
- Paper pulp residual;
- Glass Recovery residual;
- Garden Organics (GO) residual;
- Alternative Waste Treatment (AWT) residual; and
- Material Recovery Facility waste (MRF) residual

As the NCV of waste fuels vary depending on type, the facility will operate within a range of NCVs to support operational flexibility.

TNG has identified and quantified the number of eligible tonnes that are received currently at DADI's facility at Eastern Creek from third party "authorised facilities", in addition to the residual from the Genesis MPC. The design fuel mix has been determined using the waste sources that would be available to TNG today, however, the technology employed allows for significant flexibility in composition and quantity of material. The design fuel mix is summarised in **Table 7**. TNG has provided a breakdown of these waste streams to the EPA and DPE by:

- DADI customer;
- Authorised facility location;
- Resource recovery rate of facility (which exceeds the resource recovery rate criteria of the EfW Policy Statement); and
- Total tonnes per annum (tpa).

This detailed information provided in confidence to the EPA and the DPE for the purpose of this report, these tonnes have been aggregated into the design fuel components.

It is acknowledged that worldwide no two EfW plants would have "identical" feedstock as the feedstock always depends on the region and the waste fractions delivered to the plant. See **Appendix 6** for comparisons amongst referenced facility. Even if there are minor technology differences between the suppliers the basic principle of contaminant reduction remains the same irrespective of the technology.

However, when comparing the operation and emission behaviour of plants they are largely consistent, irrespective of location and feedstock. The reason for this is that the EfW plant has a destruction and removal process for every single contaminant group (including acid gases, organic substances, heavy and metals) and controlled by continuous emission monitoring. As a result, plants with comparable (not identical) feedstock are sound evidence for the suitability of the technology (refer to Project Definition Brief in Appended to the EIS)

4.1 C&D residual

The waste characterisation for C&D residual material from external "authorised facilities" is listed in **Table 7** has been calculated by:

- Defining the composition of general C&D waste (Waste Classification Guidelines);
- Defining appropriate resource recovery rates likely to be achieved for each waste stream via a purpose built C&D resource recovery facility or via source separation achieved at demolition sites;
- Data from sites;

- Construction and Demolition Waste Status Report, Hyder Consulting Pty Ltd, 2011 (Hyder C&D Report 2011); and
- Recalculating the composition of the waste using the remaining residual material.

According to the NSW Waste Classification Guidelines C&D waste means unsegregated material (other than material containing asbestos waste or liquid waste) that results from:

- the demolition, erection, construction, refurbishment or alteration of buildings other than chemical works, mineral processing works container reconditioning works waste treatment facilities the construction, replacement, repair or alteration of infrastructure development such as roads, tunnels, sewage, water, electricity, telecommunications and airports and includes materials such as:
- bricks, concrete, paper, plastics, glass and metal timber, including unsegregated timber, that may contain timber treated with chemicals such as copper chrome arsenate (CCA), high temperature creosote (HTC), pigmented emulsified creosote (PEC) and light organic solvent preservative (LOSP) but does not include excavated soil (for example, soil excavated to level off a site prior to construction or to enable foundations to be laid or infrastructure to be constructed).

In DADI's experience, up to 80% of C&D waste is successfully sorted on site during large to medium demolitions. The Genesis MPC is independently audited under the Green Star reporting guidelines (see **Appendix 7**) to verify its resource recovery rate. Supplies (waste originating from other sources) will need to demonstrate that they meet the necessary benchmarks for resource recovery, have comparable waste sorting procedures and adequate auditing procedures (refer to **Section 5**).

4.2 C&I residual

The waste characterisation for C&I residual material from external "authorised facilities" is listed in **Table 7** has been calculated by:

- Disposal-based audit C&I waste stream in the regulated areas of New South Wales, Waste and Resource Recovery branch of the NSW Environment Protection Authority, May 2015.
- Removing putrescible waste from the composition;
- Defining appropriate resource recovery rates likely to be achieved for each waste stream via a purpose built C&I resource recovery facility;
- Data from facilities;
- *Disposal-based Audit – Commercial Industrial Waste Stream in the regulated areas of New South Wales, May 2015, NSW EPA* (EPA C&I Audit 2015); and
- Recalculating the composition of the waste using the remaining residual material.

EPA C&I Audit 2015 identified C&I waste contains (by weight) mainly garbage bags (28.4 per cent), other material, such as residue from waste processing, shredder floc and pulp (18.2 per cent), wood (14.3 per cent, mainly treated timber), masonry materials including soil (12 per cent) and plastic (6.9 per cent, of which almost half is plastic film). It also contains food, cardboard, vegetation, paper, textiles, metals, and small amounts of glass, rubber and electrical items.

Garbage bags in C&I waste contain (by weight) mainly food (26.3 per cent), paper (25.2 per cent) and plastic (20.9 per cent). They also contain cardboard, textiles, garden organics, metals, glass and small amounts of masonry, rubber, and wood.

4.3 Floc residual

According to the Australian Federal Chamber of Automotive Industries the reuse and recovery rate of end-of-life vehicles in Australia is 75% (data published 2011) which obviously represents the metals. As far as information is available there is no relevant recovery of floc waste. Using floc waste as a fuel would therefore be an important contribution to improve the recovery rate

Shredder floc typically consists of a combination of plastics, rubber, textiles, seat foam metals and inert materials such as dirt and glass (see **Table 7**). The composition of shredder floc does not

differ greatly between end of life vehicles (ELVs) and white goods, although older white goods can contain polychlorinated biphenyls (PCBs), which ELVs do not, as well as higher levels of copper.

In Australia the current recycling practice for the ELVs is to drain them of fluids and dismantling of saleable parts. Parts may include wheels, batteries, engines, alternators, body panels. Approximately 65-75% of the rest of the vehicle are ferrous and nonferrous metals. The remaining 25-35% of the materials is shredder floc (which is similar to the procedures used in Europe).

Floc residual is not identified as an independent waste stream in the NSW EfW Policy, but can be classified as a residual C&I waste stream. The EPA has confirmed that floc is not excluded from EfW and will potentially be included in an amended version of the NSW EfW Policy (**Appendix 8**).

Refer to refer to Project Definition Brief Appended to the EIS for the chemical analysis breakdown of floc residual.

4.4 Paper pulp

Paper pulp is not identified as an independent waste stream in the NSW EfW Policy, but can be classified as a mix of C&I and MSW residual from paper recycling operations. The composition of paper pulp has been obtained from DADI from a post-consumer paper recycling operation in Sydney.

4.5 Glass residual

Glass residual is not identified as an independent waste stream in the NSW EfW Policy, but can be classified as MSW residual from post-consumer glass recycling operations.

The composition of glass residuals has been obtained by DADI from a glass recycling operation in Sydney. Post-consumer glass residue is predominately packaging waste (plastic and paper/cardboard).

4.6 GO residual

Garden Organic (GO) residual is classified as the residual from domestic source separated GO waste. The composition of this residual waste was obtained from Council audit data for GO bins prior to processing.

GO Processing Facilities shred and compost organic waste in open aerobic conditions to produce a stable product suitable for soil conditioning. Commercial composting facilities require planning consent under the Environmental Planning and Assessment Act 1979. Organic materials received for recycling at licensed composting facilities need to comply with allowed materials specified in the facility's environment protection licence.

There were 55 GO processing facilities in NSW in 2013 (National Waste Report 2013).

4.7 AWT residual

Alternative Waste Treatment (AWT) facilities essentially designed to accelerate the biological degradation of organic wastes and produce compost/soil conditioner (aerobic composting) or methane-rich gas suitable for energy production (anaerobic digestion). Input waste sorting (or streaming) is usually undertaken to ensure that feedstock is free of non-organic material. Post treatment separation of non-organic material may also be carried out to refine the end product.

The residual is classified as the residual waste after processing domestic residual waste (red bin) from a two bin system. Processing thus removes dry recyclables, food, GO and other organic material via processing, leaving a high calorific residual waste stream.

Typically, the ultimate residual wastes from the AWT process, and any processed material that cannot be beneficially reused, is disposed of to landfill.

There were seven AWT facilities in NSW in 2013 (National Waste Report 2013).

4.8 MRF Residual

Material Recovery Facility (MRF) residual is classified as the residual from domestic dry recycling operations. MRF in which mixed waste and/or recyclable materials are sorted and collated by material type using mechanical separation technologies. Aggregated bulk materials of each type are then sent to recycling facilities for further processing. The technologies used for material sorting in MRFs vary from small, bucket-equipped loaders to sophisticated and fully automated mechanical screening and optical sorting systems.

The composition of the residuals from MRF were obtained by DADI from a material recovery facility operator in Sydney. There is 34 MRF and mechanical sorting facilities in NSW (National Waste Report 2013).

4.9 Hazardous Material

Given the nature of waste, in particular C&D and C&I, it is possible that hazardous waste can enter the waste stream. Common hazardous waste include:

- Asbestos;
- Treated timber;
- Paints, spray cans, fuel cams, oil containers, gas bottles and explosives;
- Batteries;
- Clinical waste/ sharps/cytotoxic material;
- Contaminated soil; and
- Unidentifiable liquids.

The number for hazardous material in the C&D and C&I waste streams is expected to be low and given stricter waste classification and segregation in the industry it is expected to further decline. Refer to **Section 5.4** for greater detail.

4.9.1 Treated Timber

It is difficult to completely eliminate treated wood which may contain wood treated with chemicals such as copper chrome arsenate (CCA), high temperature creosote (HTC), pigmented emulsified creosote (PEC) and light organic solvent preservative (LOSP) in the waste composition for C&D waste and therefore it is accepted in the under the NSW Waste Classification Guidelines that C&D waste may contain these material (see **Section 3.3.4**).

According to the Hyder C&D Report 2011, “treated timber, including copper chrome arsenate (CCA) timber and painted products, are estimated to account for around 6% of total C&D waste wood in NSW “. According to the EPA C&I Audit 2015, wood waste makes up a total of 14.4% of the overall C&I waste composition of which approximately 90% is treated.

Treated timber would amount to smaller number in the total waste composition as C&D and C&I waste only to make up approximately 28.69% and 16.84% (respectively) of the total waste composition (refer to **Table 7**) and not all treated wood is hazardous. Robust waste inspection procedures (refer to **Section 5**) identify treated timber where possible, which will further reduce the likelihood of treated timber entering the fuel source.

TNG will monitor treated timber amounts for total fuel composition. This will be undertaken through general screening (**Section 5**), waste composition audits (**Section 5.3**) and analytical analysis of ash residue. If the treated timber percentage rises greater than 5% of total waste composition then treated timber sorting practices and monitoring will need to be reassessed as the rise in treated timber may give rise to arsenic in the APC residue, and copper and chrome in the bottom ash. Excess treated timber (i.e. greater than 5%) will be diverted at waste reception as part of the scanning of incoming loads and sent to landfill / an alternate waste facility. Refer to **Appendix 5** for more detail on the chemical composition of treated timber.

4.9.2 Asbestos

Asbestos is not an approved fuel for the Facility nor is it permitted in the C&D and C&I waste streams. Upstream sorting and screening procedures will further minimise the likelihood of asbestos entering the plant (refer to S**ection 5.4.2** and **Appendix 2** of the WMR).

C&I EPA Audit 2015 estimated that 0.1% of C&I waste in SMA is asbestos waste. Asbestos is not permitted in C&D waste however no data was availably regarding potential quantities of asbestos in C&D waste that is not classified as asbestos waste (i.e. asbestos soil).

Whilst asbestos remains a component of C&D, the likelihood of asbestos appearing in waste is expected to diminish over time, as the demolition or renovation of old asbestos-containing buildings becomes less frequent.

4.10 Material input streams

Table 7 summaries the findings with regards to likely fuel source composition which was by TNG based on industry data/information and Genesis Facility (which is audited data).

An authorised facility complies with the resource recovery requirements of the NSW EfW Policy to ensure that recyclables are recovered prior to energy recovery. The composition of each of the waste streams is provided in in accordance with the EfW Policy Statement. The composition of all waste streams is obtained from Australian sources (publically available documents and confidential data sourced from operators of authorised waste facilities).

Table 7: Design Fuel Mix and Composition

Material Type	Source Separated Waste									
	CRW	C&D	C&I	Floc Waste	Paper Pulp	MRF Residual	Glass Residual	GO Residual	AWT Residual	Total
Fuel Mix	**23.27%**	**28.69%**	**16.18%**	**14.43%**	**4.81%**	**1.20%**	**1.72%**	**2.06%**	**6.87%**	**100%**
Phase 1 (tpa)	128,566.8	158,512.3	89,394.5	79,725.8	26,575.3	6,630.0	9,503.0	11,381.5	37,956.8	**552500**
Phase 2 (tpa)	257,133.5	317,024.5	178,789.0	159,451.5	53,151	13,260.0	19,006.0	22,763.0	75,913.5	**1,105,000**
Paper/card	4.30%	14.10%	22.40%	3.93%	78.40%	38.54%	62.00%	30.00%	21.05%	**16.75%**
Plastic film	10.20%	6.40%	10.90%	10.90%	21.60%	26.94%	3.80%	2.50%	21.05%	**10.47%**
Dense plastic	0.00%	6.40%	10.90%	10.90%	0.00%	0.00%	34.20%	2.50%	10.53%	**7.32%**
Textiles	5.30%	0.00%	12.90%	0.18%	0.00%	0.00%	0.00%	0.00%	10.50%	**4.16%**
Glass	0.00%	0.00%	1.80%	0.00%	0.00%	8.50%	0.00%	4.00%	0.00%	**0.49%**
Vegetation	8.30%	0.00%	1.70%	0.00%	0.00%	0.00%	0.00%	35.00%	3.16%	**3.16%**
Other combustibles	0.00%	0.00%	0.00%	70.40%	0.00%	0.00%	0.00%	0.00%	0.00%	**10.16%**
Metal	1.80%	1.10%	0.40%	0.00%	0.00%	7.59%	0.00%	5.00%	0.00%	**1.00%**
Fines	0.00%	0.90%	0.20%	0.00%	0.00%	0.00%	0.00%	0.00%	11.58%	**1.10%**
Wood	58.20%	43.90%	21.50%	0.85%	0.00%	0.00%	0.00%	0.00%	4.21%	**30.24%**
Combustibles	0.00%	0.00%	2.80%	2.84%	0.00%	0.00%	0.00%	0.00%	2.11%	**1.03%**
Non-combustibles	4.50%	0.00%	0.00%	0.00%	0.00%	0.03%	0.00%	21.00%	1.05%	**1.56%**
Hazardous	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**0%**
Gyprock	2.40%	6.50%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	**2.42%**
Other	5.00%	20.75%	14.44%	0.00%	0.00%	18.40%	0.00%	0.00%	5.26%	**10.14%**

5. MANAGEMENT OF INCOMING WASTE

5.1 Chute Residual Waste (CRW) from the Genesis MPC

The process at the MPC is described below.

5.1.1 Materials Receivable Delivery, Inspection and Classification

Waste materials are currently delivered to the Genesis MPC by a combination of light, medium and heavy vehicles, with loads typically varying from approximately 1 to 40 tonnes in weight and the waste received at the Genesis MPC is co-mingled.

Upon operation of the EfW, the identified residual waste fuel will be received and sorted at the Facility (instead of going to landfill). No material will be exhumed from landfill for the purpose of the Facility.

Classification of incoming waste is based on knowing its origin; advice from the carrier; inspection of the carrier's documentation prepared in accordance with the EPA (2008) *Waste Classification Guidelines;* and verification of this information by visual inspection using the weighbridge camera ('Check Point 1').

Small mixed loads that can be unloaded by hand are directed to the hand unloading area at the western end of the MPC. These loads are also visually inspected at multiple check points. Larger mixed loads are directed to be tipped at the Genesis MPC work floor. Upon arriving at the Genesis MPC a close up visual inspection then takes place before the vehicle enters if passed the co-mingled load is then tipped onto the floor within the Genesis MPC, where a the third visual inspection takes place of the contents. Unacceptable wastes which may have eluded identification at the weighbridge or spotter 2 are identified at this point and rejected. The waste inspection procedure is provided in **Appendix B**.

Current operations are subject to extensive audits conducted on behalf of Green Star accreditors, the EPA, key waste generators and other interested parties. TNG proposes to verify the recovery rates of the Genesis MPC and any other DADI owned processing facilities using the same methodologies for the purpose of compliance with the EfW Policy. TNG will also request receipt of reports from third party facilities to verify the reported resource recovery rates of each facility. TNG will also have independent audits performed on third party facilities using the same criteria as the Green Star reporting scheme to ensure residual waste fuels are eligible for acceptance at the TNG EfW Facility. This approach has been discussed with the EPA.

All waste is classified at the weighbridge. For all waste streams that are mixed and processed via a single facility (either owned by DADI or a third party), the most conservative EfW Policy resource recovery criteria will be applied to the residual waste fuels. The current diversion rate through the Genesis MPC achieves the required EfW threshold for C&D material, which comprises the majority of the processed material. This ensures that the required recovery rate for C&I waste sufficiently exceeds (50%).

5.1.2 Sorting

Where practicable, mixed loads delivered to the Genesis MPC are first segregated by material type and placed in adequate, appropriately labelled bays and bins for transport to appropriate stockpiles for recycling, or to landfill or off-site (as required).

The larger loads tipped at the work floor after inspection and verification are mechanically pre-sorted and inspected by working from the western to the eastern end of the building.

This process ensures the early removal of items that are:

- Easy to remove; and/or
- Unnecessary or undesirable to shred and process through the Facility that effect production or increase wear:
  - Large ferrous and non-ferrous metals;
  - Large film plastic and hard plastics including PVC;
  - Reusable pallets and timbers;
  - Mattresses and carpet rolls;
  - Large concrete and rubble; and
  - Plaster board.

Following this pre-sorting process, these recovered items are stored in bins within the Genesis MPC from where they are later transported for further processing at the landfill or taken off site for processing by others.

The remaining co-mingled waste is then fed into the Genesis MPC for automatic separation.

5.1.3 Efficient Separation and Processing

Separation machinery used at the Genesis MPC is state-of-the-art and is efficient at segregating wastes for further processing and recycling; and ensuring that recycling is maximised, while residual waste is minimised.

Of the waste loads received at the Genesis MPC that are classified as containing material capable of being recovered or recycled, it is estimated that, on average, 80% of materials will be recovered by sorting, separating and processing, and made available for resale or reuse by other processors. This represents the better and higher re-use of the material indicated by the WARR Act.

The following waste streams are recovered for reuse:

- Ferrous and Non-ferrous metals;
- Plastics;
- Brick, concrete, sand, soil;
- Road base, Aggregates, Bitumen;
- Timber;
- Green waste;
- Paper, Cardboard;
- Gyprock;
- Polystyrene; and
- Reusable goods.

In accordance with the Resource Recovery Criteria of the EfW Policy, 25% of the total C&D waste processed by the Genesis MPC (the residual) will be used as residual waste fuel for the Facility and 50% of the total C&I waste processed can be used as residual waste fuel for the Facility (see **Section 8.6**). This allowable residual rate is higher than the residual material from than Genesis MPC's, as the facility achieves a recovery rate of between 75% and 80%.

The CRW waste from the Genesis MPC was audited in 2014. The results of this audit have been used to determine the composition of the material for the purposes of the design fuel mix for the Facility.

5.2 Fuel originating from other sources

In addition to CRW from the Genesis MPC, waste will arrive from external facilities. This waste will have been pre-classified according to the *NSW Waste Classification Guidelines* (refer to **Section 3.3.4**)

The waste inspection procedure will follow a similar process to the CRW from the Genesis MPC outlined in **Section 5.1**. **Figure 3** provides an outline of the process that will be taken upon arrival of waste to the facility originated from other sources.

In general the process will involve:

- Vehicles providing the appropriate waste docket and waste classification.
- Vehicle inspected at **Checkpoint 1** - CCTV inspection and weighing of vehicle to identify if there is any ineligible materials identified;
- Vehicle inspected at **Checkpoint 2** - Spotter station, waste physically inspection to identify if there is any ineligible materials identified; and
- Vehicle inspected at **Checkpoint 3** - Waste is physically unloaded and final inspection carried out to identify if there is any ineligible materials identified.

TNG will develop a Waste Inspection Procedure prior to the commencing of operation in a similar vein to Waste Inspection Procedure attached in **Appendix 2**. It is expected that this will be a condition of Development Consent.

5.3 Independent Auditing

In addition to the 'best practice' process conducted at the Genesis MPC, TNG will conduct independent audits using the Green Star criteria for assessment to checkthat all waste streams sent to the Facility comply with the EfW Policy Statement resource recovery criteria. This will apply to both CRW and fuel originating from other sources.

The *POEO (Waste) Regulations 2014* will require additional reporting from resource recovery facilities. This data can be used by the EPA to assist in ensuring third party facilities achieve the diversion rates in the EfW Policy. The resource recovery criteria verification process for all residual waste fuels received on site is summarised in **Sections 5.1** and **5.2.**

The Genesis MPC facility is accredited by Green Star, which is an independent, voluntary and internationally recognised sustainability rating system. The Genesis MPC forms part of the sustainability life cycle and certification process for Green Star providing an accredited facility for builders and building maintenance companies seeking a green star rating. The Facility is audited annually by independent green star environmental specialists. The auditors are engaged directly to Green Star, who review the systems and processes in place at a waste service facility to ensure that meet compliance with the green star framework. A copy of the green star reporting and compliance framework is provided **Appendix 7**.

5.4 Management of Potential Hazardous Waste

Given the nature of waste, in particular C&D hazardous material it is possible that hazardous waste can enter the waste stream. Common hazards include:

- Asbestos;
- Treated timber;
- Paints, spray cans, fuel cams, oil containers and explosives;
- Batteries; and
- Unidentifiable liquids.

Appendix 2 (Waste Inspection procedure) provides greater detail on how hazardous material will be identified and removed from the waste stream. Prior to commissioning, TNG will develop a site specific Waste Inspection Procedure that will be periodically reviewed.

5.4.1 Treated Timber

Robust waste inspection procedures (refer to **Section 5**) identify treated timber where possible will further reduce the likelihood of treated timber entering the fuel source

TNG will monitor treated timber amounts for total fuel composition. This will be undertaken through general screening (**Section 5**), waste composition audits (**Section 5.3**) and analytical analysis of ash residue. If the treated timber percentage rises greater than 5% of total waste composition then treated timber sorting practices and monitoring will need to be reassessed as the rise in treated timber may give rise to arsenic in the APC residue, and copper and chrome in the bottom ash. Excess treated timber (i.e. greater than 5%) will be diverted at waste reception as part of the scanning of incoming loads and sent to landfill / an alternate waste facility. Currently treated timber is extracted by hand at the checking station and dropped in the chutes of the waste conveyor.

5.4.2 Asbestos

In the case of asbestos being processed in the facility it will be treated securely without any further health risks. In case the asbestos enters the process as cement bound material, particles will not be released and the residue will remain as inert material in the bottom ash. In case the material enters in powderised form, it will be transferred to the fly ash, precipitated and removed in the APC system. As a result asbestos emissions are not considered an issue for energy from waste plants.

The waste screening procedures are outlined in the WMR (refer to **Section 5.2** and **Appendix 2** – Waste Inspection Procedure).

Whilst asbestos remains a large component of C&D waste there will be a non-recoverable component affecting the resource recovery rate. Eventually, as the demolition or renovation of old asbestos-containing buildings becomes less frequent, this problematic component of the C&D waste stream will diminish.

6. MANAGEMENT OF WASTE GENERATED

The Facility will generate the following solid, liquid and gaseous waste streams:

- Bottom ash;
- APC residue;
- Boiler ash;
- Liquid effluent from the boiler water treatment system and from the boiler blow-down;
- Ferrous material residue;
- Gaseous emissions (pyrolytic gas); and
- Staff waste.

The quantity of these waste ash streams is summarised in Table 8 and management of waste streams is discussed in section below.

While significant quantities of process materials (ammonium hydroxide, diesel, powdered activated carbon and calcium hydroxide) will be held on site, these will generally be consumed in the process or end up in the APC residue and will not generate separate waste streams. Small quantities of maintenance materials will be held on site and maintenance activities may generate small quantities of waste (waste oil, etc.).

In addition to these waste streams, the facility will generate operational waste in its offices.

6.1 Processing Ash Residue

The Facility will generate three types of residual ash which is included in **Table 8**.

In case of TNG the amount of wet bottom ash is 26.5% and the amount of APC residues (including boiler and fly ash) is estimated to be 4.0% of the waste input and therefore in line with best practice (refer to Project Definition Brief, appended in the EIS) and the sections below for further detail.

Table 8: Estimation of Ash residue and recycle/disposal options

Type of Ash	Estimated amount generated (tpa)	Worst Case amount generated (tpa)	Waste Classification	Disposal Option(s)
Bottom ash (dry)	237,456	324,000	General Solid Waste	Transported to the adjoining landfill facility for disposal
Bottom ash (wet)	293,166	400,000	General Solid Waste	Transported to the adjoining landfill facility for disposal
APC ash / Boiler ash	43,800 tpa	51,700	Restricted Solid Waste	Transported off site by a licensed contractor and taken to a waste treatment facility licensed to treat such wastes. Implementation of stabilisation techniques such as immobilisation or verification to reduce the residue to Restricted/General Solid Waste classification
Total	**336,966**	**451,700**	-	

1. Estimates based on the Facility processing 1,105,000 tonnes/year of residual waste fuel and an input mass flow of residual waste fuel of 34.5 tonnes/h.
2. Waste classifications were based on a chemical assessment and comparing results against the criterial set out in Table 2 – TCLP and SCC values for classifying waste by chemical assessment in the NSW Waste Classification Guidelines – Part 1: Classification of waste. Refer to Appendix H for assessment results.

6.1.1 Bottom Ash

The bottom ash from the grate will be discharged onto a conveyor system. The conveyor will pass under a magnetic separator to remove ferrous materials. The ash will then be discharged to a bottom ash bunker for storage. Bottom ash landfilled. In the absence of Facility samples, MRA took typical compositions of EfW incineration bottom ash (IBA) as a proxy to classify the bottom ash and identify ways to recycle or dispose it off. The proxy composition was taken from a study of EfW Incinerator Bottom Ash, Assessment of Hazard Classification of UK IBA 2011, conducted in the United Kingdom (UK). The study analyses the composition of bottom ashes from 18 EfW Facilities located in the UK for the period January 2011-June 2011. The analysis was based on MSW incineration, thus providing a very conservative contamination profile as C&I and C&D wastes are less variable in comparison to MSW.

The NSW EPA *Waste Classification Guidelines* were used to classify the proxy bottom ash sample. The results were tested against the specific contaminant concentration (SCC) thresholds using maximum contaminant concentrations provided in the samples. The results of the classification process are shown in **Appendix 3**.

As shown in the results, the proxy sample would be classified as 'hazardous waste' under Step 5 of the W*aste Classification Guidelines* due to high levels of lead and nickel in both proxy samples; however, this assessment was based only on SCC and did not take into account leachability using the toxicity characteristics leaching procedure (TCLP).

Ramboll and HZI undertook an assessment of the predicted ash fractions from the Facility, based on the expected Phase 1 residual waste fuel composition. The SCC values obtained for bottom ash by Ramboll/HZI were similar to the average values obtained by MRA; however; Ramboll/HZI also derived TCLP values. This assessment shows that the bottom ash would be classified as General Solid Waste. Results of this assessment are shown in **Appendix 3**.

Based on the waste mix of the TNG facility a bottom ash quantity of 21.5% (on dry basis) of the fuel input was calculated. The operational data from the reference plant show bottom ash quantities in the order of 20 to 25% (on dry basis) of the waste input. The TNG project also has a relevant wood input, however, this wood is part of the C&D waste. Wood from C&D waste often has rests of cement or plaster sticking to it and screws or nails left in it which increases the calculated "ash" content. As a result it can be concluded that the assumption of 21.5% for TNG is a conservative and reasonable value (**Appendix 6**)**.**

To minimise the concentration of metals, particularly lead and nickel, in the bottom ash residual waste of the Facility, the following measures will be taken:

- Acceptance of C&I and C&D waste streams only from third party authorised facilities;
- Preliminary inspection of waste, source verification and CCTV footage;
- Visual inspection post tipping;
- Contractual tools such as penalties or right of refusal for delivery of waste with high lead or nickel concentrations;
- Pre-screening, sorting and separation processes to remove hazardous materials at Genesis MPC, PSC and/or other authorised facilities;
- Options to immobilise waste will be examined in the event that sorting does not reduce lead and nickel concentrations to be able to achieve a 'restricted solid waste' classification; and
- Periodic testing of bottom ash.

Operation of the Facility will be fully automatically controlled from a stand-alone control room. The proposed main control and supervision system will consist of a Distributed Control System (DCS). Further detail of the DCS is provided in Appendix E.

Due to the inherent value of lead-acid and nickel-cadmium batteries, this waste stream is typically recycled in Australia. Batteries have also been listed as a core waste stream that must be collected at the 86 new community recycling centres (CRCs) that are being established through the $467.5m Waste Less Recycle More Grant Program. This investment in recycling infrastructure will serve to further reduce the number of batteries, the dominant source of nickel and lead, from the residual waste streams currently received at the Genesis MPC.

6.1.2 Boiler Ash

Boiler ash is the residue generated in the combustion, comprising fine particles which rise with the flue gas. Its chemical composition falls between that of bottom ash and APC ash. The characterisation of boiler ash is depending on in which boiler pass it is accumulated. The boiler ash of all passes will be conservatively disposed of with the APC residues, unless it can be proven to be reusable following rigorous testing procedures in compliance with EPA regulations.

Boiler and fly ash contains the fine particles which have been carried out by the flue gas and transferred to boiler and particle removal system. The total amount of boiler and fly ash is typically 2-3% of the waste input.

Boiler ash will be disposed of with the bottom ash.

6.1.3 Air pollution control (APC) Ash

APC residues comprise fine particles of ash and residues from the APC process (the remaining products from elimination of the acid gases, mainly salts as calcium chloride from HCl removal and calcium sulphate from SO^2 removal). APC residue ash will be collected into sealed storage silos and transported via sealed tanker off-site for further treatment or disposal to landfill. If TCLP testing shows it is leachable then it will be stabilised with cement (**Appendix 6**).

As shown in **Table 8**, Ramboll/HZI calculated the amount of APC residue that would be generated at the nominal load (based on 8,000 hours of operation and feed of 1,105,000 tpa at design waste composition with a NCV of 12.34 MJ/kg and ash content of approximately 20%) to be 43,800 tpa.

APC residue is generally more hazardous than boiler ash. The actions described in **Section 6.1.1** to minimise the concentration of metals in the bottom ash waste stream will also support that metals concentrations in APC residue remain low to comply with a 'restricted solid waste' classification (**Appendix 3**). APC residue is destined for disposal in a licensed facility either in NSW or interstate depending on the waste classification. Because of the potentially alkalinity of APC residue, there is a potential the waste may be classified as Hazardous Waste (although current analysis classifies it as Restricted Solid Waste). In the event the waste exceeds the criteria for Restricted Solid Waste then the residue will be taken off site for immobilisation at a hazardous waste treatment facility to be treated prior to disposal at the appropriately licenced facility.

Air pollution control residues are the remaining products from elimination of the acid gases (mainly salts as calcium chloride from HCl removal and calcium sulphate from SO^2 removal). Depending on the contaminants in the fuel and the air pollution control technology the amount of products is in the range of 2-4% of the waste input.

6.2 Residual Ash Collection Process

The APC ash silos at the facility will be elevated, allowing the residue transport vehicles to park underneath the silo and use gravity to load the ash residue. No manual handling is required.

Further compositional testing of APC ash will be conducted to classify this waste stream. Options under consideration to dispose of APC ash include:

- Disposal to waste landfill that is licensed to accept the appropriate class of waste;
- Because of the potentially alkalinity of APC residue, there is a potential the APC residue may be classified as Hazardous Waste (although current analysis Restricted Solid Waste). In the event the waste exceeds the criteria for Restricted Solid Waste, stabilisation techniques such as immobilisation or verification to reduce the waste classification to an appropriate level for disposal to a licenced facility will be implemented; and
- APC residues require a general solid waste classification for disposal at the Genesis landfill and a restricted solid waste classification for disposal at the Kemps Creek Landfill. Other options such as salt cavern storage will be explored as required.

Refer to **Appendix 2, Appendix 6** and **Section 6.1** for detailed procedures for each ash type.

All waste that cannot be reused will be classified and transported in accordance with the *Environment Operations (Waste) Regulation 2014.*

A listing of other types of waste generated is described below.

6.3 Ferrous Material Residue

In the process of bottom ash being discharged to the conveyor system, the conveyor passes under a magnetic separator to remove ferrous materials and discharged to an indoor storage bunker with adequate capacity for storing bottom ash and metal recovered for a minimum of 5 days.

Ferrous metals will be removed from the bottom ash by means of magnetic separators and discharged to into bins which are then transported offsite to metal recycler.

Depending on the degree of pre-treatment carried out on the CRW, C&I and C&D waste, TNG may consider that magnetic separators are not required.

It is anticipated that ferrous metals will be collected by a scrap metal recycler for recycling.

6.4 Liquid Effluent

Liquid effluents will be produced from the boiler water treatment system and from the boiler blow-down. All boiler blow-down and liquid effluent produced is fed to the bottom ash discharger via the process water system.

Under normal operating conditions, no effluent is disposed of to the sewer or stormwater systems but returned to the Facility for re-use. In this way, the liquid effluent produced on site will either be evaporated or absorbed into the ash for disposal or re-use off site.

Liquid effluent will be collected in a storage tank to balance the amounts generated and disposed of to the ash quench. This will consist of boiler blowdown, boiler water treatment, swilling down water, occasional maintenance discharges and drain water from contaminated areas.

The re-use of the different water streams within the process results in a liquid-effluent free discharge EfW Facility during normal operation.

6.5 Gaseous emissions (pyrolysis gas)

Pyrolytic gas produced in the combustion process pass is mixed with secondary air and recirculated flue gas, which are injected at high velocity into the secondary combustion chamber above the grate, resulting in intensive mixing and the complete burnout of the pyrolytic gas.

Within the flue gas treatment (FGT) system the flue gas is scrubbed and treated before being vented to the atmosphere through a stack. The flue gas is treated within a reactor with a combination of lime and activated carbon and filtered through a fabric bag filter.

Further details are provided in Air Quality and Greenhouse Gases report appended to the EIS.

6.6 Staff Waste

The offices on site generate negligible commercial and industrial waste in the offices and staff rooms. SITA is currently engaged to remove waste generated by staff members. The waste is stored in a three metre cubic skip bin on site and is removed weekly.

6.7 Other Waste

The following chemicals are kept on site in low quantities and will generate empty packaging / drums / containers which will require disposal post use:

- Waste lubricant oil;
- Used lubricant oil drum; and
- Scrap metal from the workshop.

Small quantities of maintenance materials will be held on site and maintenance activities may generate small quantities of waste (such as waste oil,) that will sent for recycling or appropriate disposal following waste classification

Any spilled chemical substances within the bunded area that are required to leave site as waste will be classified and transported in accordance with the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes*.

Packaging / drums / containers will be collected by the supplier or disposed of in accordance with their waste classification.

The hazards associated with storage of these materials and other dangerous goods are addressed in full in the Preliminary Hazard Analysis and Fire Risk Assessment appended to the EIS. With the exception of transformer oil, these will generally be consumed in the process or end up in the APC residue and will not generate separate waste streams

7. AVAILABILITY OF WASTE

NSW generates more waste to landfill than the other jurisdictions. The following is an estimate of the availability of in SMA. The assumptions are made from publically available information and DADI's industry experience.

7.1 CRW – Genesis Facility

In a confidential waste report provided to the DPE, the eligible tonnes received currently across DADI's extensive waste asset portfolio for the year ending 30 June 2015 was:

- 879,249 tonnes received at Genesis;
- 530,118 is landfilled; and
- 361,806 is available as a potential EfW fuel source (identified as non-contaminated soils or non-asbestos containing soils). This means 68.2% of material received to landfill is potentially available as a fuel source for the Facility.

This data is summarised in a TNG prepared a confidential report in November 2015 (DADI Source of Waste Report, 2015) detailed the waste breakdown of the waste received at the MPC. Given its commercially sensitive nature this detailed information is provided in confidence to the DPE and the NSW EPA. The incoming waste materials are accounted for by reference to an EPA mandated descriptive category. Returns are forwarded monthly to the NSW EPA identifying the quantity by weight of each material in each specified category. All stockpiles of these materials are subject to a biannual aerial photograph and independent survey the results of which are reported to the NSW EPA.

It should be noted that under the current NSW waste levy it is more profitable for DADI to recycle waste as oppose to using the waste for a fuel source in the TNG Facility. Therefore, it will be the preference and aim of DADI's Genesis MPC to recycle as far as reasonable practicable and not divert any recycling opportunities in favour of use at the Facility.

7.2 C&D and C&I Waste NSW

The National Waste Report, 2013 which was collated by the Commonwealth Department of the Environment (now the Department of the Environment and Energy) (National Waste Report 2013) is the most recent publically available collection of waste data. The following is a summary of findings relating to the availability of waste as a fuel source in NSW:

- C&I waste generation was approximately 5,500,000 tpa with a resource recovery rate of 60%, which is 1% above the Australian average. NSW was targeting a C&I recovery rate of 63% by 2014. Therefore, 2,200,000 tpa is potentially available for EfW fuel source in NSW; and
- C&D waste generation was approximately 6,900,000 tpa with a resource recovery rate of 75 per cent which is nine percentage points above the Australian average. NSW is targeting a C&D recovery rate of 76% by 2014. Therefore 1,725,000 tpa is potentially available for EfW fuel source in NSW.

Ramboll Environ estimate that the following amounts of waste available in SMA that is potentially available as a fuel source for EfW.

- **1,112,150 tonnes of C&D**; and
- **1,430,000 tonnes of C&I**.

The above assumption is based on taking a representative 65% (represented NSW population in the SMA) from the figures of the National Waste Report, 2013. This is considered a conservative assumption as the percentage of construction and industry in the Sydney area would represent a

higher ratio to rural and township areas of NSW when compared against the population percentages (greater construction activities, greater density of commercial and industrial waste generators etc.).

The National Waste Report, 2013 concluded that for NSW:

- The data reflects NSW's well-established recovery infrastructure for MSW and C&D waste streams, sitting well above the national average. C&I recovery infrastructure appears to be less well established, sitting at about the national average; and
- Over the five-year period (2006/07 to 2010/11):
  - waste generation increased by 12%, consistent with population and GDP growth;
  - recycling increased by 34%;
  - energy recovery increased by about 38% due to increased landfill gas recovery; and
  - disposal decreased by 15%, or by 3% per year.

7.3 Source Separated Waste NSW

Public available information relating to source separated waste was not always readily available from public searches. **Table 9** is a combination of publically available information and data from DADI's Genesis landfill and Genesis MPC which was used by TNG to ascertain and provide confidence that there was adequate fuel source available to satisfy Phase 1 commissioning.

Table 9 summarises key data relating to source separated wastes from various sources from which in the information was obtain. Where available, information relating to SMA was preferred, followed by NSW and other States/Territories in Australia.

Table 9: Estimated Source Separated Waste Availability

Source Separated Waste	Estimated waste to landfill	Source	Scope of Source
Floc residual	169,152 tpa	Confidential, *Source of Waste Report, November 2015,*	Source Waste Report stated that 112,768 tpa of floc residual is received at the Genesis landfill. At the time of this report Genesis was receiving floc residual from two of the three main producers. Based DADI verified calculation on known availability an estimated 169,152 tpa is available from the three main producers.
Paper Pulp residual	25,101 tpa	Confidential, *Source of Waste Report, November 2015,*	Source Waste Report stated that 25,101 tpa of pulp residual is received from one customer alone.
MRF residual	Not available	*National Waste Report 2013*	There are 34 MRF and mechanical sorting facilities in NSW. Residue quantities were not available but based on DADI experience the amount of available waste which would otherwise go to landfill is sufficient.
	17,633.98 tpa from the MPC alone.	Confidential, *Source of Waste Report, November 2015,*	The Confidential Report prepared by TNG indicated the following volumes of incoming MRF residual (both baled and loose MRF) to the Genesis landfill alone. The waste volumes are reported as per the EPL.
AWT residual	200,929 tpa (SMA)	*NSW EPA, NSW Local Government Waste and Resource Recovery Data Report*	In 2012–13, four councils from the SMA started sending part of their residual waste to an AWT facility. A total of 21 councils (15 from the SMA), sent all or

Table 9: Estimated Source Separated Waste Availability

Source Separated Waste	Estimated waste to landfill	Source	Scope of Source
		– as reported by council 2012-13	part of their kerbside residual waste to an AWT facility
Glass residual	468,000 tpa	*Sustainability Victoria, Market Fact Sheet – recycled glass*	While this is not NSW report, Victoria is recovering 76% of glass waste and has a smaller population then NSW. The Facility anticipates requiring a fraction (26,575t for Phase 2) of the Victorian estimated waste to landfill volumes (see **Table 7**).
	7,376 tpa	Confidential, *Source of Waste Report, November 2015,*	The Confidential Report prepared by TNG indicated that 7,376 tpa from one supplier alone is sent to the Genesis landfill..
GO residual	21,210 tpa (SMA)	*NSW EPA, NSW Local Government Waste and Resource Recovery Data Report – as reported by council 2012-13*	- Of the 466,984 tpa of 'kerbside organics bin' collected 15,837 tpa is disposed of; - Of the 168,875 tpa of 'drop off organics' collected 14,050 is disposed of. - Of the 31,557 tpa of 'clean up organics' collected 4,883 is disposed of. The report estimates 61% of the data is from SMA
	Not available	*National Waste Report, 2013*	The report does not include GO residual from GO processing facilities. There are 55 GO processing facilities in NSW. Data on residue to landfill was not publically reported.

7.4 Fuel Source Availability Discussion

Based on Publicly available information on data related to key waste streams availability is summarised in Error! Reference source not found..

Table 10: Estimated Source Separated Waste Availability

	% Fuel Mix[5]	Phase 1[6] '000'	Phase 2[7] '000'	Estimated Available Waste SMA[8] '000'
CRW	23.27%	128	257	361
C&D	28.69%	158	317	1,112
C&I	16.18%	89	178	1,430
Floc residual	14.43%	79	159	170
AWT residual	6.87%	37	75	200
Paper Pulp residual	4.81%	27	53	25
GO residual	2.06%	11	22	21
Glass residual	1.76%	9.5	19	486
MRF residual	1.20	6.60	13	17
TOTAL	**100%**	**552,5**	**1,150**	**3,822**
Note: Figures in this table are rounded up and down for simplicity. Refer to Table 7 for exact quantities.				

Table 10 illustrates that in the Sydney Metropolitan Area (SMA) there is adequate availability of waste that would otherwise be going to landfill from the five main waste streams (CRW, C&D, C&I, floc waste and AWT waste) to meet Phase 1 and Phase 2. This is based on the calculation in **Sections 7.1**, **7.2** and **7.3**.

The remaining waste source has not been comprehensively accounted due to limited publically availability information, however, **Table 9** and **Table 10** demonstrates sufficient evidence sourced from comparable States reporting; information from Genesis landfill; and/or DADI experience within the industry, that the quantities required will be sufficient to meet the Facility's requirements (especially Phase 1).

It is acknowledged that that not all the estimated available waste to landfill in **Table 9** and **Table 10** will be able to be used as a fuel source for the Facility. It is also acknowledged that composition may vary but the technology employed allows for significant flexibility in composition and quantity of material (see **Appendix 6**).

In addition, there has been some expressed concern from community groups and statutory authorities regarding the availability of waste for this project and EfW project will compromise recycling programs in NSW. The following responses have been made to these comments:

- EfW projects compliments recycling programs; they do not compete with them. The Proposal compliments NSW's target of increasing waste diverted from landfill to 75% by 2021-22.
- Under the current NSW waste levy it is more profitable for Genesis MPC to recycle waste as oppose to using the waste for a fuel source in the Facility. Therefore, it will be the preference

[5] Percentages derived from the Project Definition Brief.
[6] Figures based on percentage data from Phase 1 processing capacity of 552,500 tpa
[7] Figures based on percentage data from Phase 2 processing capacity of 1,105,000 tpa
[8] Data base on estimated derived in Sections 7.1, 7.2 & 7.3

to promote source separation as far as reasonable practicable and not divert any recycling opportunities in favour of use at the TNG Facility.

- The Genesis MPC is a licenced facility and fuel will be sourced from licenced facilities and contractors who are required by law to meet the recovery targets set in the WARR Strategy.
- TNG acknowledges that due to technological advances and regulatory changes, recycling percentages have increased over time and will continue to increase. However, there will still be an increased pressure as waste generation continue to rise (2006/07 to 2010 waste generation has increased by 12%) in line with population and economic growth.
- The Queensland government abolished the modest levy which applied to Queensland (equivalent of the NSW s88 Levy) in 2012. As a result, a number of operators diverted waste for landfill in NSW to Queensland. In 2014 NSW EPA introduced a "Proximity Principle" making it an offence to transport any waste by road more than 150 km from where it was generated in NSW. It is accepted as a result of the 2014 "Proximity Principle" that this will divert waste back to NSW landfills (the quantities of this has not been quantified).
- TNG has not made any agreements or arrangements for the supply of waste from non-Genesis sources. Given the Proposal is not approved these cannot be procured at this stage due to the sensitive nature of the information. However, preliminary studies completed, suggest there will be more than adequate supply of waste that would otherwise be going to landfill.

Given the nature of waste, it is acknowledges that information regarding availability of certain waste streams varies and that waste recycling percentage have increased. However, the availability of waste as a fuel sources has commercial consequences to TNG, therefore TNG required the background research to be completed so as to be confident that there is an adequate supply of waste that would otherwise be landfilled.

8. RESPONSE TO ENERGY FROM WASTE POLICY CONTROLS

8.1 Policy framework

The NSW EPA produced a policy statement titled *NSW Energy from Waste Policy Statement*, *2015 (the NSW EfW Policy)* to set out a policy framework and overarching criteria that apply to facilities in NSW proposing to thermally treat waste or waste derived material. TNG recognises that the EPA facilitates a risk-based approach to the recovery of EfW. The NSW EPA has applied the following overarching principles to waste avoidance and recovery:

- Higher value resource recovery outcomes are maximised;
- Air quality and human health are protected;
- 'Mass burn' disposal outcomes are avoided; and
- Scope is provided for industry innovation.

The Facility has been designed to recover energy from waste or waste-derived materials that are not listed as eligible waste fuels. Additional information regarding the use of eligible and non-eligible waste fuels is summarised in the following sections.

8.2 Eligible and Other Waste Fuels

8.2.1 Eligible Wastes

Waste or waste-derived materials that pose minimal risk of harm to human health and the environment due to their origin, low levels of contaminants and consistency over time are categorised as eligible wastes. The following wastes are categorised by the *NSW EfW Policy* as eligible waste fuels:

- Biomass from agriculture;
- Forestry and sawmilling residues;
- Uncontaminated wood waste;
- Recovered waste oil;
- Organic residues from virgin paper pulp activities;
- Landfill gas and biogas;
- Source-separated green waste (used only in processes to produce char); and
- Tyres (used only in approved cement kilns).

From the above list, the Genesis MPC facility generates uncontaminated wood waste (refer to **Table 7**) which are mixed with C&I and C&D and MSW waste streams. Green waste is generated; however, the NSW EfW Policy states this is to be source-separated to be eligible.

In the event that the residual waste fuel that the Genesis MPC produces changes and/or it makes operational and economic sense to thermally treat eligible waste fuels through the Facility, TNG will seek a resource recovery exemption from the EPA. TNG will ensure that the origin, composition and consistency of these wastes are recorded before seeking an exemption to ensure that the emissions from thermal treatment will be known and consistent over time.

8.2.2 Other waste fuels

The Facility is proposing to thermally treat a combination of eligible fuels and other waste fuels waste-derived material that fall outside of the low-risk eligible fuels. As per Section 4 of the NSW EfW Policy, facilities using non eligible fuels must demonstrate that they will be using current international best practice techniques, particularly with respect to:

- Process design and control (refer to **Appendix 4** and the Project Definition Brief appended in the EIS);

- Emission control equipment design and control (refer to the Local Air Quality and Greenhouse Gas Assessment in **Appendix L** of the EIS);
- Emission monitoring with real-time feedback to the controls of the process (refer to the Local Air Quality and Greenhouse Gas Assessment in **Appendix L** of the EIS);
- Arrangements for the receipt of waste refer to **Section 5** of this report); and
- Management of residues from the energy recovery process (refer to **Section 6.1** of this report).

The Policy also states that using a combination of eligible fuels and other waste fuels means the Facility is subject to the requirements of an energy recovery facility.

TNG proposes to primarily treat waste or waste-derived materials that are not listed as eligible waste fuels and that meet the requirements of an energy recovery facility. TNG has performed detailed waste mapping to identify the sources and composition of allowable non-eligible waste fuels in the market (see Section 4).

The analysis is conducted at a state level, considering waste generated in the Sydney Metropolitan Area (SMA), Extended Regulated Area (ERA), Regional Regulated Area (RRA) and the Rest of NSW to map allowable waste streams at a state level.

All calculations, assumptions regarding the EfW Policy interpretation, and data sources are detailed in **Section 8.6**.

8.3 Public consultation and good neighbour test

TNG has committed to - and is continuing - an extensive community and stakeholder consultation process. This process will be ongoing to ensure the community understands the importance and impacts of the project. MRA reported that TNG understands its obligation to provide effective information and public consultation regarding the EfW proposal, from concept to detailed development assessment and commissioning. TNG engaged in dialogue with the community commencing in late October 2013, at the same time as the DGRs were requested from the DPE.

In line with TNG NSW's commitment to open, transparent and ongoing community engagement a range of additional communication activities will be undertaken. Additional communication and consultation with the community (to support the public exhibition or during preparation of the EIS) includes:

- Printed collateral – including fact sheets to provide further information about the technical aspects of the project, together with updates and answers to frequently asked questions;
- Community information events – such as site visit community days to enable direct interaction between the project team and interested community members and stakeholders;
- Project website – to post regular updates and to enable the upload of relevant documents and plans. Updates could also be provided during the work program;
- In addition to the above it is envisaged that the 1,800 community information telephone number be continued to ensure there is a direct point of contact to respond to queries.",

8.3.1 Stakeholder Consultation Strategy

TNG has developed a stakeholder consultation strategy to engage stakeholders over the life of the project in order to keep them informed and to respond to any concerns. TNG acknowledges that different aspects of the proposed project will concern different stakeholders. TNG is committed to:

- Mitigating risks and stakeholder concerns during the planning stages of the Proposal;
- Providing information to all stakeholders and seeking feedback prior to implementation; and
- Maintaining open and transparent communication channels with all stakeholders.

TNG engaged KJA Pty Ltd to develop a Communications and Consultation Strategy to guide stakeholder and community engagement during the preparation and the public exhibition of the EIS (KJA Pty Ltd 2014). The following information provides a summary of the progress achieved by the stakeholder consultation strategy to date.

8.3.2 Stakeholder Identification

Stakeholders were identified through consultation with local community groups, individuals and organisations with an interest in the project. Stakeholders were also identified with aerial mapping and site visits. A detailed database has been maintained of all interactions with identified stakeholders including phone calls and correspondence.

8.3.3 Communication Strategy and Engagement Tools

Commencing in November 2013, the engagement tools and activities have been specifically directed toward the local consultation tasks and, where applicable, complemented by an active media and government relations program. Emphasis has been placed on different target groups with an interest in the project. The key tools utilised to engage stakeholders include:

- Project Website: A dedicated website (www.tngnsw.com.au) was created to offer general information on the Proposal, together with a project flyer, video, and answers to general frequently asked questions.
- 1800 community line and project email: A dedicated, toll-free 1800 community information line (1800 252 040) and email address (info@tngnsw.com.au) was established from the inception of the consultation to provide an immediately available and central point of contact for stakeholder and community enquiries. Questions raised by residents over phone and email form the basis of FAQs listed on the website.
- Key stakeholder correspondence: Correspondence has been sent via post and/or email to the identified key stakeholders and community groups. The correspondence was distributed in early December 2013.
- Letter notification: Letter notifications were sent to local residents to provide information about the project. An additional flyer was mailed to invite residents to a community information and site tour. A total of 4,000 residents received project flyers.
- Briefings: Personal briefings have been undertaken with local government, state government and Minchinbury Residents Action Group representatives.
- Door knocks: As an additional strategy to engage with neighbouring businesses, a door knock was conducted:
- Community information day and site tour: On 22 February 2014, approximately 32 people attended a community information afternoon hosted by TNG. The community information session was followed by a site tour.
- Media: Local newspapers were briefed and provided direct contact numbers for further questions.
- Waste Avoidance and Resource Recovery Conference – 6 to 8 May 2014: TNG attended and presented at the above conference where representatives from federal, state and local government, industry leaders and the EPA NSW were in attendance.

8.3.4 Feedback

The Communication and Consultation Strategy has generated useful feedback from stakeholders, which has been considered in preparation of this EIS, as well as future communications with stakeholders. Common comments and concerns raised include:

- Traffic concerns including routes, access and cumulative impacts;
- The number of vehicle movements that will be generated by the Facility;
- Potential emissions and emission monitoring;

- Health impacts;
- Noise and dust concerns;
- Timeframe for development; and
- Odour management.

8.4 Technical criteria

So that emissions are below levels that may pose a risk of harm to the community, facilities proposing to recover energy from waste need to meet current international best practice techniques (BAT). The Europe Union has developed a reference document for best available techniques on waste incineration - *Integrated Pollution Prevention and Control, Reference Document on the Best Available, Techniques for Waste Incineration*, August 2006, European Commission (BREF, 2006). This directive is now incorporated in and replaced by the Industrial Emissions Directive (IED) of 2010.

An assessment was undertaken of the p Proposal against the "*Reference Document on the Best Available Techniques for Waste Incineration*" (August 2006). The assessment framework demonstrates that the facility will adopt and implement the best available techniques in relation to:

- Design;
- Emissions; and
- Energy Efficiency.

Refer to **Appendix 4** for BAT evaluation.

A summary of the technical criteria document in the EfW Policy Statement and TNG's proposed design is summarised in Air Quality and Greenhouse Gas Assessment in Appendix L of the EIS.

8.5 Thermal efficiency criteria

The NSW EfW Policy is restricted in its scope to facilities that are designed to thermally treat waste for the recovery of energy rather than as a means of disposal. The net energy produced from thermally treating waste, including the energy used in applying best practice techniques, must therefore be positive.

To meet the thermal efficiency criteria, facilities must demonstrate that at least 25% of the energy generated from the thermal treatment of the material will be captured as electricity (or an equivalent level of recovery for facilities generating heat alone).

Energy recovery facilities must also demonstrate that any heat generated by the thermal processing of waste is recovered as far as practicable, including use of waste heat for steam or electricity generation or for process heating of combined heat and power schemes.

The Facility has been designed to have a thermal input of 469.6MWe (117.4MWe for each incineration line) at the design point. The Facility has an assumed net electrical efficiency of 30% which is above the 25% efficiency criteria rate. The Facility has been designed to export approximately 140MWe (30% X 469.6MW). High net electrical efficiency is a priority for TNG. The export voltage will be set to match the requirements of the local high voltage electricity grid.

The Facility will comply with the energy recovery requirements of the EfW Policy. Although markets for heat recovery may exist (Fulton Hogan, Austral Brick) and the Facility has the ability to supply heat, the Facility is predominantly an electricity generator, which complies with EPA requirements of an EfW. As a result documenting potential users of heat is not a key issue and has not been undertaken. TNG will be exporting electricity to the grid.

Refer to the Project Definition Brief appended to the EIS.

8.6 Resource recovery criteria

The EPA considers energy recovery to be a complementary waste management option for the residual waste produced from material recovery processes or source-separated collection systems. The NSW EfW Policy objectives in setting resource recovery criteria set out in **Table 11**.

Table 11: Resource Recovery Criteria

Criteria	Response
Promote the source separation of waste where technically and economically achievable	EfW complements recycling programs; it does not compete with them. The project compliments NSW's target increasing waste diverted from landfill to 75% by 2021-22. Under the current NSW waste levy it is more profitable for Genesis MPC to recycle waste as oppose to using the waste for a fuel source in the TNG Facility. Therefore, it will be the preference to promote source separation as far as reasonable practicable and not divert any recycling opportunities in favour of use at the TNG Facility. Refer to **Section 5** of this report for further detail on separation procedures. In relation to fuel originating from other sources refer to **Section 5.2** for waste inspection procedures and **Section 5.3** for independent auditing procedures. When procuring contractor from licenced and approved waste and recycling organisations, TNG will impose that source separation is to meet State recovery requirements (i.e. WARR Strategy).
Drive the use of best practice material recovery processes	Refer to **Section 5** of this report for further detail on separation procedures. An overview of the process is as follows: 1. The Genesis Xero Waste Facility operates pursuant to Environmental Protection Licence (EPL 20121). Waste materials which are received by it previously would have been landfilled. 2. The incoming waste materials are accounted for by reference to an EPA mandated descriptive category. 3. Returns are forwarded monthly to the NSW EPA identifying the quantity by weight of each material in each specified category. 4. The site commenced commercial operation with a clean base level verified by independent survey which is provided to the NSW EPA. 5. Segregated materials such as brick, concrete sand and soil including (co-mingled brick and concrete) delivered to the site are readily identifiable by category and are managed in a specified part of the site by crushing, grinding, screening and separating. 6. These materials (when processed) are sold from site. Until they are sold they remain in stockpile either as raw material for processing or as processed material for sale. 7. All stockpiles of these materials are subject to a biannual aerial photograph and independently survey the results of which are reported to the NSW EPA. 8. The reporting enables the NSW EPA to ensure that the amount remaining in stockpiles matches to: a) the balance of stock on hand from the previous survey plus

Table 11: Resource Recovery Criteria

Criteria	Response
	b) new additional materials received in the same period less c) the materials sold and transported off site during the same period. This leaves: d) the fraction landfilled. 9. The same methodology applies also to mulch and to timber wastes. 10. Co-mingled wastes containing materials from both the C&D and the C&I waste streams are weighed as they enter the site as part of the overall obligation to weigh incoming materials. They are dealt with in a separate processing centre. 11. Fractions are able to be recovered by a range of manual and mechanical processes. These include ferrous and non-ferrous metals, paper, cardboard , wood, plastic and concrete/ brick aggregates 12. Of these, the concrete/ brick aggregates are removed to be processed with the 'hardfill' materials, wood is managed with the remaining wood waste and the balance of recoverable materials are removed from site (steel, plastic, cardboard , paper). These are transported from site for processing by others. 13. Following the removal of all of these fractions there is a residue left which is currently landfilled and that quantity is also weighed for compliance with the *Protection of the Environment Operations Act 1997.*
Ensure only the residual from bona-fide resource recovery operations are eligible for use as a feedstock for an energy recovery facility	The Genesis MPC is transparent in its operation and performance to the regulator as required under State legislation. All incoming material is weighed upon arrival; all outgoing material is weighed upon departure; and the fraction committed to landfill is weighed. All weights are reported monthly to the NSW EPA and verified by twice yearly independent survey. The Genesis MRC does not release actual figures because they are commercial in confidence and confer upon Genesis a significant competitive advantage. The proportion of recycling is verifiable and EPA has the records. In collection of fuel from other sources TNG will develop a rigorous procurement process, in addition to **Section 5.3** independent auditing procedures.
Energy recovery facilities may only receive feedstock from authorised waste facilities or collection systems that meet the criteria outlined in Table 1.	The Genesis MPC operates pursuant to Environmental Protection Licence (EPL) 20121. Waste materials which are received by it previously would have been landfilled. Of the waste loads received at the Genesis MPC that are classified as containing material capable of being recovered or recycled it is estimated that, on average, 80% of materials is recovered by sorting, separating and processing, and made available for resale or reuse by other processors. This is a higher rate than the NSW averages and exceeds the WARR Strategy criteria. In addition (as described in **Section 5.3**), the Applicant proposes to verify the recovery rates of the TNG by requiring that audits be conducted by Green Star accredited auditors as per the same reporting scheme required for the Genesis MPC (example Green

Table 11: Resource Recovery Criteria

Criteria	Response
	Star audit in **Appendix 7**). In relation to fuel originating from other sources, in accordance with the Resource Recovery Criteria of the EfW Policy and to meet resource recovery requirement of the WARR Strategy the following criteria has been set which apply to the TNG Facility: • **Only 25% of C&D waste processed can be processed as a residual waste fuel source for the TNG.** According to the National Waste Report, 75% of C&D was is currently being recovered in NSW which would leave a maximum 25% C&D waste available for energy recovery at TNG Facility. • **Only 50% of the total C&I waste processed can be used as residual waste fuel source for the TNG.** According to the National Waste Report, 60% of C&I was is currently being recovered in NSW which would leave a maximum 40% C&I waste available for energy recovery at TNG Facility. • **Only 10% of the total source separated recyclables from MSW (MRF) waste processed can be used as residual waste fuel source for the TNG.** Based on NSW averages, and that all waste to landfill can be used as a fuel source, TNG is confident that though robust contract procurement contacts requirements, TNG will be able to adequately ensure that fuel originating from other sources meet the conditions of Table 1 of the NSW EfW Policy and WARR Strategy. TNG will require that all waste streams sent to the Facility comply with the EfW Policy Statement resource recovery criteria which includes ensuring appropriate inspection and auditing procedures are in place. This will apply to both CRW and fuel originating from other sources (**Section 5.3**). The Genesis MPC is a licenced facility and fuel will be sourced from licenced facilities and contractors who are required by law to meet the recovery targets set in the WARR Strategy. Note that floc residual waste is not identified as an independent waste stream in the NSW EfW Policy, but classified as commercial waste. EPA indicated that floc is not excluded from the NSW EfW Policy and will likely be included in an amended version of the NSW EfW Policy and that the resource recovery threshold would be 25%, in accordance with current metal recycling operations (**Appendix 8**).

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10. LIMITATIONS

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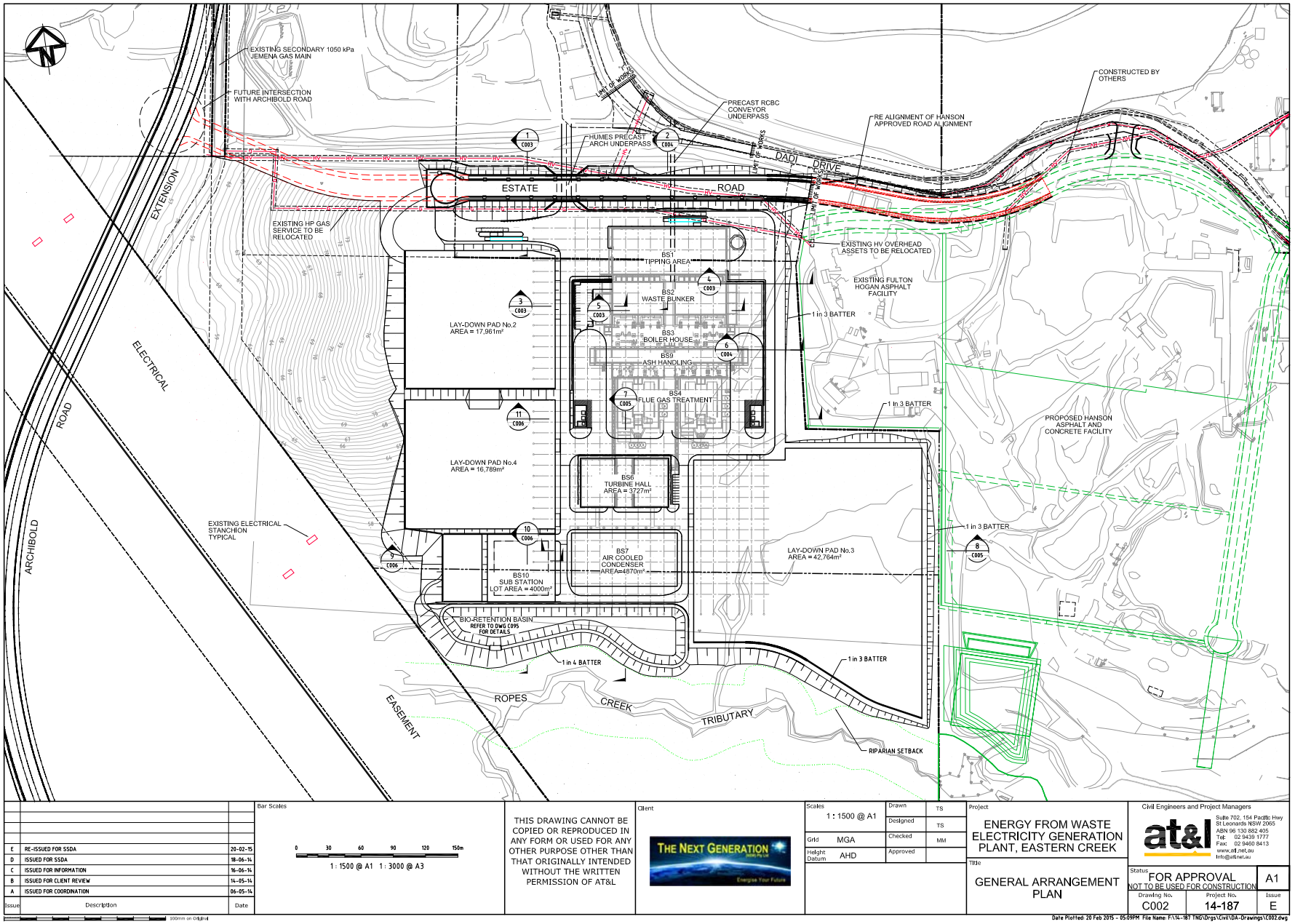
FIGURES



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E	RE-ISSUED FOR SSDA	20-02-15
D	ISSUED FOR SSDA	18-06-14
C	ISSUED FOR INFORMATION	16-06-14
B	ISSUED FOR CLIENT REVIEW	14-05-14
A	ISSUED FOR COORDINATION	06-05-14

Bar Scales: 0 30 60 90 120 150m
1 : 1500 @ A1 1 : 3000 @ A3

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Scales: 1 : 1500 @ A1
Grid: MGA
Height Datum: AHD
Drawn: TS
Designed: TS
Checked: MM
Approved:

Project: ENERGY FROM WASTE ELECTRICITY GENERATION PLANT, EASTERN CREEK

Title: GENERAL ARRANGEMENT PLAN

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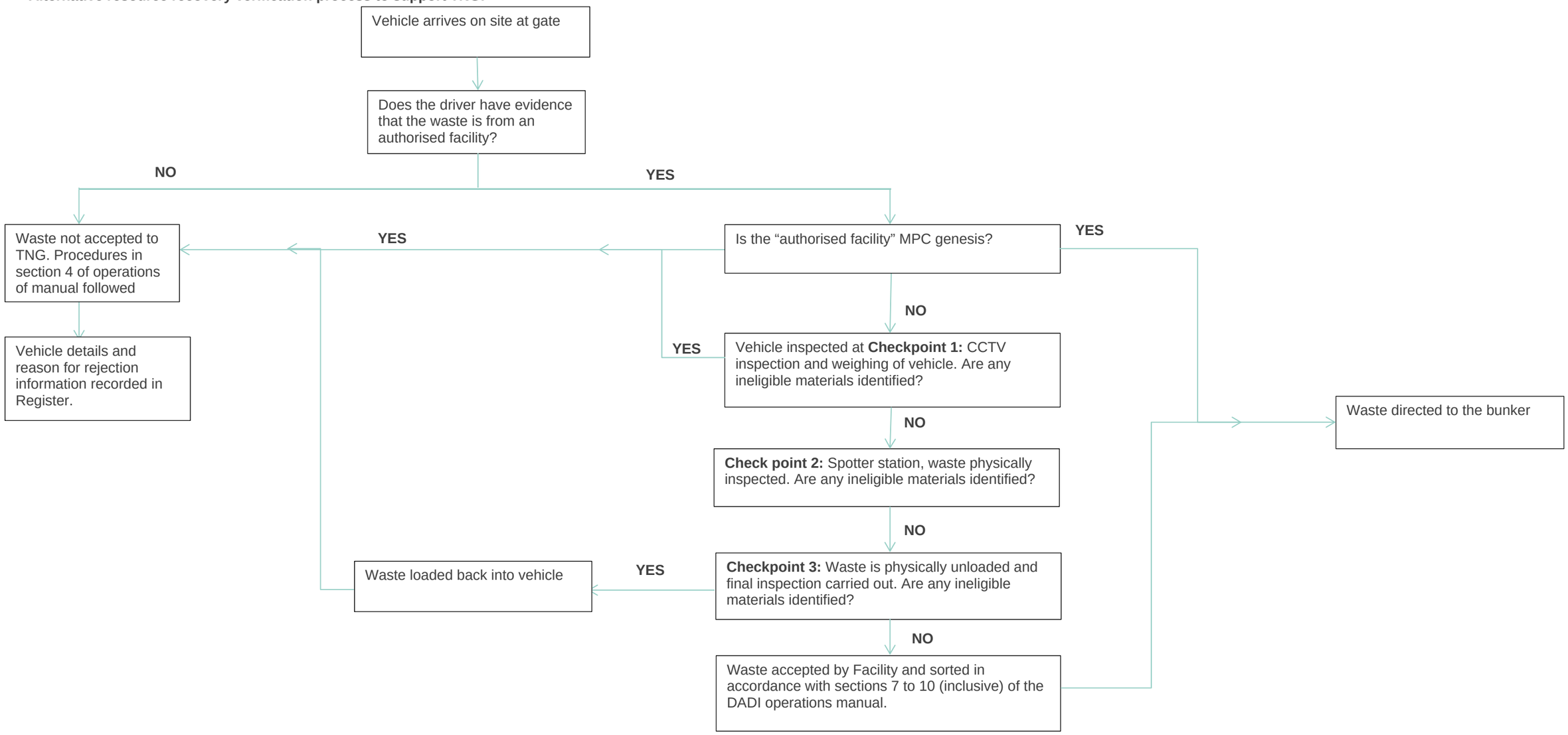
Alternative resource recovery verification process to support TNG.



APPENDIX 1
NSW ENERGY FROM WASTE POLICY STATEMENT

NSW Energy from Waste Policy Statement

www.epa.nsw.gov.au

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Contents

Definitions

Eligible waste fuels	Waste or waste-derived materials considered by the EPA to pose a low risk of harm to the environment and human health due to their origin, low levels of contaminants and consistency over time
Energy recovery facility	A facility that thermally treats a waste or waste-derived material that does not meet the definition of an eligible waste fuel. These facilities must be able to demonstrate that they will be using current international best practice techniques.
Processing Facility	Facility undertaking bona-fide resource recovery operations producing separate output material streams for reuse or recovery. Facility may be separate to or on the same site as energy from waste facility.
Resource recovery order and exemption	Resource recovery orders and exemptions are issued by the EPA under Part 9 of the Protection of the Environment Operations (Waste) Regulation 2014 and exempt a person from the various waste regulatory requirements that apply to the use of a waste fuel (e.g. waste disposal licensing, levy payments, etc.). The exemptions apply to waste fuels determined by the EPA to be fit-for-purpose, bona-fide energy recovery opportunities.
Thermal treatment	In accordance with Schedule 1 of the *Protection of the Environment Operations Act 1997*, thermal treatment means the processing of waste by burning, incineration, thermal oxidation, gasification, pyrolysis, plasma or other thermal treatment processes.
Waste	As defined in the dictionary of the *Protection of the Environment Operations Act* 1997

1. Introduction

The Environment Protection Authority (EPA) recognises that the recovery of energy and resources from the thermal processing of waste has the potential, as part of an integrated waste management strategy, to deliver positive outcomes for the community and the environment. Energy from waste can be a valid pathway for residual waste where:

- further material recovery through reuse, reprocessing or recycling is not financially sustainable or technically achievable
- community acceptance to operate such a process has been obtained.

In NSW, two key policy objectives are enshrined in the state's waste legislation. Firstly, the *Protection of the Environment Operations Act 1997* (POEO Act) sets the framework to ensure that human health and the environment are protected from the inappropriate use of waste. Secondly, the *Waste Avoidance and Resource Recovery Act 2001* (WaRR Act) aims to ensure that consideration of resource management options occurs in the following order:

1. avoidance of unnecessary resource consumption
2. resource recovery (including reuse, reprocessing, recycling and energy recovery)
3. disposal.

Where waste cannot be avoided or products reused, various recovery technologies are available to maximise resource efficiencies and increase the sustainability of our communities, businesses and industries.

The EPA has applied the following overarching principles to waste avoidance and recovery:

- higher value resource recovery outcomes are maximised
- air quality and human health are protected
- 'mass burn' disposal outcomes are avoided
- scope is provided for industry innovation.

The thermal treatment of waste provides an opportunity to recover the embodied energy from waste, offset the use of non-renewable energy sources, and avoid methane emissions from landfill.

However, these outcomes are contingent on ensuring that any energy recovery proposals represent the most efficient use of the resource and are achieved with no increase in the risk of harm to human health or the environment. Clean air is fundamental to everyone's wellbeing: poor air quality can be particularly critical to the health of children and chronically ill and older people, as well as affecting the natural environment and amenity of communities.

To ensure emissions are below levels that may pose a risk of harm to the community, facilities proposing to recover energy from waste will need to meet current international best practice techniques, particularly with respect to:

- process design and control
- emission control equipment design and control
- emission monitoring with real-time feedback to the controls of the process.

The NSW Energy from Waste Policy Statement sets out the policy framework and overarching criteria that apply to facilities in NSW proposing to thermally treat waste or waste-derived materials for the recovery of energy and in doing so provides regulatory clarity to industry and the community.

2. Energy recovery framework and scope

The NSW Energy from Waste Policy Statement outlines the policy framework and technical criteria that apply to facilities proposing to recover energy from waste in NSW.

Scope of the policy statement

The scope of the policy statement covers all facilities undertaking the thermal treatment of any waste[1] or waste-derived materials, where thermal treatment means the processing of wastes by combustion, thermal oxidation, thermal or plasma gasification, pyrolysis and torrefaction. Where a thermal process, such as pyrolysis or gasification, produces a gas for subsequent combustion (for example, a syngas), the facility where that gas is combusted will also be subject to this framework.

However, there are some thermal treatment applications that fall outside the scope of this policy statement. The following facilities are excluded as they are not considered to be undertaking genuine energy recovery:

- incineration facilities for the destruction of waste
- facilities for the thermal treatment of contaminated soil
- facilities proposing the thermal treatment of unprocessed mixed waste streams
- facilities proposing the thermal treatment of waste that has been exhumed from landfills
- facilities proposing the thermal treatment of hazardous waste materials.

Other facilities excluded from this policy statement include those that are undertaking a form of thermal treatment to which the technical or resource recovery criteria contained within the statement are not relevant or for which other regulatory frameworks already apply, namely:

- thermal processes where there is no change in the chemical composition of the waste
- transport fuels produced from waste
- autoclaving processes
- biological processes, such as anaerobic digestion and composting of waste.

Policy framework

The definition of waste covers a range of materials that vary in their origin, composition, contamination and risk profile. The EPA recognises that a framework that facilitates a risk-based approach to the recovery of energy from waste will deliver certainty for industry, the community and the environment.

This policy statement establishes a two-tiered framework separating the requirements for low-risk wastes proposed for thermal treatment from all other wastes.

Waste or waste-derived materials that pose a minimal risk of harm to human health and the environment due to their origin, low levels of contaminants and consistency over time will be categorised as **eligible waste fuels** and listed in the policy statement. As information about certain waste and waste-derived streams improves, the EPA will review the eligible waste fuels list from time to time. Further information

[1] As defined in the *Protection of the Environment Operations Act 1997*

regarding the requirements to be met by eligible waste fuels is available in Section 3 of this policy statement.

Facilities proposing to thermally treat any waste or waste-derived materials that are *not* listed as an eligible waste fuel must meet the requirements of an **energy recovery facility**. Further information regarding the requirements for energy recovery facilities is available in Section 4 of this policy statement.

Public consultation and the good neighbour principle

Regardless of whether a facility plans to proceed with a proposal under Section 3 or 4 of this policy statement, it will be essential that proponents provide effective information and public consultation about energy from waste proposals. As proposals progress from the concept to detailed development assessment stage, proponents should engage in a genuine dialogue with the community and ensure that planning consent and other approval authorities are provided with accurate and reliable information.

The operators of an energy from waste facility will need to be 'good neighbours' – particularly if near a residential setting but also where there are workers in other facilities. This would apply to waste deliveries and operating hours, but most importantly with respect to readily available information about emissions and resource recovery outcomes.

3. Eligible waste fuels

Eligible waste fuels are those that are considered by the EPA to pose a low risk of harm to human health and the environment due to their origin, composition and consistency.

The following wastes are categorised by the EPA as eligible waste fuels:

1. biomass from agriculture
2. forestry and sawmilling residues
3. uncontaminated wood waste
4. recovered waste oil
5. organic residues from virgin paper pulp activities
6. landfill gas and biogas
7. source-separated green waste (used only in processes to produce char)
8. tyres (used only in approved cement kilns).

The EPA may update the list of eligible waste fuels from time to time.

Eligible waste fuels may be thermally treated using a range of treatment technologies, provided a resource recovery order and exemption has been granted by the EPA. The origin, composition and consistency of these wastes must ensure that emissions from thermal treatment will be known and consistent over time.

Facilities proposing to use eligible waste fuels must meet the following criteria:

- ability to demonstrate to the EPA that the proposed waste consistently meets the definition of an EPA-approved eligible waste fuel
- confirm there are no practical, higher order reuse opportunities for the waste
- fully characterise the waste and/or undertake proof of performance
- meet the relevant emission standards as set out in the Protection of the Environment Operations (Clean Air) Regulation 2010.

> **Note:** Eligible waste fuels that also fall under the definition of a standard fuel as defined in the Protection of the Environment Operations (Clean Air) Regulation 2010 would not need to meet the above criteria but will still require appropriate approval for their use.

Further details, including how to apply for a resource recovery order and exemption for the use of an eligible waste fuel and definitions for each of the listed eligible waste fuels, are provided in the EPA's *Eligible Waste Fuels Guidelines*.

4. Energy recovery facilities

Any facility proposing to thermally treat a waste or waste-derived material that is not a listed eligible waste fuel (Section 3) must meet the requirements to be an energy recovery facility. If the facility is proposing to thermally treat a combination of eligible and other waste fuels, it will be subject to the requirements of an energy recovery facility.

Energy recovery facilities refer to facilities that thermally treat waste-derived materials that fall outside of the low-risk 'eligible waste fuels'. These facilities must therefore demonstrate that they will be using current international best practice techniques, particularly with respect to:

- process design and control
- emission control equipment design and control
- emission monitoring with real-time feedback to the controls of the process
- arrangements for the receipt of waste
- management of residues from the energy recovery process.

The above- listed considerations will ensure that air toxics and particulate emissions are below levels that may pose a risk of harm to the community or environment.

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.

In addition to implementing current best practice techniques, energy recovery facilities must ensure that they meet the following technical, thermal efficiency and resource recovery criteria as discussed below.

Technical criteria

The gas resulting from the process should be raised, after the last injection of combustion air, in a controlled and homogenous fashion and even under the most unfavourable conditions to a minimum temperature of 850°C for at least 2 seconds (as measured near the inner wall or at another representative point of the combustion chamber). If a waste has a content of more than 1% of halogenated organic substances, expressed as chlorine, the temperature should be raised to 1100°C for at least 2 seconds after the last injection of air.

The process and air emissions from the facility must satisfy **at a minimum** the requirements of the Group 6 emission standards within the Protection of the Environment Operations (Clean Air) Regulation 2010.[2]

There must be **continuous measurements** of **NO_x, CO, particles (total), total organic compounds, HCl, HF** and **SO_2**. This data must be made available to the EPA in real-time graphical publication and a weekly summary of continuous monitoring data and compliance with emissions limits published on the internet. The continuous measurement of HF may be omitted if treatment stages for HCl are used which ensure that the emission limit value for HCl is not being exceeded.

[2] Note: An existing facility may apply to the EPA for an alternative NO_x and VOCs emission standard in accordance with clause 36 of the Protection of the Environment Operations (Clean Air) Regulation 2010.

There must be **continuous measurements** of the following operational parameters: **temperature** at a representative point **in the combustion chamber**; concentration of **oxygen**; **pressure** and **temperature in the stack**; and **water vapour** content of the exhaust gas. This must be conducted and held by the proponent for a period of three years.

As part of the environment protection licence conditions of any energy recovery facilities, the EPA will require operators to undertake proof of performance (POP) trials to demonstrate compliance with air emissions standards. Following successful POP trials, there must be **at least two measurements per year of heavy metals**, **polycyclic aromatic hydrocarbons**, and **chlorinated dioxins and furans**. One measurement at least every three months shall be carried out for the first 12 months of operation. If and when appropriate measurement techniques are available, continuous monitoring of these pollutants will be required.

The total organic carbon (TOC) or loss on ignition (LOI) content of the slag and bottom ashes must not be greater than 3% or 5%, respectively, of the dry weight of the material.

Waste feed interlocks are required to prevent waste from being fed to the facility when the required temperature has not been reached either at start-up or during operation.

An air quality impact assessment must be undertaken in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*.

An energy recovery facility processing wastes other than 'eligible waste fuels' must satisfy all of the above requirements, regardless of whether the facility is an existing or purpose-built facility and the waste input is the sole feedstock or a fuel for co-firing.

Thermal efficiency criteria

This policy statement is restricted in its scope to facilities that are designed to thermally treat waste for the recovery of energy rather than as a means of disposal. The *net* energy produced from thermally treating that waste, including the energy used in applying best practice techniques, must therefore be positive.

To meet the thermal efficiency criteria, facilities must demonstrate that at least 25% of the energy generated from the thermal treatment of the material will be captured as electricity (or an equivalent level of recovery for facilities generating heat alone).

Energy recovery facilities must also demonstrate that any heat generated by the thermal processing of waste is recovered as far as practicable, including use of waste heat for steam or electricity generation or for process heating of combined heat and power schemes.

Resource recovery criteria

The EPA considers energy recovery to be a complementary waste management option for the residual waste produced from material recovery processes or source-separated collection systems.

The policy statement's objectives in setting resource recovery criteria are to:

- promote the source separation of waste where technically and economically achievable
- drive the use of best practice material recovery processes
- ensure only the residual from bona-fide resource recovery operations are eligible for use as a feedstock for an energy recovery facility.

Energy recovery facilities may only receive feedstock from waste processing facilities or collection systems that meet the criteria outlined in Table 1.

Proponents wishing to use waste or waste-derived materials for energy recovery that are not defined in Table 1 must contact the EPA to discuss their proposal. The EPA will consider any such proposals on a case-by-case basis in accordance with the energy from waste considerations outlined in this policy statement and the principles set out in the POEO Act and WaRR Act.

Table 1: Resource recovery criteria for energy recovery facilities

Mixed wastes		
Waste stream	**Processing facility**	**% residual waste allowed for energy recovery**
Mixed municipal waste (MSW)	Facility processing mixed MSW waste where a council has separate collection systems for dry recyclables and food and garden waste	No limit by weight of the waste stream received at a processing facility
	Facility processing mixed MSW waste where a council has separate collection systems for dry recyclables and garden waste	Up to 40% by weight of the waste stream received at a processing facility
	Facility processing mixed MSW waste where a council has a separate collection system for dry recyclables	Up to 25% by weight of the waste stream received at a processing facility
Mixed commercial and industrial waste (C&I)	Facility processing mixed C&I waste	Up to 50% by weight of the waste stream received at a processing facility
	Facility processing mixed C&I waste where a business has separate collection systems for all relevant waste streams	No limit by weight of the waste stream received at a processing facility
Mixed construction and demolition waste (C&D)	Facility processing mixed C&D waste	Up to 25% by weight of the waste stream received at a processing facility
Residuals from source-separated materials		
Source-separated recyclables from MSW	Facility processing source-separated recyclables from MSW	Up to 10% by weight of the waste stream received at a processing facility
Source-separated garden waste	Facility processing garden waste	Up to 5% by weight of the waste stream received at a processing facility
Source-separated food waste (or food and garden waste)	Facility processing source-separated food or source-separated food and garden waste	Up to 10% by weight of the waste stream received at a processing facility

Separated waste streams	
Waste stream	**Feedstock able to be used at an energy recovery facility**
Waste wood	Residual wood waste sourced directly from a waste generator e.g. manufacturing facility
Textiles	Residual textiles sourced directly from a waste generator
Waste tyres	End-of-life tyres
Biosolids	Used only in a process to produce a char for land application
Source-separated food and garden organics	Used only in a process to produce a char for land application

Notes

1. The EPA may give consideration to increases to the maximum allowable percentage of residuals from facilities receiving mixed municipal and commercial and industrial waste where a facility intends to use the biomass component from that process for energy recovery, rather than land application and the facility can demonstrate they are using best available technologies for material recovery of that stream.
2. Waste streams proposed for energy recovery should not contain contaminants such as batteries, light bulbs or other electrical or hazardous wastes.
3. Bio-char or char materials produced from facilities using mixed waste streams will not be able to be considered for land application as a soil amendment or improvement agent.
4. The C&I no limit category is likely to apply only to mixed waste collected from single generators of large volumes of waste (e.g. supermarkets) or precinct based businesses (e.g. shopping centers). Proponents will need to demonstrate that each entity generating waste has effective and operating collection systems for **all** waste streams they generate that have reuse or recycling opportunities (e.g. paper/cardboard collection; organic collection; and residual waste collection). Proponents wishing to use the C&I no limit category will need to contact the EPA to determine the eligibility of each entity.

APPENDIX 2
WASTE INSPECTION PROCEDURES

GENESIS XERO WASTE

DIAL A DUMP INDUSTRIES
KEEPING AUSTRALIA CLEAN

ALEXANDRIA LANDFILL
PREMIER WASTE MANAGEMENT FACILITY

DIAL A DUMP INDUSTRIES

SPOTTERS TRAINING MANUAL

This training manual is YOUR guide on the practices to be followed during your daily activities to ensure that BOTH you and your co-worker work in a safe and productive environment.

TABLE OF CONTENTS

INTRODUCTION

The area with the Alexandria Landfill and Genesis Waste Management Facility that you will be working in is overall known as the **Recycling Area** and you will be required to perform your duties under one or more divisions of this Area**.** Highlighted below are the Recycling Areas for both these sites.

Recycling Area – Alexandria Landfill

Recycling Area – Genesis, Eastern Creek

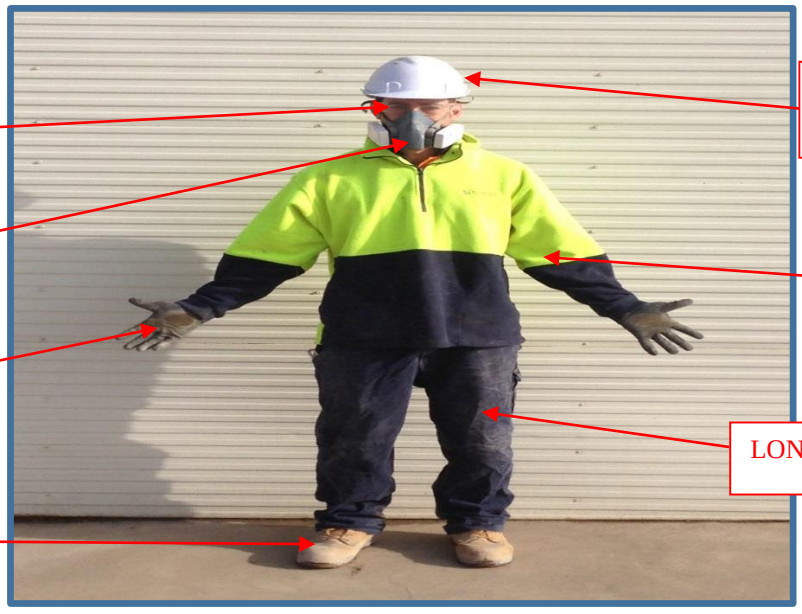
In the Recycling Area mixed building and dry waste is brought in and tipped onto the ground where it is sorted and various materials are recovered for re-use.

SAFETY CLOTHING AND PPE

Dial a Dump Industries is always striving for best practices in safety both in the working environment and to its employees.

SAFETY IS EVERYONE'S RESPONSIBILITY. IT IS IMPORTANT TO LEAD BY EXAMPLE AND PAY HIGH ATTENTION TO YOUR PERSONAL PROTECTIVE EQUIPMENT (PPE)

You must ALWAYS wear your PPE correctly.



The following items are necessary for your duties:

- High visibility clothing
- Safety boots
- Hard Hat
- Safety Gloves
- Ear Protection
- Dust Mask
- Eye Protection

- You must wear LONG pants and LONG sleeve shirts for safety.
- Your appearance must be neat, tidy and presentable at all times.
- You must NOT wear tracksuit pants or garments that are ripped or unpresentable.

OPERATING A TWO WAY RADIO

In this role you will be required to operate a two way radio as it is used to communicate with the weighbridge and other staff on site. This is a very important means of communication and needs to be taken care of at all times.

You will be issued with a 2-way radio on the commencement of your role and will be responsible for its daily working and charging and also for reporting any damages, loss or malfunction.

There are different internal frequencies used on both sites which are mentioned as below:

Genesis, Eastern Creek:

Channel 1 – Landfill and Weighbridge

Channel 2 – MPC Floor operations and Crushing Area

Channel 3 – MPC Production and Maintenance

Alexandria Landfill:

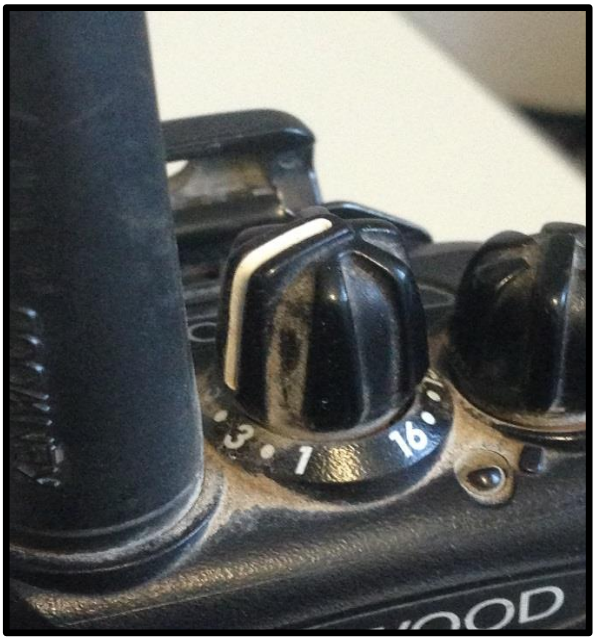
Channel 1 – Dial A Dump Industries Bin Trucks

Channel 2 – Crushing and additional projects

Channel 3 – Weighbridge and rest of site

Below are a couple of photos showing a 2-way radio similar to the one that will be issued to you.

2-way Radio

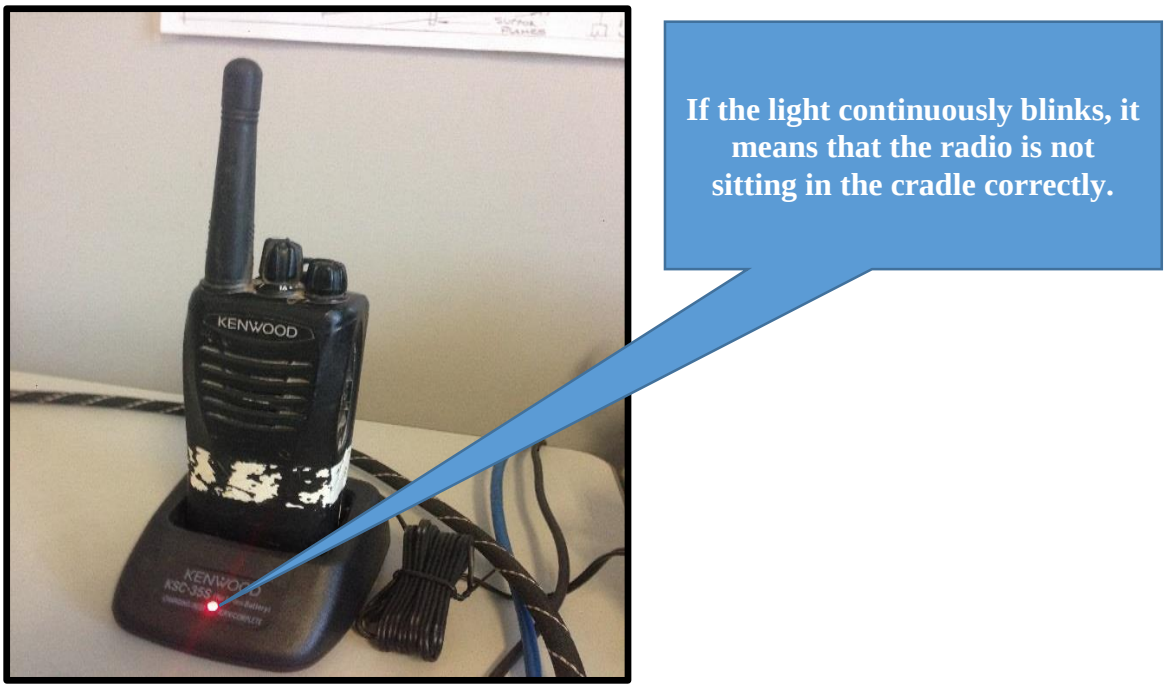


Radio showing different channels

You will receive some basic training on how to use the radio from your supervisor. A summary of your daily use is provided below:

- Turn on radio
- Select channel required.
- To set squelch turn knob until crackling sound stops

- When you want to call another person hold call button down and hold radio approximately 15cms from your mouth and speak clearly, hold the button for 2 seconds after you have finished speaking
- You do not need to yell at radio when speaking.
- When you have finished what you have to say, end your conversation by saying "OVER".
- If someone is speaking to you and you need acknowledge their instructions use the same procedure only that you will say "ROGER THAT" when they have finished speaking.
- Make sure 2way is kept in your possession at all times
- At the end of shift make sure you put it on charge. A red light on the charger indicates that the radio is being charged and a green light indicates that the radio is fully charged.



It is important to remember that basic radio etiquettes are expected to be observed at all times. Dial A Dump Industries has a zero tolerance for the use of any offensive language, gestures or behaviour at any of its sites and offenders will be dealt with accordingly.

THE CHECKPOINT/ SPOTTER STATION

Once the vehicles clear the Provisional Inspections at the Weighbridge and enter the site, their entrance to the Recycling Area is via the Checkpoint or Spotter Station. This is where your role as a Spotter will commence.

Checkpoint at Alexandria Landfill

Spotter Station 1 at Genesis, EC

YOUR ROLE AS A SPOTTER INCLUDES BUT IS NOT LIMITED TO:

- Ensuring that the Waste is acceptable to be tipped and subsequently processed in the Recycling Area.
- Make sure the safe delivery of loads to the appropriate tip face or stockpiles based on the type and composition of the load.
- Make sure that recycled materials do not get contaminated with unsuitable materials such as paint, chemicals or asbestos.
- Sort and recover the various materials for reuse.

Your role also includes directing traffic as per the Site Traffic Management Plans to ensure the safety of all the customers and staff members on site. You can contact your Supervisor for details on the site traffic management plans or view them in Appendix III of this document.

As a major point of contact for the vehicles on site, your work, presentation and behaviour are very important in the smooth running of the Recycling Area and in ensuring safe and efficient practices.

SPOTTER'S ROLES AND RESPONSIBILITIES

1. STOPPING THE VEHICLE IN THE RIGHT LOCATION

The Checkpoint or Spotter Station is a very important point of contact with the Customer. Every single vehicle, including the Dial A Dump trucks will need to be stopped and have a Primary Inspection conducted on their loads.

To ensure this inspection is carried out smoothly and safely, ensure you are physically present at the entrance or beginning of the Checkpoint with a STOP sign and signal the vehicle to stop.

Make sure you are aware of ALL MOVING VEHICLES and mobile equipment around the area while stopping the Customer vehicles.

You must signal to the approaching vehicle to slowly stop at the Checkpoint by raising your hand forward or motioning the vehicle to slow down and stop near the appropriate viewing deck.

Keep in mind that approaching vehicles can vary from domestic cars and trailers to utility vehicles, skip trucks and heavy haulage trucks so always be aware of your surroundings.

2. CHECK THE DOCKET

Your first step in the Primary Inspection stage is to greet the Customer and check his docket provided by the Weighbridge.

This step is required for 3 main purposes:

- It serves as a documented proof that the Customer has commenced a legitimate transaction with the company and has not bypassed the

Weighbridge. If you receive a customer that does not have a docket, contact the Weighbridge immediately.

- The docket also reveals what is the type of material the customer has indicated that he is bringing in. Verifying this is very important as different materials have different prices so it is your duty to ensure the Customer pays for exactly what he is bringing in.
- Lastly, once you have verified the above 2 steps, the type of material on the docket will help you guide the Customer to the right tipping location on site or within the Recycling Area.

Having said that, there will be occasions when majority of the load will be as per the docket and generally acceptable within the Recycling Area but it may contain traces or small evidence of certain hazardous or putrescible material which can result in the load being classified as an Unacceptable Load.

Identification of such material not only ensures the site safety and the safety of its employees and customers, but also ensures our compliance with the site licenses. This makes the following step of the Primary Inspections a very crucial step.

3. PRIMARY INSPECTIONS

Primary inspections are extremely important and are your first opportunity to spot and prevent any Hazardous or Putrescible Waste entering the Recycling Area. This involves a basic but thorough visual

inspection of the load in as much detail as possible before the load gets tipped.

Thus, it is very important you request the driver to uncover the load by removing the tarp and have a good look, feel and smell of the incoming loads.

In case the Customer's vehicle is larger, you may be required to use the viewing deck to conduct the Primary Inspection as shown below:

However, it is equally important that these inspections are done safely so please remember and abide by the below:

i) You have to always be wearing the appropriate Personal Protective Equipment (PPE) while carrying out the inspections.
ii) You are never to climb on top of loads or into bins to conduct the inspections.
iii) Always be aware of moving machineries or mobile equipment around you while carrying out the inspections.

Before we move any further, let us now understand the various types of unacceptable materials that you might come across during the Primary Inspections and their corresponding action plans.

4. UNACCEPTABLE MATERIAL

Below are the details regarding the unacceptable materials and the respective protocols following their identification:

- *Food waste*

No food scraps, food bags, garbage bags or household rubbish containing food scraps should be accepted.




Sometimes loads can be scattered with hidden food waste in them as shown below.

There can be quite heavy penalties applicable to the site if found accepting food waste. Thus it is very important to follow the below mentioned steps:

- In case you find a load scattered with food waste, it needs to be rejected. Inform the Weighbridge immediately over the 2-way radio and provide photographs of the load and the vehicle via email.
- In case you find 1 or more sealed food waste bags in an otherwise acceptable load, there are 2 options. The load can either be completely rejected, sent back to the Weighbridge or the customer can tip the acceptable load and take the sealed food waste bags with him. In case of the latter, conduct a thorough inspection of the tipped load to ensure there are no traces of food waste in the load.
- If you do find a small amount of food waste in the load and are unsure of whether the load is acceptable or not, do not allow the load to be tipped and request for assistance from your Supervisor.

Hazardous material

Hazardous waste normally comprises of any unidentified liquids, any soil or sand with paint mixed in it, oil or any type of fuel.

Examples of such waste include Paint containers, spray paint, fuel cans, oil containers, acids and explosives.

A good way to identify hazardous waste is to look for relative signage on the containers.

If such materials are scattered or spilled throughout the load, the load must be rejected, inform the Weighbridge via the 2-way radio and send photographs via email.

If there are only a few cans which can be hand-picked and have not affected or contaminated the rest of the load, the customer must remove the items from the load and take them off site.

In case you are unsure of the load, contact your Supervisor immediately.

In certain extreme cases, Hazardous materials may also cause you to feel ill, dizzy or experience any other feeling that is not normal. These may include funny smells, stinging in the eyes or a burning sensation on the skin.

In such an event, leave the area immediately, ask for the customer to leave the area as well and contact your Supervisor immediately.

Asbestos Containing Materials (ACM)

Dial a Dump Industries notifies all its customers that "**NO ASBESTOS IS ACCEPTED IN THE RECYCLING FACILITY"**. This makes the timely identification and handling of all Asbestos Containing Materials (ACM) extremely important not only from a compliance perspective, but also from a health and safety point of view for everyone on site.

Please ensure you request your supervisor to provide you with a copy of the Dial A Dump Industries Asbestos Management Plan to better understand the affects Asbestos Containing Materials can have an individual's health if it is not carefully identified and removed in time.

Hence from an identification and removal point of view, it is very important that every new load that enters the Recycling Area is tipped as a physically separate load from the processing stockpiles that have already been previously inspected and cleared as shown below.

The Asbestos Handling protocol consists of 3 scenarios, each of which are outlined below along with their corresponding action plans:

<u>Scenario 1:</u> Asbestos or ACM is spotted during the Primary Inspection from the Spotter Station or just before the load is tipped.

Action Plans:

1) YOU MUST INFORM YOUR SUPERVISOR IMMEDIATELY
2) It is imperative that you or any other staff member DO NOT HANDLE ASBESTOS OR ASBESTOS CONTAINING MATERIALS (ACM) WITHOUT PERSONAL PROTECTIVE EQUIPMENT which includes gloves, safety glasses and a P3 grade dust filtration mask or equivalent breathing apparatus.

3) Once the material has been determined as Asbestos or ACM, the load immediately classifies as a "Rejected Load". Write the term 'Rejected Load' on the docket, sign it and take photos of the load, the ACM, truck registration and the Docket.
4) Notify the Weighbridge of the Rejected Load immediately, send the photos to the Weighbridge via email and redirect the truck with his signed docket back to the Weighbridge.

Scenario 2: Asbestos or ACM is spotted during the Secondary Inspection (details of which are provided on page 22 of this document) once the load has been tipped and the vehicle has not left the tipping area.

Action Plans:

1) Ensure you do not sign the docket and that the truck/ vehicle does not leave the tipping area.
2) YOU MUST INFORM YOUR SUPERVISOR IMMEDIATELY.
3) It is imperative that you or any other staff member DO NOT HANDLE ASBESTOS OR ACM WITHOUT PERSONAL PROTECTIVE EQUIPMENT which includes gloves, safety glasses and a P3 grade dust filtration mask or equivalent breathing apparatus.
4) Once the material has been determined as Asbestos or ACM, the load immediately classifies as a "Rejected Load" and it will be required to be reloaded. You must **first isolate the load** using barriers or

witches' hats as shown below and mark the load as contaminated.

5) Once the load is isolated, contact the relevant operator to carry out the reload.
6) Write the term 'Rejected Load' on the docket, indicate the additional reload fee on the docket that needs to be charged, sign it and **BEFORE the reloading commences** take photos of the load, the ACM, truck registration and the Docket.
7) Notify the Weighbridge of the Rejected Load immediately, send the photos to the Weighbridge via email and redirect the truck with his signed docket back to the Weighbridge.

<u>Scenario 3:</u> Asbestos or ACM is spotted in the stockpile once the vehicle has left the site and load has been pushed up.

Action Plans:

1) YOU MUST INFORM YOUR SUPERVISOR IMMEDIATELY.
2) It is imperative that you or any other staff member DO NOT HANDLE ASBESTOS OR ACM WITHOUT PERSONAL PROTECTIVE EQUIPMENT which includes gloves, safety glasses and a P3 grade dust filtration mask or equivalent breathing apparatus.
3) Isolate the area immediately and communicate any available or known information regarding the load to the Weighbridge regarding the Customer name, Vehicle Registration, type of truck, time of tipping, etc. DO NOT assume or guess any information and only provide the information you are certain of.
4) You will need to ensure that no more loads are pushed up on top or in front of the contaminated area and you **<u>MUST</u> follow the Asbestos handling protocol mentioned in the "Designated Clean Area" section mentioned in the Asbestos Protocol Training Manual for Dial A Dump Industries.**

Fully covered hook bins can be used to store ACM in the Designed Clean Areas

5) Ensure photos are taken and a record of the actions taken are filed in the relevant Spotter Stations or at Checkpoint.

For further details on Asbestos and the Company's policies regarding Asbestos, please refer to the DADI Asbestos Management Plan, Feb 2014.

All Spotters must read and adhere to the EHS – Work Instruction Landfill Spotters – Asbestos Identification and Handling and the Asbestos Protocol Training Manual for Dial A Dump Industries.

5. NOTIFIABLE ITEMS

There are certain types of waste which are acceptable to be received into the Recycling Area but involve additional costs to handle. These items can be tipped by Customers by paying an additional charge at the Weighbridge on their way out.

It is therefore important that you identify these items that can be brought in with a typical load.

Single and Double Mattresses (Each)

Car and/or Truck tyres (Each)

Insulation (By m3)

Carpet Rolls (per roll)

Fibro Sheeting (By m3)

Car Batteries (Each)

Rubber Conveyors or piping

Fire Extinguishers

Tree stumps

Gas Bottles

Oversize Concrete

Rubbish in load (Crushing only)

In case you identify any of the above items in a load, you must:

- <u>Inform the Customer</u> of the presence of the particular item in the load and the fact that it will carry an additional charge.
- Do not let the customer unload or tip the items if they do not accept the additional charge.
- You will need to inform the Weighbridge of the material and quantity of the Additional Charge over the 2-way radio and email the photographs through.

- If you are unsure about any procedures, charges or materials contact your Supervisor.

6. RAW STOCKPILE MATERIALS

Raw stockpile materials are those materials that need not be tipped along with General Rubbish as they might be clean and can be processed at much lower costs.

Proper identification, classification and direction can not only help us ensure the quality of our stockpiles is maintained but can also result in a significant reduction in Operational Expenses.

On inspection of certain loads, you might find that the load is devoid of any general rubbish and is similar to the Raw Stockpile Materials as shown below:

Concrete

Brick

Sand

Green waste

Clean Hard

GSW-R

Timber

Timber Yard

Should you do determine that the incoming load is clean enough to be sent to one of the Raw Stockpiles, please ensure:

- Confirm with your Supervisor if you have any doubts regarding the integrity or classification of the material
- Walk or drive the Customer to the correct stockpile for unloading. If there is another spotter in one of the designated areas, such as Spotter Station 2 at Genesis, Eastern Creek then ensure you inform the Spotter over the 2-way radio of the incoming vehicle.
- Inform your Supervisor in case you have to leave the Spotter Station or Checkpoint to direct the Customer.
- A spotter will need to remain with the customer while the load is being tipped.
- Carry out a thorough Secondary Inspection on the load for any contaminations or general rubbish.
- You must inform the Weighbridge of any changes to the classification of the material, write it on the docket and email the photos through. For example change from Brick to General Waste or change from General Waste to Timber.
- In the Crushing Area there is often some confusion regarding the changing of Brick loads to General Rubbish or Rubbish in Load.
- As a rule of thumb, any skip bin that comes to the Crushing Area with a load classified as clean brick and has even a little amount of rubbish in it will be classified as a General Rubbish Load.
- For any larger loads such as hook bins or truck and dogs, classify the loads as General Rubbish only if it would take more than 10 minutes

to pick the load clean. Otherwise, contact the Weighbridge and mark the dock as Rubbish in Load.

7. SECONDARY INSPECTIONS

Secondary Inspections are carried out once the vehicle has cleared the Provisional Inspection at the Weighbridge and the Primary Inspection at the Spotter Station or Checkpoint.

These inspections have to be detailed and very thorough and are to be carried out once the load has been tipped and spread out for inspection in the Recycling Area.

For the safety of all staff personnel and Customers, please ensure the following precautions are taken while the load is being tipped:

- All Customers along with the employees need to wear their Personal Protective Equipment which includes but is not limited to their hard hats, steel-toe boots and high-visibility vests.
- All customers and employees are clear and a safe distance from where the load is being tipped.
- All mobile equipment and machineries are clear from the tipping area.

Once the load has been safely tipped in the appropriate area, the load will need to be spread out for the Secondary Inspection. Contact the appropriate operator to spread the load out via the 2-way radio.

Inspect the load thoroughly for any contaminations, unacceptable material and additional charges.

In case you find any unacceptable materials or additional charge items in the load, you will need to follow the protocols mentioned above based on the appropriate material and redirect the vehicle back to the Weighbridge.

Always remember that the Customers should not be allowed to leave the Recycling Area until the Secondary Inspection of their load is satisfactory. The Customers are obligated to return their docket, signed by you, back to the Weighbridge once they have tipped so the transaction can be finalised. Do not sign or hand over the Customers their dockets until you have thoroughly completed the Secondary Inspection.

8. UNLOADING VEHICLES IN THE HAND UNLOAD AREA

The Hand Unload Area is a specific area designed for smaller vehicles, Utes, cars, etc. to unload their waste by hand rather than it being tipped.

This ensures that such smaller vehicles have a safer and easier tipping area which helps them avoid high traffic areas where mostly larger trucks and heavy mobile equipment are in operation.

When directing a vehicle to the Hand Unload Area, it is very important that you stay with the vehicle whilst it is unloading and not leave it unattended. This ensures the safety of the Customers and prevents them from wandering anywhere away from the safety of the Hand Unload Area and enable you to spot the load while it is being unloaded.

9. MAINTAINING YOUR CONDUCT

Although not too frequent, but there is always the possibility of an occasional dispute with the customer, ranging from bringing in hazardous material to deductions in the load.

As a representative of Dial A Dump Industries, it is important you always remember to maintain a good conduct and follow the necessary protocol.

In case a customer gets angry, argumentative or abusive with you or any other colleague or even another customer, ensure you speak to them in a professional and decent manner and try to calm them down.

If necessary, explain it to them that you would need assistance in making a final decision regarding the matter or dealing with the situation better and immediately request the aid of your Supervisor or Manager.

10. HAND SORTING DUTIES

Hand sorting is a very important part of the overall sorting operations and needs to be conducted diligently.
However, before you commence any hand sorting activities, please ensure the following:

- You must be wearing the appropriate PPE which includes Steel-toe boots, picking gloves, hard hat, safety glasses, dust masks, high visibility full sleeves shirt or vest and long pants.
- Ensure you alert all operators on mobile equipment or heavy machinery around you of your intentions to commence the hand sorting.
- You are not to climb over stockpiles to hand sort any loads. Request the operators to spread the load out for you before you enter the area.
- Ensure that the area where you are hand sorting is closed off by the use of witches' hats while the hand sorting is in progress.

- Ensure that you have the appropriate bins into which you will be placing the sorted material close by.
- Do not attempt to lift, drag or pull and weights over 20kgs. It may result in unnecessary and avoidable injuries or strains.
- DO NOT stick your hand in unclear loads WITHOUT GLOVES or EYE MASKS.
- Be aware of potential hazards such as needle sticks, broken glass and sharp objects.
- DO NOT stick hands in to containers or suspicious loads.

Below is a list of materials that can be extracted from a load efficiently using hand sorting:

Copper

Alloys

Aluminium

Reo missed by magnet grab

Wire Cables

Gas Bottles

Fire Extinguishers

Stainless Steel

Cardboard

Polystyrene

Hard Plastics

Clear Plastics

- ✓ The hand sorting process needs to be performed in an organised manner. Each material that is pulled out needs to be placed in it respective marked location or bin.
- ✓ If you are unsure of where a particular item is to be placed, contact your supervisor.
- ✓ Take extreme precaution when dealing with hazardous items such as fire extinguishers, gas bottles and batteries. Ensure that they are never left or in or anywhere near the path of heavy machineries.

- ✓ The hand sorting responsibilities can vary between sites and between spotter stations. Please ensure you receive clear and precise instructions from your supervisor regarding the same.

11. MACHINERIES AND SAFETY

The types of machinery that you will be working around will include, but not be limited to the following:

Magnet Excavator

Fuchs Grab

Front End Loader

Mobile Screens

Forklifts

Bobcat

Working around such machinery can be challenging if the correct protocol is not followed. To ensure everyone's safety, please ensure the following:

- You are not to use or try to use any of the machines without the appropriate ticket(s) and prior consent from your Supervisor.
- Ensure you and everyone around you is dressed in the appropriate PPE especially high visibility vest/clothing and hard hat.
- DO NOT cross the path of an operating machinery or stand behind an operating machinery.
- Be aware at all times the operation and location of Machine and equipment in the Recycling Area.
- Always use 2-way radio communication when working around such machinery.

12. General Maintenance and House Keeping duties

Dial A Dump Industries is proud to own and operate 2 of the finest state of the art Waste Management and Recycling Facilities in Sydney. As a representative of Dial A Dump Industries, you are expected to maintain

the same standards in the eyes of the customers coming into the site by paying attention to the general house-keeping around the Spotter Stations and Checkpoint.

By ensuring that your area is always clean and tidy, you will help provide a safe and healthy work environment for everyone invloved.

FIRST AID

The **closest** first aid stations at Alexandria Landfill are at the Site Office building.

The closest first aid station at Genesis, Eastern Creek is located in Spotter Station 1 and Spotter Station 2.

Spotter Station 1

Site Office at Alexandria

For a full list of First aid supplies and a list of all Safety Officers on site, contact your Supervisor.

In the event that you, any other employee or a customer is injured during any activity on site, you are expected to follow the below mentioned protocol:

- Check for Danger and assess the situation to ensure there is no danger to the person attending the injured person. Dangers could include Fire, Traffic, Gas, etc.

- Contact a First Aid Officer to assess the injury.

- Contact your Supervisor immediately.

- For any serious Injuries – call the emergency number **"000".**

The Site Address for Alexandria Landfill is: 10 – 16 Albert Street, St Peters NSW 2015. The nearest cross street is Campbell Rd.

The site address for Genesis, Eastern creek is: End of Honeycomb drive, off Wonderland Drive, Eastern Creek NSW 2766.

Once the injured person has been attended to and is in a safe and stable condition, you will be required to fill out an injury report. These forms are located in the First Aid tool boxes in the site office, Spotters Station and Checkpoint.

In the event that your Supervisor is unavailable at the time of the injury, the list of emergency contacts is listed below:

- ✓ **Rodney Johnson – 0408 919 562**
- ✓ **Ronan Dunlea – 0429 293 909**
- ✓ **Joi Feiertag – 0428 888 519**
- ✓ **Chris Biggs – 0438 902 021**

* *Serious Injury* includes back or head injuries, sprained or suspected broken bones and serious lacerations.

* *Minor Injury* includes minor cuts, abrasions, bumps, knocks and eye irritations.

APPENDIX 3
ESTIMATION OF ASH AND RESIDUE COMPOSITION

MEMO

Job	**The Next Generation Project** **Estimation of ash and residue composition**
Client	**Ian Malouf, Dial-a-Dump Industries**
Memo no.	**TNGWTE-141-001, ver. 3**
Date	**18 March 2015**
To	**Ian Malouf**
From	**Tore Hulgaard**
Copy to	**Martin Brunner; Ramboll** **Ute Fleck, HZI** **Claudia Einsporn, HZI**

Date 18 March 2015

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1. Introduction

Ramboll and HZI have been asked to do an assessment of the ash fractions from the plant, based on the expected waste composition.

The assessment has been based on the expected waste composition received from DADI, version *Composition Summary Final 090215b.*

The assessment of the ash fraction has been divided 3 fractions:

- Bottom ash
- Boiler ash
- Fly ash/APC residue

The assessment has been made by Ramboll and HZI in collaboration. Furthermore Ramboll have made a few minor comments/considerations to the assessment.

2. Ash and residue composition

We have performed an estimation of the ash and residue amounts and composition based on the expected waste composition.

The estimate has been performed in close collaboration with HZI, and is based on the experience from Ramboll and HZI, including available literature data.

The mass balance is followed for each element from waste to the amounts and composition of the respective outputs, i.e. bottom ash, boiler ash, and APC residue (APC=air pollution control).

The anticipated amount of added lime and activated carbon (PAC= pulverized activated carbon) are considered, including the effect on

the resulting amount of the APC-residue.

The input mass flow of waste is chosen at the nominal load point of 34.5 tonnes/h. Each output is characterised by its mass flow for one EfW line at 34.5 tonnes/h and the specific contaminant concentration and leachable concentration.

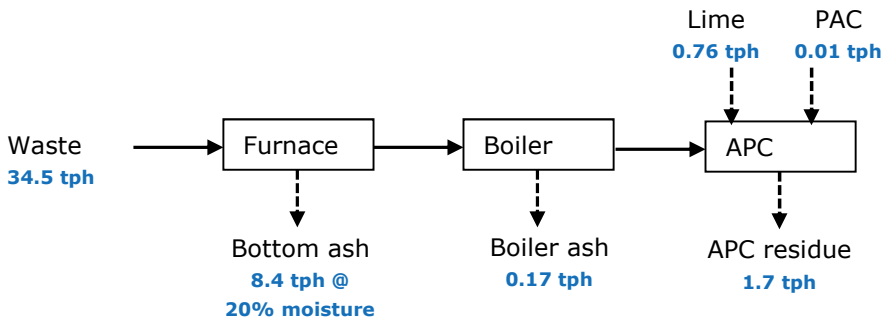

Figure 1 Mass flows, estimated nominal

We note that the residual composition of waste is a consequence of the composition and mass flow of each material fraction. Moreover that material fractions are not precisely defined when it comes to elemental composition. Also the mass flows of each material fraction may vary. For these reasons quite large variations should be foreseen. However a WtE facility is designed to cope exactly with such variations.

The residues may be handled as separate products or they may be mixed and handled as one residue. I Europe the bottom ash is often used for road construction, otherwise the boiler ash could be mixed into the bottom ash. The APC residue is usually kept and disposed as a separate fraction. The resulting residues and their composition are compared with limit values in Appendix 1.

In USA it is common to mix the residues and treat them as one, as illustrated with resulting concentrations in Appendix 2. In this case the output mass is the sum of residues mass flows in Figure 1, i.e. estimated as 10.3 tph.

2.1 Accumulated ash quantities

At nominal load the plant will be processing 1,105,000 tonnes/year of waste.

Based on the estimated waste composition, the total amount of ash and residue will be (rounded amounts):

Bottom Ash:	270.000	tonnes/year @ 20% moisture content
Boiler Ash:	5.000	tonnes/year
APC Residue:	55.000	tonnes/year
Sum	330,000	tonnes/year

Appendix 1

Composition and leaching properties of individual residues

Energy from Waste Facility, Eastern Creek

TCLP and SCC values for classifying waste by chemical assessment

	Bottom ash		Boiler ash		APC residue		Waste Classification Guideline Table 2	
	Leachable concentration	Specific contaminant concentration	Leachable concentration	Specific contaminant concentration	Leachable concentration	Specific contaminant concentration	Leachable concentration	Specific contaminant concentration
Contaminant	TCLP1 mg/l	SCC1 mg/kg DM	TCLP1 mg/l	SCC1 mg/kg	TCLP1 mg/l	SCC1 mg/kg	TCLP1 mg/l	SCC1 mg/kg
Antimony		46		600		360		
Arsenic	0.1	10	0.3	30	0.2	18	5	500
Benzo(a)pyrene	< 0.001	< 0.1	< 0.01	< 1	< 0.01	< 1	0.04	10
Cadmium	0.3	18	2.4	120	3.1	156	1	100
Chlorine		2,769		36,000		164,360		
Chromium		1,205		750		225		
Chromium (VI)	< 0.1	< 10	< 0.1	< 10	< 0.01	< 1	5	1,900
Copper		4,821		3,000		900		
Fluorine		154		1,200		3,265		
Lead	2.5	1,000	7.5	3,000	4.5	1,800	5	1,500
Manganese		2,892		1,800		540		
Mercury	< 0.01	0.3	< 0.01	2	< 0.01	19	0.2	50
Nickel	0.1	241	0.1	150	< 0.1	45	2	1,050
Sulfur		5,128		40,000		55,203		
Thalium		0		3		4		
Tin		333		1		600		
Vanadium		100		0.30		180		
Zinc		7,051		25		20,000		
C org		8,051		6280		8,740		
SiO_2		438,462		270,000		63,000		
CaO		110,769		144,000		349,765		
Al_2O_3		101,538		110,000		33,000		
Fe_2O_3		78,769		38,400		8,960		
Na_2O		9,231		8,000		3,200		
MgO		23,077		30,000		7,000		
K_2O		5,769		15,000		6,000		
Other matrix elements		2,410		1,500		450		

Appendix 2

Composition and leaching properties of residues when mixed

Energy from Waste Facility, Eastern Creek

TCLP and SCC values for classifying waste by chemical assessment

	mix Bottom ash, Boiler ash, APC residue		Waste Classification Guideline Table 2	
	Leachable concentration	Specific contaminant concentration	Leachable concentration	Specific contaminant concentration
Contaminant	TCLP1 mg/l	SCC1 mg/kg DM	TCLP1 mg/l	SCC1 mg/kg
Antimony		120		
Arsenic	0.1	12	5	500
Benzo(a)pyrene	< 0.001	< 0.1	0.04	10
Cadmium	0.8	48	1	100
Chlorine		35,752		
Chromium		1,000		
Chromium (VI)	< 0.1	< 10	5	1,900
Copper		4,000		
Fluorine		797		
Lead	3	1,200	5	1,500
Manganese		2,400		
Mercury	< 0.01	4	0.2	50
Nickel	0.1	200	2	1,050
Sulfur		15,841		
Thalium		1		
Tin		400		
Vanadium		120		
Zinc		10,000		
C org		8,154		
SiO_2		360,000		
CaO		159,233		
Al_2O_3		88,000		
Fe_2O_3		64,000		
Na_2O		8,000		
MgO		20,000		
K_2O		6,000		
Other matrix elements		2,000		

APPENDIX 4
BAT EVALUATION

MEMO

Job	**BAT Evaluation**
Client	**DADI TNG NSW**
Memo no.	**4**
Date	**23/02/2016**
To	**To whom it may concern**
From	**Martin Brunner**
Copy to	**Ian Malouf (DADI)**
	Phill Andrew (Savills)
	Rachael Snape (Urbis)
	Geert Stryg (Ramboll)

1. Methodology to compare the TNG technology with the BAT requirements

Based on the long term experience of Waste-to-Energy in Europe the best available techniques (BAT) have been evaluated, defined and documented in the "Reference Document on the Best Available Techniques for Waste Incineration (August 2006)" (in short BREF).

Following a request by TNG Ramboll has compared the requirements as summarized as 68 basic requirements in Chapter 5.1 and 5.2 of the above document.

2. Results and conclusions

The detailed evaluation of each point is found in the attachment. In summary the results of the evaluation are:

1. Design: all requirements defined by BREF are fulfilled
2. Emissions: The expected emissions are within the required operational values given by BREF
3. Energy efficiency: The TNG facility exceeds the requirements of the BREF

It can therefore be concluded that the TNG facility fulfils the BREF requirements and therefore is BAT.

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Checked by	MBR
Approved by	GES

Revision 200

BAT	TNG	BAT fullfilled?
1. the selection of an installation design that is suited to the characteristics of the waste received, as described in 4.1.1 and 4.2.1 and 4.2.3	The thermal treatment is calculated for a calorific value of 8,5 MJ/kg- 16,5 MJ/kg. The plant is designed for a waste throughput of 25,35 t/h to 46,48 t/h. The waste type is mainly Chute Residual Waste (CRW) from the Genesis Facility, Commercial and Industrial (C&I), Construction and Demolition (C&D) and flock waste. A combination of water cooled grate and air cooled grate was chosen. The air cooled grate is characterized through: - suitable for waste with low to medium heat values - suitable for municipal and other heterogeneous solid wastes - can cope with sewage sludge and/or medical waste mixed with municipal waste - applied at most modern MSW installations The water cooled grate protects the grate against intense heat (LCV: 10 – 20 GJ/t) otherwise it has the same characteristics. The design features of the secondary combustion chamber are a central current flow.	Yes
2. the maintenance of the site in a generally tidy and clean state, as described in 4.1.2	It is integral part of the contract; it is defined as one the operator's tasks.	Yes
3. to maintain all equipment in good working order, and to carry out maintenance inspections and preventative maintenance in order to achieve this	The Proposed Facility will be operated and maintained by a dedicated Operations and Maintenance team. For planning the major shutdown a short shutdown is carried out approx. 1 year in advance. A normal duration for such a short shutdown is generally a few days. The operator installs a computer-controlled program used to ensure ongoing maintenance of the plant components. The program records conducted maintenance jobs and systematic maintenance can be planned for the individual components. A maintenance plan will be established to determine weekly, monthly, annual or longer interval inspections, tests and maintenance activities which have to be performed.	Yes

BAT	TNG	BAT fullfilled?
4. to establish and maintain quality controls over the waste input, according to the types of waste that may be received at the installation, as described in: 4.1.3.1 Establishing installation input limitations and identifying key risks, and 4.1.3.2 Communication with waste suppliers to improve incoming waste quality control, and 4.1.3.3 Controlling waste feed quality on the incinerator site, and 4.1.3.4 Checking, sampling and testing incoming wastes, and 4.1.3.5 Detectors for radioactive materials.	A three point checking procedure will be on-site to ensure only permitted waste is unloaded into the waste bunker. Initial inspections of the vehicle loads are undertaken at the weighbridge to check the content of the incoming and its origin. All loads are recorded and monitored by on-site CCTV when entering the tipping hall and while the loads are tipped off. Suspect loads are either rejected from the facility or are analysed in a designated inspection area or on the tipping hall floor prior to being tipped into the waste bunker. If the analysis shows that the load contains unsuitable material the waste is reloaded to the vehicle and rejected. Detectors for radioactive material are not necessary.	Yes
5. the storage of wastes according to a risk assessment of their properties, such that the risk of potentially polluting released is minimised. In general it is BAT to store waste in areas that have sealed and resistant surfaces, with controlled and separated drainage as described in 4.1.4.1.	The waste bunker is built of concrete and has a resistant surface. Due to the high thermal value of the waste there is no need for controlled and separated drainage.	Yes
6. to use techniques and procedures to restrict and manage waste storage times, as described in 4.1.4.2, in order to generally reduce the risk of releases from storage of waste/container deterioration, and of processing difficulties that may arise. In general it is BAT to: - prevent the volumes of wastes stored from becoming too large for the storage provided - in so far as is practicable, control and manage deliveries by communication with waste suppliers, etc.	- The waste bunker has the capacity to store the amount of 5-7 days of waste delivery. - The waste is continuously removed. - It is ensured that no excessive amounts will arrive.	Yes
7. to minimise the release of odour (and other potential fugitive releases) from bulk waste storage areas (including tanks and bunkers, but excluding small volume wastes stored in containers) and waste pre-treatment areas by passing the extracted atmosphere to the incinerator for combustion (see 4.1.4.4). In addition it is also considered to be BAT to make provision for the control of odour (and other potential fugitive releases) when the incinerator is not available (e.g. during maintenance) by: a. avoiding waste storage overload, and/or b. extracting the relevant atmosphere via an alternative odour control system	The incineration air supply (primary or secondary) is taken from the waste storage areas. By enclosing the waste storage areas and limiting the size of the entrances to the waste storage areas, a slight under pressure can be ensured on whole waste storage area.	Yes
8. the segregation of the storage of wastes according to a risk assessment of their chemical and physical characteristics to allow safe storage and processing, as described in 4.1.4.5	The waste is delivered in defined fractions. Segregation of the storage of wastes is not necessary.	Yes

BAT	TNG	BAT fullfilled?
9. the clear labelling of wastes that are stored in containers such that they may continually be identified, as described in 4.1.4.6.	The waste is not stored in containers.	Not relevant
10. the development of a plan for the prevention, detection and control (described in 4.1.4.7) of fire hazards at the installation, in particular for: - waste storage and pre-treatment areas - furnace loading areas - electrical control systems - bag house filters and static bed filters. It is generally BAT for the plan implemented to include the use of: a. automatic fire detection and warning systems, and b. the use of either a manual or automatic fire intervention and control system as required according to the risk assessment carried out.	Fire detection and firefighting systems are installed at the critical areas of the plant (e.g. waste bunker, electrical rooms, feed hopper,...). In case of fire detection the firefighting systems start automatically.	Yes
11. the mixing (e.g. using bunker crane mixing) or further pre-treatment (e.g. the blending of some liquid and pasty wastes, or the shredding of some solid wastes) of heterogeneous wastes to the degree required to meet the design specifications of the receiving installation (4.1.5.1). When considering the degree of use of mixing/pre-treatment it is of particular importance to consider the cross-media effects (e.g. energy consumption, noise, odour or other releases) of the more extensive pre-treatment's (e.g. shredding). Pre-treatment is most likely to be a requirement where the installation has been designed for a narrow specification, homogeneous waste.	The waste bunker has sufficient space and sufficient capacity for the mixing of different waste streams. The waste is mainly delivered as shredded fraction.	Yes
12. the use of the techniques described in 4.1.5.5 or 4.6.4 to, as far as practicably and economically viable, remove ferrous and non-ferrous recyclable metals for their recovery either: a. after incineration from the bottom ash residues, or b. where the waste is shredded (e.g. when used for certain combustion systems) from the shredded wastes before the incineration stage.	The recyclable material is removed before the waste is delivered to the waste incineration plant.	Yes
13. the provision of operators with a means to visually monitor, directly or using television screens or similar, waste storage and loading areas, as described in 4.1.6.1	A video system is installed to monitor waste reception, feeding and storage, furnace as well as main out streams and their loading areas.	Yes
14. the minimisation of the uncontrolled ingress of air into the combustion chamber via waste loading or other routes, as described in 4.1.6.4	To minimize the uncontrolled ingress of air into the combustion chamber, the feed hopper always has to be filled to a certain level during operation. The level of the feed hopper is checked by the DCS.	Yes

BAT	TNG	BAT fullfilled?
15. the use of flow modelling which may assist in providing information for new plants or existing plants where concerns exist regarding the combustion or FGT performance (such as described in 4.2.2), and to provide information in order to: a. optimise furnace and boiler geometry so as to improve combustion performance, and b. optimise combustion air injection so as to improve combustion performance, and c. where SNCR or SCR is used, to optimise reagent injection points so as to improve the efficiency of NO_x abatement whilst minimising the generation of nitrous oxide, ammonia and the consumption of reagent (see general sections on SCR and SNCR at 4.4.4.1 and 4.4.4.2).	The incineration and the boiler layout are based on good experiences and are realised on several operating plants. The SNCR (injection of ammonia), the secondary combustion chamber and the FGT design is based on a fluid dynamics flow model.	Yes
16. in order to reduce overall emissions, to adopt operational regimes and implement procedures (e.g. continuous rather than batch operation, preventative maintenance systems) in order to minimise as far as practicable planned and unplanned shutdown and start-up operations, as described in 4.2.5	The waste feeding is continuously. Implementation of a process orientated automatic start up and shut down procedure to minimise the emissions in those operational cases. Mixture of the waste to get a homogeneous fuel and preventative maintenance system avoid unplanned shutdowns.	Yes
17. the identification of a combustion control philosophy, and the use of key combustion criteria and a combustion control system to monitor and maintain these criteria within appropriate boundary conditions, in order to maintain effective combustion performance, as described in 4.2.6. Techniques to consider for combustion control may include the use of infrared cameras (see 4.2.7), or others such as ultra-sound measurement or differential temperature control	The following information is part of the combustion control system: - grate temperatures at various positions - caloric value of the waste - thickness of waste layer on the grate (visual control) - furnace and flue gas temperature at various positions - CO-, O_2-, CO_2- and H_2O-measurements at various positions - steam production data (e.g. temperature, pressure) - openings in the combustion wall for visual observation by cameras - length and position of the fire in the furnace - emission data for combustion related substances	Yes

BAT	TNG	BAT fullfilled?
18. the optimisation and control of combustion conditions by a combination of: a. the control of air (oxygen) supply, distribution and temperature, including gas and oxidant mixing b. the control of combustion temperature level and distribution, and c. the control of raw gas residence time. Appropriate techniques for securing these objectives are described in: 4.2.8 Optimisation of air supply stoichiometry 4.2.9 Primary air supply optimisation and distribution 4.2.11 Secondary air injection, optimisation and distribution 4.2.19 Optimisation of time, temperature, turbulence of gases in the combustion zone, and oxygen concentrations 4.2.4 Design to increase turbulence in the secondary combustion chamber	For an optimal combustion the thermal processes are monitored and regulated by measurements of the furnance temperature and the content of CO and O2 in the flue gas. For a more detailed description see point 17. by means of combustion control the following elements are controlled: - Primary air quantity and distribution - Oxygen content of flue gas (stoichiometry) - Secondary air quantity and distribution - Injection of recirculating flue gas in order to increase turbulence in the secondary combustion chamber	Yes
19. in general it is BAT to use those operating conditions (i.e. combustion temperatures residence times and turbulence) that are specified in Article 6 of Directive 2000/76. The use of operating conditions in excess of those that are required for efficient destruction of the waste should generally be avoided. The use of other operating conditions may also be BAT – if they provide for a similar or better level of overall environmental performance. For example, where the use of operational temperatures of below the 1100 °C (as specified for certain hazardous waste in 2000/76/EC) have been demonstrated to provide for a similar or better level of overall environmental performance, the use of such lower temperatures is considered to be BAT.	The temperature / time requirements of the post-combustion chamber are continuously monitored. See point 17.	Yes
20. the preheating of primary combustion air for low calorific value wastes, by using heat recovered within the installation, in conditions where this may lead to improved combustion performance (e.g. where low LCV/high moisture wastes are burned) as described in 4.2.10. In general this technique is not applicable to hazardous waste incinerators.	For high energy efficiency and optimal combustion conditions preheating of primary and secondary combustion air is realised by using low pressure steam and saturated steam from the boiler drum.	Yes
21. the use of auxiliary burner(s) for start-up and shut-down and for maintaining the required operational combustion temperatures (according to the waste concerned) at all times when unburned waste is in the combustion chamber, as described in 4.2.20	Only in the case that the temperature in the secondary combustion chamber drops below a minimum temperature of 850 °C oil or gas fired support burners automatically start operation. Otherwise, the burners remain in a standby position.	Yes

BAT	TNG	BAT fullfilled?
22. the use of a combination of heat removal close to the furnace (e.g. the use of water walls in grate furnaces and/or secondary combustion chambers) and furnace insulation (e.g. refractory areas or other lined furnace walls) that, according to the NCV and corrosiveness of the waste incinerated, provides for: a. adequate heat retention in the furnace (low NCV wastes require higher retention of heat in the furnace) b. additional heat to be transferred for energy recovery (higher NCV wastes may allow/require heat removal from earlier furnace stages) The conditions under which the various techniques may be applicable are described in 4.2.22 and 4.3.12	To protect the walls of the boiler against corrosion Inconel will be cladded in sections where the flue gas temperature exceeds 850 °C.	Yes
23. the use of furnace (including secondary combustion chambers etc.) dimensions that are large enough to provide for an effective combination of gas residence time and temperature such that combustion reactions may approach completion and result in low and stable CO and VOC emissions, as described in 4.2.23	The furnace dimensions are large enough to ensure that for 2 seconds residence time the flue gas has a temperature above 850 °C (for all operational conditions). Experiences of several plants have shown low values for CO and VOC. After the combustion chamber two empty passes are installed to enable a complete burnout. In addition to secondary air a part of the flue gas is recirculated and injected together with the secondary air to achieve a maximum turbulence and burnout as well as stable CO and VOC emissions.	Yes
24. When gasification or pyrolysis is used, in order to avoid the generation of waste, it is BAT to: a. combine the gasification or pyrolysis stage with a subsequent combustion stage with energy recovery and flue-gas treatment that provides for operational emission levels to air within the BAT associated emission ranges specified in this BAT chapter, and/ or b. recover or supply for use of the substances (solid, liquid or gaseous) that are not combusted	No gasification or pyrolysis.	Not relevant

BAT	TNG	BAT fullfilled?
25. in order to avoid operational problems that may be caused by higher temperature sticky fly ashes, to use a boiler design that allows gas temperatures to reduce sufficiently before the convective heat exchange bundles (e.g. the provision of sufficient empty passes within the furnace/boiler and/or water walls or other techniques that aid cooling), as described in 4.2.23 and 4.3.11. The actual temperature above which fouling is significant is waste type and boiler steam parameter dependent. In general for MSW it is usually 600 – 750 ºC, lower for HW and higher for SS. Radiative heat exchangers, such as platten type super heaters, may be used at higher flue-gas temperatures than other designs (see 4.3.14).	At the first position in the horizontal pass a protection evaporator is installed. The calculated gas temperature before the protection evaporator is around 650°C. This evaporator protects the superheater in order to minimize fouling. Further a conservative spacing of the boiler tubes prevents clogging and resulting operational problems.	Yes
26. the overall optimisation of installation energy efficiency and energy recovery, taking into account the techno-economic feasibility (with particular reference to the high corrosivity of the flue-gases that results from the incineration of many wastes e.g. chlorinated wastes), and the availability of users for the energy so recovered, as described in 4.3.1, and in general: a. to reduce energy losses with flue-gases, using a combination of the techniques described in 4.3.2 and 4.3.5 b. the use of a boiler to transfer the flue-gas energy for the production of electricity and/or supply of steam/heat with a thermal conversion efficiency of: i. for mixed municipal waste at least 80 % (ref. Table 3.46) ii. for pretreated municipal wastes (or similar waste) treated in fluidized bed furnaces, 80 to 90 % iii. for hazardous wastes giving rise to increased boiler corrosion risks (typically from chlorine/sulphur content), above 60 to 70 % iv. for other wastes conversion efficiency should generally be increased in the range 60 to 90 % c. for gasification and pyrolysis processes that are combined with a subsequent combustion stage, the use of a boiler with a thermal conversion efficiency of at least 80 %, or the use of a gas engine or other electrical generation technology	The most important measures to reduce the energy loss are: a) reduce excess air b) recirculate flue gas c) reduce the flue gas temperature at the boiler exit of 145°C d) heat recovery by condensate preheating The thermal conversion of the boiler is 91,9%.	Yes
27. to secure where practicable, long-term base-load heat/steam supply contracts to large heat/steam users (see 4.3.1) so that a more regular demand for the recovered energy exists and therefore a larger proportion of the energy value of the incinerated waste may be used.	The average net electrical efficiency is 29,6%. Necessary measures have been foreseen for later export of heat.	Yes

BAT	TNG	BAT fullfilled?
28. the location of new installations so that the use of the heat and/or steam generated in the boiler can be maximised through any combination of: a. electricity generation with heat or steam supply for use (i.e. use CHP) b. the supply of heat or steam for use in district heating distribution networks c. the supply of process steam for various, mainly industrial, uses (see examples in 4.3.18) d. the supply of heat or steam for use as the driving force for cooling/air conditioning systems Selection of a location for a new installation is a complex process involving many local factors (e.g. waste transport, availability of energy users, etc) which are addressed by IPPC Directive Article 9(4). The generation of electricity only may provide the most energy efficient option for the recovery of the energy from the waste in specific cases where local factors prevent heat/steam recovery.	See point 27.	Yes
29. in cases where electricity is generated, the optimisation of steam parameters (subject to user requirements for any heat and steam produced), including consideration of (see 4.3.8): a. the use of higher steam parameters to increase electrical generation, and b. the protection of boiler materials using suitably resistant materials (e.g. claddings or special boiler tube materials) The optimal parameters for an individual installation are highly dependent upon the corrosivity of the flue-gases and hence upon the waste composition.	Depending on the flue gas composition and the waste conditions the steam parameters were determined to be 73barA/430°C. This superheated steam parameters ensure high energy efficiency. The net electrical efficiency is 29,6%.	Yes
30. the selection of a turbine suited to: a. the electricity and heat supply regime, as described in 4.3.7 b. high electrical efficiency	A condensing turbine was chosen as there are no possibilities to supply heat to customers.	Yes
31. at new or upgrading installations, where electricity generation is the priority over heat supply, the minimisation of condenser pressure, as described in 4.3.9	The turbine exhaust pressure (100 mbar, 22°C) and the air cooled condenser are designed so that the high ambient temperatures of Sydney can be handled.	Yes

BAT	TNG	BAT fullfilled?
32. the general minimisation of overall installation energy demand, including consideration of the following (see 4.3.6): a. for the performance level required, the selection of techniques with lower overall energy demand in preference to those with higher energy demand b. wherever possible, ordering flue-gas treatment systems in such a way that flue gas reheating is avoided (i.e. those with the highest operational temperature before those with lower operational temperatures) c. where SCR is used; i. to use heat exchangers to heat the SCR inlet flue-gas with the flue-gas energy at the SCR outlet ii. to generally select the SCR system that, for the performance level required (including availability/fouling and reduction efficiency), has the lower operating temperature d. where flue-gas reheating is necessary, the use of heat exchange systems to minimise flue-gas reheating energy demand e. avoiding the use of primary fuels by using self produced energy in preference to imported sources	To minimise the overall energy consumption the following measures were taken: - SNCR instead of SCR to avoid the flue gas reheating for the catalytic reaction - efficient preheating of primary and secondary air - minimal condenser pressure - placing high temperature equipment before (upstream) lower temperature equipment - use of frequency controlled rotating equipment for those equipment parts which operate at variable speeds. - high efficient DCS system to minimise the measure failure SCR is not relevant.	Yes
33. where cooling systems are required, the selection of the steam condenser cooling system technical option that is best suited to the local environmental conditions, taking particular account of potential cross-media impacts, as described in 4.3.10	As result of the local conditions and to minimize the water consumption an air cooled condenser has been chosen.	Yes
34. the use of a combination of on-line and off-line boiler cleaning techniques to reduce dust residence and accumulation in the boiler, as described in 4.3.19	Online cleaning devices for all parts of the boiler are foreseen. Offline cleaning is carried out manually during revisions.	Yes
35. the use of an overall flue-gas treatment (FGT) system that, when combined with the installation as a whole, generally provides for the operational emission levels for releases to air associated with the use of BAT listed in Table 5.2	The emission guarantees are in accordance with the European Industrial Emission Directive. The expected operational emission levels are in line with the values given in Table 5.2.	Yes

BAT	TNG	BAT fullfilled?
36. when selecting the overall FGT system, to take into account: a. the general factors described in 4.4.1.1 and 4.4.1.3 b. the potential impacts on energy consumption of the installation, as described in section 4.4.1.2 c. the additional overall-system compatibility issues that may arise when retrofitting existing installations (see 4.4.1.4)	The following factors have been taken account for the selection of the FGT system: - type of waste, its composition and variation - type of combustion process, and its size - through recirculation of flue gases less flue gas flow and lower flue gas temperature - flue gas composition and fluctuations in the composition - target emission limit values - restrictions on discharge of aqueous effluents - availability of land and space - availability and cost of outlets for residues accumulated/recovered - minimize consumables	Yes
37. when selecting between wet / semi-wet / and dry FGT systems, to take into account the (non-exhaustive) general selection criteria given as an example in Table 5.3 [See at the end of this document]	The Flue gas cleaning process is characterised by the following features: - No effluent as necessary for wet FGT - minimized consumables and residues - Dry injection of Calcium Hydroxide (Ca(OH)2) and Powdered Activated Carbon (PAC) - Separate injection of water for conditioning and reactivation of recycled lime particles - Compact design - Low manpower requirement	Yes
38. to prevent the associated increased electrical consumption, to generally (i.e. unless there is a specific local driver) avoid the use of. two bag filters in one FGT line (as described in 4.4.2.2 and 4.4.2.3)	The installation has only one bag filter.	Yes

BAT	TNG	BAT fullfilled?
39. the reduction of FGT reagent consumption and of FGT residue production in dry, semi-wet, and intermediate FGT systems by a suitable combination of: a. adjustment and control of the quantity of reagent(s) injected in order to meet the requirements for the treatment of the flue-gas such that the target final operational emission levels are met b. the use of the signal generated from fast response upstream and/or downstream monitors of raw HCl and/or SO2 levels (or other parameters that may prove useful for this purpose) for the optimisation of FGT reagent dosing rates, as described in 4.4.3.9 c. the re-circulation of a proportion of the FGT residues collected, as described in 4.4.3.7 The applicability and degree of use of the above techniques that represents BAT will vary according to, in particular: the waste characteristics and consequential flue-gas nature, the final emission level required, and technical experience from their practical use at the installation	a) The quantity of reagents injected is regularly checked by measuring the target final operational emission levels. Depending on the emission level the reagents are injected. b) Measuring devices are installed to check the raw gas c) A part of the residues are recirculated into the semi dry reactor which results in a high efficiency, lower consumption of absorbent, protection of filter bags and a higher operational safety.	Yes
40. the use of primary (combustion related) NO_x reduction measures to reduce NO_x production, together with either SCR (4.4.4.1) or SNCR (4.4.4.2), according to the efficiency of flue-gas reduction required. In general SCR is considered BAT where higher NO_x reduction efficiencies are required (i.e. raw flue-gas NO_x levels are high) and where low final flue-gas emission concentrations of NOX are desired. One MS reported that technical difficulties have been experienced in some cases when retrofitting SNCR abatement systems to existing small MSW incineration installations, and that the cost effectiveness (i.e. NOX reduction per unit cost) of NOX abatement (e.g. SNCR) is lower at small MSWIs (i.e. those MSWIs of capacity <6 tonnes of waste/hour).	In the first pass of the boiler ammonia is injected into the flue gas stream. The results are well controlled and low NOx emissions which are below the levels given by the Industrial Emissions Directive. The most important factors for NOx reduction measures are: - O_2 content - flue gas recirculation - optimized secondary air injection Neither retrofitting nor small installation, therefore not relevant.	Yes

BAT	TNG	BAT fullfilled?
41. for the reduction of overall PCDD/F emissions to all environmental media, the use of: a. techniques for improving knowledge of and control of the waste, including in particular its combustion characteristics, using a suitable selection of techniques described in 4.1, and b. primary (combustion related) techniques (summarised in 4.4.5.1) to destroy PCDD/F in the waste and possible PCDD/F precursors, and c. the use of installation designs and operational controls that avoid those conditions (see 4.4.5.2) that may give rise to PCDD/F reformation or generation, in particular to avoid the abatement of dust in the temperature range of 250 – 400 °C. Some additional reduction of de-novo synthesis is reported where the dust abatement operational temperature has been further lowered from 250 to below 200 °C, and d. the use of a suitable combination of one or more of the following additional PCDD/F abatement measures: i. adsorption by the injection of activated carbon or other reagents at a suitable reagent dose rate, with bag filtration, as described in 4.4.5.6, or ii. adsorption using fixed beds with a suitable adsorbent replenishment rate, as described in 4.4.5.7, or iii. multi layer SCR, adequately sized to provide for PCDD/F control, as described in 4.4.5.3, or iv. the use of catalytic bag filters (but only where other provision is made for effective metallic and elemental Hg control), as described in 4.4.5.4	For the reduction of PCDD/F emissions the following techniques are applied: - optimized secondary air injection - maximal gas burn out - minimization of fly ash deposits in the boiler - continuous boiler cleaning - no dedusting equipment where the gas temperature is above 200°C - SNCR	Yes
42. where wet scrubbers are used, to carry out an assessment of PCDD/F build up (memory effects) in the scrubber and adopt suitable measures to deal with this build up and prevent scrubber breakthrough releases. Particular consideration should be given to the possibility of memory effects during shut-down and start-up periods.	No wet scrubbers are used.	Not relevant
43. if re-burn of FGT residues is applied, then suitable measures should be taken to avoid the re-circulation and accumulation of Hg in the installation	No re-burn of FGT residues is applied.	Not relevant

BAT	TNG	BAT fullfilled?
44. for the control of Hg emissions where wet scrubbers are applied as the only or main effective means of total Hg emission control: a. the use of a low pH first stage with the addition of specific reagents for ionic Hg removal (as described in 4.4.6.1, 4.4.6.6 and 4.4.6.5), in combination with the following additional measures for the abatement of metallic (elemental) Hg, as required in order to reduce final air emissions to within the BAT emission ranges given for total Hg b. activated carbon injection, as described in 4.4.6.2, or c. activated carbon or coke filters, as described in 4.4.6.7	No wet scrubbers are used.	Not relevant
45. for the control of Hg emissions where semi-wet and dry FGT systems are applied, the use of activated carbon or other effective adsorptive reagents for the adsorption of PCDD/F and Hg, as described in 4.4.6.2, with the reagent dose rate controlled so that final air emissions are within the BAT emission ranges given for Hg	For the control of Hg emissions an activated carbon injection into the semi dry reactor is applied. The reagent dose rate is controlled to ensure that the final air emissions are within the BAT ranges given for Hg.	Yes
46. the general optimisation of the re-circulation and re-use of waste water arising on the site within the installation, as described in 4.5.8, including for example, if of sufficient quality, the use of boiler drain water as a water supply for the wet scrubber in order to reduce scrubber water consumption by replacing scrubber feed-water (see 4.5.6)	To avoid additional water consumption a complete recirculation of condensate is installed. The boiler drain water is used for the bottom ash quenching.	Yes
47. the use of separate systems for the drainage, treatment and discharge of rainwater that falls on the site, including roof water, so that it does not mix with potential or actual contaminated waste water streams, as described in 4.5.9. Some such waste water streams may require only little or no treatment prior to their discharge, depending on contamination risk and local discharge factors	A separate system is used for the drainage, treatment and discharge of rainwater so that it does not mix with potential or actual contaminated waste water streams.	Yes

BAT	TNG	BAT fullfilled?
48. where wet flue-gas treatment is used: a. the use of on-site physico/chemical treatment of the scrubber effluents prior to their discharge from the site, as described in 4.5.11, and thereby to achieve, at the point of discharge from the effluent treatment plant (ETP), emission levels generally within the BAT associated operational emission level ranges that are identified in Table 5.4 [See at the end of this document] b. the separate treatment of the acid and alkaline waste water streams arising from the scrubber stages, as described in 4.5.13, when there are particular drivers for the additional reduction of releases to water that result, and/or where HCl and/or gypsum recovery is to be carried out c. the re-circulation of wet scrubber effluent within the scrubber system, and the use of the electrical conductivity (mS/cm) of the re-circulated water as a control measure, so as to reduce scrubber water consumption by replacing scrubber feed-water, as de- scribed in 4.5.4 d. the provision of storage/buffering capacity for scrubber effluents, to provide for a more stable waste water treatment process, as described in 4.5.10 e. the use of sulphides (e.g. M-trimercaptotriazine) or other Hg binders to reduce Hg (and other heavy metals) in the final effluent, as described in 4.5.11 f. when SNCR is used with wet scrubbing the ammonia levels in the effluent discharge may be reduced using ammonia stripping, as described in 4.5.12, and the recovered ammonia re-circulated for use as a NOX reduction reagent	No wet flue gas treatment is used.	Not relevant

BAT	TNG	BAT fullfilled?
49. the use of a suitable combination of the techniques and principles described in 4.6.1 for improving waste burnout to the extent that is required so as to achieve a TOC value in the ash residues of below 3 wt % and typically between 1 and 2 wt %, including in particular: a. the use of a combination of furnace design (see combustion technology selection in 4.2.1), furnace operation (see 4.2.17) and waste throughput rate (see 4.2.18) that provides sufficient agitation and residence time of the waste in the furnace at sufficiently high temperatures, including any ash burn-out areas b. the use of furnace designs that, as far as possible, physically retain the waste within the combustion chamber (e.g. narrow grate bar spacings for grates, rotary or static kilns for appreciably liquid wastes) to allow its combustion. The return of early grate riddlings to the combustion chamber for re-burn may provide a means to improve overall burn out where they contribute significantly to the deterioration of burnout (see 4.2.21) c. the use of techniques for mixing and pre-treatment of the waste, as described in BAT 11, according to the type(s) of waste received at the installation d. the optimisation and control of combustion conditions, including air (oxygen) supply and distribution, as described in BAT 18	The expected value of TOC is < 1%. A combination of different techniques/measures is used to improve the waste burnout: - optimal combustion conditions with a classic combustion control system, - flow optimised secondary combustion chamber, - visual check of the fire on the grate, - optimal design of the boiler geometry, - optimal temperature distribution on the grate, - optimal waste distribution over the grate - adjustment of particular grate speed - ensuring that the plant is operated within its capacity (fire control diagram) - good mixing of the waste before feeding	Yes
50. the separate management of bottom ash from fly ash and other FGT residues, so as to avoid contamination of the bottom ash and thereby improve the potential for bottom ash recovery, as described in 4.6.2. Boiler ash may exhibit similar or very different levels of contamination to that seen in bottom ash (according to local operational, design and waste specific factors) – it is therefore also BAT to assess the levels of contaminants in the boiler ash, and to assess whether separation or mixing with bottom ash is appropriate. It is BAT to assess each separate solid waste stream that arises for its potential for recovery either alone or in combination.	There is a separate management of bottom ash from fly ash and FGT residues. The FGT residues will be stored in separate enclosed silos before being transported by sealed tankers to an appropriate offsite treatment facility. This complies with the hazardous waste legislation.	Yes
51. where a pre-dedusting stage (see 4.6.3 and 4.4.2.1) is in use, an assessment of the composition of the fly ash so collected should be carried out to assess whether it may be recovered, either directly or after treatment, rather than disposed of	No pre-dedusting stage is installed.	Not relevant
52. the separation of remaining ferrous and non-ferrous metals from bottom ash (see 4.6.4), as far as practicably and economically viable, for their recovery	A magnetic separator is placed above a conveyor to remove ferrous metals from bottom ash.	Yes

BAT	TNG	BAT fullfilled?
53. the treatment of bottom ash (either on or off-site), by a suitable combination of: a. dry bottom ash treatment with or without ageing, as described in 4.6.6 and 4.6.7, or b. wet bottom ash treatment, with or without ageing, as described in 4.6.6and 4.6.8, or c. thermal treatment, as described in 4.6.9 (for separate treatment) and 4.6.10 (for in-process thermal treatment) or d. screening and crushing (see 4.6.5) to the extent that is required to meet the specifications set for its use or at the receiving treatment or disposal site e.g. to achieve a leaching level for metals and salts that is in compliance with the local environmental conditions at the place of use.	The bottom ash is treated according to b) before reuse or landfill	Yes
54. the treatment of FGT residues (on or off-site) to the extent required to meet the acceptance requirements for the waste management option selected for them, including consideration of the use of the FGT residue treatment techniques described in 4.6.11	The FGT residues will be stored in separate enclosed silos before being transported by sealed tankers to an appropriate offsite treatment facility. This complies with the hazardous waste legislation.	Yes
55. the implementation of noise reduction measures to meet local noise requirements (techniques are described in 4.7 and 3.6)	Noise reduction measures are installed at the turbine-generator, at the fans and at other critical plant sections.	Yes
56. apply environmental management. A number of environmental management techniques are determined as BAT. The scope (e.g. level of detail) and nature of the EMS (e.g. standardised or non-standardised) will generally be related to the nature, scale and complexity of the installation, and the range of environmental impacts it may have. BAT is to implement and adhere to an Environmental Management System (EMS) that incorporates, as appropriate to individual circumstances, the following features: (see Chapter 4.8) [Number of bullet points omitted]	The plant is operated by qualified personnel and the staff will be sent to relevant qualifying courses. To ensure that employees are aware of the relevant parts of the environmental permit, regular dialogue meetings are held with the employees. The plant is ISO 14001 and OHSA 18001 certified. Additional information can be found in the quality manual where environmental measurements, reports and factors such as environmental requirements, responsibilities and competencies of facilities and technical installations are described. The operator is responsible to install the environmental system.	Yes
57. the storage of all waste, (with the exception of wastes specifically prepared for storage or bulk items with low pollution potential e.g. furniture), on sealed surfaces with controlled drainage inside covered and walled buildings	The waste is stored in the waste bunker. The waste bunker has sealed surfaces.	Yes

BAT	TNG	BAT fullfilled?
58. when waste is stockpiled (typically for later incineration) it should generally be baled (see Section 4.1.4.3) or otherwise prepared for such storage so that it may be stored in such a manner that risks of odour, vermin, litter, fire and leaching are effectively controlled.	The risks of odour, vermin, litter, fire and leaching are effectively controlled because the waste is stockpiled in a closed building. There is no influence to the environment (only the open delivery boxes).	Yes
59. to pre-treat the waste, in order to improve its homogeneity and therefore combustion characteristics and burn-out, by: a. mixing in the bunker (see 4.1.5.1), and b. the use of shredding or crushing for bulky wastes e.g. furniture (see 4.1.5.2) that are to be incinerated, to the extent that is beneficial according to the combustion system used. In general grates and rotary kilns (where used) require lower levels of pre-treatment (e.g. waste mixing with bulky waste crushing) whereas fluidized bed systems require greater waste selection and pre- treatment, usually including full shredding of the MSW.	The pre-treat of waste in order to improve its homogeneity is a) mixing of waste in the bunker b) shredding of waste.	Yes
60. the use of a grate design that incorporates sufficient cooling of the grate such that it permits the variation of the primary air supply for the main purpose of combustion control, rather than for the cooling of the grate itself. Air-cooled grates with well distributed air cooling flow are generally suitable for wastes of average NCV of up to approx 18 MJ/kg. Higher NCV wastes may require water (or other liquid) cooling in order to prevent the need for excessive primary air levels (i.e. levels that result in a greater air supply than the optimum for combustion control) to control grate temperature and length/position of fire on the grate (see section 4.2.14)	For the grate a combination of water cooled blocks and air cooled blocks is used. The calorific value is below 18 GJ/t (usually 10-11 GJ/t).	Yes
61. the location of new installations so that the use of CHP and/or the heat and/or steam utilisation can be maximised, so as to generally exceed an overall total energy export level of 1.9 MWh/tonne of MSW (ref. Table 3.42), based on an average NCV of 2.9 MWh/tonne (ref. Table 2.11)	Currently no heat or steam export is planned (however the plant is designed for heat export in case of future possibilities)	Yes

BAT	TNG	BAT fullfilled?
62. in situations where less than 1.9 MWh/tonne of MSW (based on an average NCV of 2.9 MWh /tonne) can be exported, the greater of: a. the generation of an annual average of 0.4 – 0.65 MWh electricity/tonne of MSW (based on an average NCV of 2.9 MWh/tonne (ref. Table 2.11) processed (ref. Table 3.40), with additional heat/steam supply as far as practicable in the local circum- stances, or b. the generation of at least the same amount of electricity from the waste as the annual average electricity demand of the entire installation, including (where used) on-site waste pre-treatment and on-site residue treatment operations (ref. Table 3.48)	The annual average production is 1,02 MWh electricity/tonne of waste.	Yes
63. to reduce average installation electrical demand (excluding pre-treatment or residue treatment) to be generally below 0.15 MWh/tonne of MSW processed (ref. Table 3.47 and section 4.3.6) based on an average NCV of 2.9 MWh/tonne of MSW (ref. Table 2.11)	The electrical demand of the of the plant is 0,123 MWh electricity/tonne of waste.	Yes
64. the storage of wastes: a. in enclosed hoppers or, b. on sealed surfaces with controlled drainage inside covered and walled buildings	The waste is stored in the waste bunker. The waste bunker has sealed surfaces and is inside a closed building.	Yes
65. when waste is stockpiled (typically for later incineration) it should generally be baled (see Section 4.1.4.3) or otherwise prepared for such storage so that it may be stored in such a manner that risks of odour, vermin, litter, fire and leaching are effectively controlled	see point 58.	
66. at new and existing installations, the generation of the greater of: a. an annual average of generally at least 0.6 – 1.0 MWh electricity/tonne of waste (based on an average NCV of 4.2 MWh/tonne), or b. the annual average electricity demand of the entire installation, including (where used) on-site waste pretreatment and on-site residue treatment operations	The annual average production is 1,02 MWh electricity/tonne of waste.	Yes

BAT	TNG	BAT fullfilled?
67. the location of new installations so that: a. as well as the 0.6 – 1.0 MWhe/ tonne of electricity generated, the heat and/or steam can also be utilised for CHP, so that in general an additional thermal export level of 0.5 – 1.25 MWh/tonne of waste (ref. section 3.5.4.3) can be achieved (based on an average NCV of 4.2 MWh/tonne), or b. where electricity is not generated, a thermal export level of 3 MWh/tonne of waste can be achieved (based on an average NCV of 4.2 MWh/tonne)	The annual average production is 1,02 MWh electricity/tonne of waste.	Yes
68. to reduce installation energy demand and to achieve an average installation electrical demand (excluding pretreatment or residue treatment) to generally below 0.2 MWh/tonne of waste processed (ref. Table 3.47 and section 4.3.6) based on an average NCV of 4.2 MWh/tonne of waste	The electrical demand of the plant is 0,123 MWh electricity/tonne of waste.	Yes

APPENDIX 5
TREATMENT OF WASTE WOOD

RAMBØLL

ENERGY

MEMO

Job	**Treatment of Waste Wood**
Client	**DADI TNG NSW**
Memo no.	**3**
Date	**18/02/2016**
To	**To whom it may concern**
From	**Martin Brunner**
Copy to	**Ian Malouf (DADI)** **Phill Andrew (Savills)** **Rachael Snape (Urbis)** **Geert Stryg (Ramboll)**

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Introduction

This Memo summarises the information of two important reports on waste wood treatment.

The first report is a study from the Danish Government with the target to evaluate the consequences of increased metal concentration due to the treatment of shredder residue and impregnated wood.

The second report is a study from the WRAP (Waste & Resources Action Programme). In this report potential options for diverting treated wood waste away from landfill were identified.

1. Report of the Danish Environmental Protection Agency (Miljøstyrelsen)

The Danish Government's resource strategy, "Denmark without waste", defined new guidelines for the handling of waste within the Danish municipalities. The new handling includes more waste separation, which, in the future, will result in a changed composition of the waste that is used for energy recovery, compared to the composition today. The resource strategy also demands an increased degree of energy recovery from shredder residue and impregnated wood. Both of these waste fractions have a relatively high concentration of environmentally problematic trace metals.

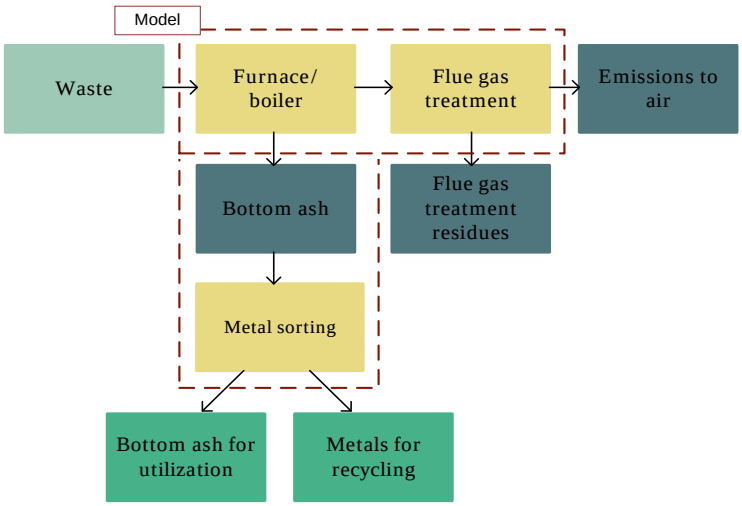
The Danish Environmental Protection Agency (Miljøstyrelsen) had asked for a study evaluating the consequences of an increased metal concentration in the waste which led to Waste-to-Energy facilities. In the evaluation the impact of the metals on the air emissions and the residues, i.e. bottom ash and flue gas treatment residue was estimated.

For the evaluation of the influence of incinerating impregnated wood, shredder residue and shredder residue with a high metal content, a number of scenarios were developed. The scenarios are for the subsequent evaluations.

- Basic waste (mixed waste suited for incineration)
- Basic waste and 10% collected impregnated wood
- Basic waste and 10% shredder residue
- Basic waste and 10% shredder residue with high metal concentrations

Each scenario was modelled with regard to waste composition and expected composition of the resulting incineration residues. Additionally, the amount of metal that can be extracted from the bottom ashes and recycled was investigated. Whether or not the bottom ashes are still suitable for further utilization (e.g. road construction) was investigated as well.

The model developed for the evaluation can be visualized as shown below:



Conclusions

The consequences of incinerating shredder residue and impregnated wood are:

Co-incinerating 10% collected impregnated wood along with the basic waste, brings an increase of the average arsenic content in the waste, whereas the concentrations of copper and chromium do not differ significantly from the basic waste. The increased arsenic content will primarily end up in the residues from the flue gas cleaning process, and to some extent the concentration in the bottom ash is also increased. It is, however, probable that the concentration of arsenic in leachate will not increase.

Full-scale tests with co-incineration of impregnated wood have not shown a significant increase of arsenic emissions to air. Air emissions of arsenic (and trace metals in general) are rather dependent on technology and operation than on the concentration in the feed.

By incinerating 10% shredder residue mixed with the basic waste, there is an increase of metals (copper, lead, zinc and others) in the bottom ash compared to bottom ash of an incineration of 100% basic waste. The increase can be assigned to the increased metal content of the shredder residue which, to a large degree, can be extracted and recycled. The bottom ash has a slightly increased concentration of trace metals, even after a sorting process, but full scale tests showed no indication of increased trace metal concentrations in leachate.

The concentration of trace metals in flue gas cleaning residues is increased when co-combusting shredder residue. Full scale test showed however, that the incineration of 10% shredder residue mixed with basic waste does not lead to increased trace metal emissions compared to the incineration of 100% basic waste.

Reference
Ministry of Environment and Food of Denmark, Environmental Project No. 1654, 2015 "Vurdering af metalholdigt affald til forbrænding" (Abstract in English) http://mst.dk/service/publikationer/publikationsarkiv/2015/mar/vurdering-af-metalholdigt-affald-til-forbraending/

2. Report Waste & Resources Action Programme

This study was conducted by TRADA Technology Ltd and Enviros Consulting Ltd for the Waste & Resources Action Programme (WRAP). The objective of this work was to identify potential options to divert treated wood waste from landfill.

Treated wood waste (TWW) represents a large proportion of the arising waste wood . A WRAP study on waste composition found that (including laminated and veneered wood) an average of 85% of the wood from the analysed Civic Amenity sites was treated and 23% of the wood from the analysed construction and demolition sites was treated. Another WRAP study on assessing the management for TWW estimated that in total, the UK produces up to 3.3 million tonnes of TWW per year.

For this study, TWW was defined as wood that had been treated with at least one of the following:

- Copper, Chromium, Arsenic (CCA)
- Copper Organics
- Creosote
- Light Organic Solvent Preservatives (LOSP)
- Micro-emulsion
- Paint / stain
- Varnish

The following options were identified to divert TWW from undesirable disposal such as landfill or incineration without energy recovery:

- *Reuse* - the reuse of an item for its original purpose. An application can be found for the TWW without (/with minimal) additional processing
- *Recycling / composting* - the TWW is reprocessed into an alternative product
- Thermal treatment - recovery of energy and/or process by-products

Thermal treatment as an option to process TWW

Wood treated with heavy metals and halogenated organic compounds falls under the scope of the Industrial Emission Directive (IED) which imposes strict emission levels for a range of materials including arsenic. Arsenic is a particular issue because its highly volatile nature makes the emissions difficult to control. In addition, ash generated from the combustion of Copper Chrome Arsenic (CCA) TWW is considered to be hazardous waste.

Evaluation of options for managing TWW

The identified options were reviewed and assessed against a set of 10 decision criteria identified as important to determine the current status and capability of the option to manage the different types of TWW. The criteria included development status, cost and environmental impact. Options were assigned a score on a scale of 1 to 5 whereby a score of 1 was a poor performance and a score of 5 was a good performance. The assessment process identified the technically most viable options (with some being less suitable for all types of TWW). For those options a a risk assessment was conducted to identify preferred waste management options.

The following options were analysed in a risk assessment:

- Direct reuse
- Recycling to panelboard
- Recycling to mulch
- Recycling to animal bedding
- Recycling to compost
- Recycling to wood cement composites
- Thermal processing and disposal

Risk Assessment of options for managing TWW

A risk assessment is conducted to determine if a proposed activity poses an acceptable risk. This involves the identification of hazards, an assessment of the likelihood of the occurrence of the hazard and a comparison of the outcome to an accepted standard. For this assessment the hazards associated with treated wood waste were identified. The likelihood of the hazard being present does not require an evaluation because it was assumed that the TWW is in the waste stream. The outcome of the assessment was compared to available standards.

Treatment loadings were based on the British Standard loading levels, however, for certain service situations lower levels than those prescribed by the British Standard are often used in practice, and some of these were also assessed.

The results are summarised in the following matrix. The matrix shows that for the more hazardous preservative treated wood wastes, CCA and creosote, the options are more limited. However, reuse is a feasible option which, in the waste management hierarchy, is the most favourable option apart from waste prevention at the source.

Risk Assessment Summary

	Re-use	Panel board / wood cement	Mulch	Animal bedding	Compost	Thermal treatment
CCA (Cr, Co, As)	✓	✓	×	×	×	✓
Creosote	✓	✓	×	×	×	✓
Paint/varnish	✓	✓	✓	?	≈	✓
LOSP	✓	✓	≈	?	≈	✓
Micro-emulsion	✓	✓	≈	?	≈	✓
Copper organics	✓	✓	?	?	?	✓

✓ treatment option considered feasible on the basis of the assessed risks within regulatory limits.

× treatment option precluded through risk or legislative barriers.

≈ treatment option may be possible – assessed levels of exposure are several orders of magnitude below the identified LD50 values. Further investigation is required.

? treatment option is unlikely to be possible – assessed levels of exposure are close to the identified LD50.

For thermal processing and subsequent disposal the risk assessment has determined that all the categories of waste wood identified are feasible and meet the regulatory requirements.

Conclusions

- Many very different technologies have been developed to remediate TWW (especially Chrome, Copper, Arsenic - CCA), but none is able to achieve a 100% remediation and none is developed to operate at a commercial scale.
- There is a high potential to reuse most types of TWW, although CCA and creosote treated material would have to be used for applications where close contact with people and animals is unlikely.
- There is potential to use TWW in panels and cement composites. However, panelboard from 100% CCA and creosote treated material would have to be used for applications where direct contact with people and animals is unlikely. The use will also be restricted by an industry standard for panel production which imposes strict limits on permitted levels of identified heavy metals (which includes copper chromium and arsenic), creosote and PCP.
- For mulch products, compost and animal bedding there are likely to be legislative restrictions for the use of wood treated with CCA and creosote. There might be potential to use other TWW materials but further investigation is required.
- **Thermal treatment is suitable for all types of TWW. It is important to control the emissions. This is a particular issue for arsenic, which is highly volatile but will be effectively eliminated by state of the art APC control.**

Reference

Options and Risk Assessment for Treated Wood Waste, The Waste & Resources Action Programme http://www2.wrap.org.uk/downloads/Options_and_Risk_Assessment_for_Treated_Wood_Waste.6ac4f667.2237.pdf

APPENDIX 6
WASTE COMPOSITION

RAMBØLL ENERGY

MEMO

Job	**TNG reference plants – Waste composition**
Client	**DADI TNG NSW**
Memo no.	**2**
Date	**23/02/2016**
To	**To whom it may concern**
From	**Martin Brunner**
Copy to	**Ian Malouf (DADI)**
	Phill Andrew (Savills)
	Rachael Snape (Urbis)
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1. Introduction

It has been questioned to which extent the reference facilities are comparable to the TNG project in view of technology as well as fuel. This memo compiles the basic information like technology, chemical analysis, fuel mix or bottom ash quantities of the different reference facilities and compares them with the design values of the TNG project.

2. Relevance of reference technologies and plants

Evaluating the significance of the reference plants it is important to understand which key parameters relate to which part of the technology.

Made by	AHTE
Checked by	MBR
Approved by	GES

Revision: 200

The suitability of the **furnace / boiler** technology highly depends on the fuel characteristics (calorific value, water and ash content) as well as the macroscopic appearance (particle size distribution) of the waste. The only emission parameters influenced by the furnace/boiler technology are the residual carbon in the ash and the TOC and CO content of the flue gas.

The **air pollution control** system is designed depending on the chemical composition/contaminant concentration of the waste. Most important factor - as it primarily defines the amount of consumables and the design residence time - is the chlorine content of the waste. The APC includes multiple steps of elimination and therefore all other contaminants in the waste (especially the heavy metals and trace organic substances) are rather of secondary importance for the APC performance.

As a result of the above it can be said that a facility is a relevant reference for the furnace/boiler technology when it contains a comparable (CV, size distribution) waste feedstock and is relevant for the APC if there is a comparable chlorine content of the waste. Given that a plant fulfils the aforesaid requirements, it can be therefore concluded that it is a relevant reference for the emissions of the TNG facility.

3. Key plant parameters (appendix A)

This attachment shows the key plant parameters as capacity, fuel mix and furnace/boiler as well as APC technology/supplier.
There are two facilities (Grossräschen and Ferrybridge) which have a very similar capacity as the TNG project, the others have a typical size per line of European plants of approx. 150,000 tonnes per year. All plants have an important proportion of C&I waste, several have a feedstock containing only C&I and C&D waste.
All plants have AEE or HZI as supplier. From 2005 to 2010 (which is the construction and commissioning period of most of the plants) both companies belonged to the AEE group. During that time there was an intensive exchange of know-how and it can therefore be said that both companies used comparable principles for the design of their facilities.
All plants contain a semidry APC system operated with lime and activated carbon as consumable. Even if there are certain technology differences between the suppliers the basic principle of contaminant reduction remains the same irrespective of the technology.
As a result it can be said that the key performance parameters and emissions of these plants are a relevant reference for the TNG facility.

4. Chemical waste composition (appendix B)

Besides chemical composition of the design fuel of the reference facilities (where available) this appendix also shows the percentage of wood (calculated based on the chemical analysis) and the design chlorine range of the fuel.
As mentioned under point 2. of this memo, the most relevant parameters for the design of the combustion are the calorific value, the water and the ash content of the waste. It is obvious that the TNG facility lies well within the range of the reference facilities.

Waste Wood

Concerning the percentage of wood the TNG facility again is comparable with other facilities especially Premnitz, a facility which is also exclusively fuelled by CI and C&D waste. The rather high value of Ferrybridge is due to the fact that this facility additionally accepts a separate wood fraction. Additional information on the treatment of waste wood is found in **memo 3**.

Chlorine

In view of the APC design the chlorine content of the waste is relevant. Here again it is obvious that the TNG facility is well within the range of the other facilities. It should be noted, that the facilities of Premnitz, Knapsack and Mallorca have chlorine values above 1% and are all categorised as facilities with a necessary furnace temperature of 850°C. The facility of Knapsack even allows 1.7% chlorine in their feedstock.

The main contribution to the chlorine content of the waste is PVC. PVC (C_2H_3Cl) itself contains approx. 57% of Chlorine. In municipal waste typically approximately 50 % of the chlorines come from PVC, in C&I waste the contribution of PVC to the overall Chlorine content is expected to be even higher.

In the EU regulation the following is stated: "*If **hazardous waste** with a content of more than 1 % of halogenated organic substances, ...*" . We are aware that the EFW policy from NSW only states: "*If **a waste** has a content of more than 1% of halogenated organic substances, ..*". Nevertheless PVC is not considered a hazardous material.

During combustion PVC is fully decomposed to CO_2, HCl and water vapour. The HCl will be eliminated by the Air Pollution Control (APC) system which is designed, controlled and operated to capture such substances even when occurring as a spike. The chosen APC technology for this facility is standard in modern WTE plant with comparable feedstock and with continuously very low emissions.

Mixing of waste

The fuel of TNG has some fractions containing PVC and their chlorine content will be slightly above 1%, nevertheless the waste in total and as an average will not contain more than 1% chlorine. Main reason for this is the extensive mixing of waste before feeding it to the combustion process.

The mixing and homogenisation of the different waste streams is a very important aspect of the operation of a waste-to-energy plant and therefore it is given a very high importance. When the waste is tipped in to the bunker it has to be picked up by the crane grab so to keep the delivery area free and allow further waste deliveries. The waste is then offloaded in the storage area. During times with low delivery it is the duty of the crane driver (or in the case of an automatic crane of the automation system) to thoroughly mix the waste by picking it up and dropping it in a different place of the storage area. This ensures a thorough mixing of the different waste fractions. To be fed to the combustion system the waste is again picked up by the crane grab.

As a result any waste is picked and offloaded at least 2 to 3 times before being fed into the combustion process and therefore is well mixed. As a conclusion it is reasonable to assume that the contaminant concentrations of the different waste streams will be well homogenised when being fed to the combustion process.

5. Fuel mix (appendix C)

This appendix shows the fuel mix based on different categories (mixed C&D, mixed C&I, SRF/solid recovered fuel) of the reference plants. Obviously there is no plant with an “identical” fuel, however it can be seen that many of the reference plants have much higher fractions of mixed C&I which is the most difficult fuel. The fraction of mixed C&D is higher in the case of TNG, yet C&D waste mainly contains wood and therefore is an easy fuel, especially when it has been first sorted and shredded.

6. Bottom ash quantity (appendix D)

This attachment lists the operational “real” bottom ash quantities of different plants. As mentioned in memo 1 (point 4.) the bottom ash quantity is a result of the fuel composition and does not depend on the technology.

Based on the waste mix of the TNG facility a bottom ash quantity of 21.5% (on dry basis) of the fuel input was calculated. The operational data from the reference plant show bottom ash quantities in the order of 20 to 25% (on dry basis) of the waste input. Exceptions are Ferrybridge with a separate stream of wood (which can have rather low ash content) and Mallorca with a very special fuel mix (especially tyres).

The TNG project also has a relevant wood input, however this wood is part of the C&D waste. Wood from C&D waste often has rests of cement or plaster sticking to it and screws or nails left in it which increases the calculated “ash” content. As a result it can be concluded that the assumption of 21.5% for TNG is a conservative and reasonable value.

Appendix A Reference Facilities

Key Plant Parameters

Facility / Location	Country	Start up	Capacity t/a	Fuel mix	Furnace / Boiler	Supplier Furnace / Boiler	APC	Supplier APC
TNG	AU	-	4 x 276'250	C&I, C&D	Grate	HZI	Semi dry (lime)	HZI
Grossräschen	DE	2008	1 x 246'000	C&I, C&D	Grate	AEE*	Semi dry (lime)	LAB
Heringen	DE	2009	2 x 148'500	C&I, C&D, some MSW	Grate	AEE*	Semi dry (lime)	LAB
Premnitz	DE	2008	1 x 150'000	C&I, C&D	Grate	AEE*	Semi dry (lime)	Lühr
Hannover	DE	2005	2 x 140'000	C&I, C&D, some MSW	Grate	AEE*	Semi dry (lime)	LAB
Knapsack	DE	2009	2 x 150'000	C&I, C&D	Grate	AEE*	Semi dry (lime)	Lühr
Ferrybridge	UK	2015	2 x 256'500	C&I, C&D, some MSW, wood	Grate	HZI	Semi dry (lime)	HZI
Riverside	UK	2011	3 x 195'000	MSW, C&I	Grate	HZI	Semi dry (lime)	HZI
TIRME Mallorca	ES	2009	4 x 104'000	MSW, C&I, C&D, Hospital waste, sewage sludge, tyres	Grate	HZI	Semi dry (lime)	HZI

* AEE up to 2010 HZI was part of the AEE Group

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Appendix B Reference Facilities

Chemical Analysis Design Fuel

		TNG	Grossräschen	Heringen	Premnitz	Hannover	Knapsack	Ferrybridge	Riverside	TIRME Mallorca
Carbon (C)	%	31.4	35.2	n.a.	28.5	n.a.	n.a.	35.6	26.6	27.4
Hydrogen (H)	%	4.1	1.9	n.a.	4.0	n.a.	n.a.	5.2	3.8	2.9
Nitrogen (N)	%	0.3	3.8	n.a.	0.3	n.a.	n.a.	0.6	0.5	1.2
Sulphur(S)	%	0.4	0.4	n.a.	0.2	n.a.	< 0.8	0.2	0.1	0.2
Chloride (Cl)	%	0.9	0.7	n.a.	0.5	n.a.	1.2	0.5	0.7	0.5
Oxygen (O)	%	18.1	14.3	n.a.	19.5	n.a.	n.a.	25.1	17.8	11.6
Water (H2O)	%	23.4	25.0	n.a.	22.0	n.a.	18.0	20.0	30.8	27.8
Ash	%	21.5	18.8	n.a.	25.0	n.a.	19.0	12.8	19.7	28.5
Total	%	100.0	100.0	-	100.0	-	-	100.0	100.0	100.0
NCV	MJ/kg	12.30	12.50	12.6	13.00	13.5	15.00	13.50	9.60	10

source: HZI

Percentage of wood (estimation based on chemical analysis of waste)

		TNG	Grossräschen	Heringen	Premnitz	Hannover	Knapsack	Ferrybridge	Riverside	TIRME Mallorca
Wood	%	30.2	23.9	n.a.	32.7	n.a.	n.a.	42.0	29.8	19.4

Chloride range of fuel (average)

		TNG	Grossräschen	Heringen	Premnitz	Hannover	Knapsack	Ferrybridge	Riverside	TIRME Mallorca
Cl	%	0.88	0.70	n.a.	0.2-1.5	n.a.	0.5-1.7	0.50	n.a.	0.2-1.1

n.a = not available

Appendix C Reference Facilities

Fuel Mix

	Mixed C&D								Mixed C&I						SRF from MSW	MSW
		paper/card	plastic	textile	glass	vegetation	wood	hazardous (hospital waste)		paper/card	plastic	textile	flock waste			
TNG	**28.7%**	x	x	x	x	x	x	-	**71.3%**	x	x	x	x	**0.0%**	-	-
Grossräschen *	**9.8%**	x	x	-	x	x	x	x	**83.2%**	x	x	x	x	**7.0%**	x	x
Heringen *	**13.6%**	x	x	x	-	x	x	x	**62.4%**	x	x	x	-	**24.0%**	x	-
Premnitz *	**14.3%**	x	x	x	-	x	x	x	**57.0%**	x	x	x	x	**28.7%**	x	-
Hannover *	**9.0%**	x	x	x	-	x	x	x	**75.3%**	x	x	x	x	**15.7%**	x	x
Knapsack	**10.0%**	x	x	x	-	x	x	x	**90.0%**	x	x	x	-	**0.0%**	x	-
Ferrybridge [1)]	**10.0%** [2)]	n.a.	n.a.	n.a.	n.a.	n.a	x	n.a.	**30.0%**	n.a.	n.a.	n.a.	n.a.	**60.0%**	x	x
Riverside	**n.a.**	x	x	x	x	x	x	-	**n.a.**	x	x	x	-	**n.a.**	x	-
TIRME Mallorca	**n.a.**	n.a.	n.a.	n.a.	n.a.	n.a	n.a.	n.a.	**n.a.**	n.a.	n.a.	n.a.	n.a.	**n.a.**	x	x

[1)] Design Waste

[2)] Waste Wood

* values from the year 2014, see https://www.itad.de/information/abfallverwertungsanlagen

all other values given from the operators verbally

SRF Solid Recovered Fuel

MSW Municipal Solid Waste

n.a. not available

Appendix D Reference Facilities

Bottom Ash Quantities (operation data 2014)

Facility / Location	LHV @ LPN MJ/kg	Capacity t/a	Fuel mix	bottom ash (wet) t/a	bottom ash Quantity (wet) %	bottom ash Quantity (dry) %	Remarks
TNG	12.3	4 x 276'250	C&I, C&D	293'166	26.5%	21.5%	
Grossräschen	12.5	1 x 246'000	C&I, C&D	68'729	27.9%	22.4%	
Heringen	12.6	2 x 148'500	C&I, C&D, some MSW	91'243	30.7%	24.6%	
Premnitz	11.2	1 x 150'000	C&I, C&D	no data	-	-	
Hannover	13.5	2 x 140'000	C&I, C&D, some MSW	49'460	17.7%	14.1%	
Knapsack	11-17	2 x 150'000	C&I, C&D	81'000	27.0%	21.6%	
Ferrybridge	8.5	2 x 256'500	C&I, C&D, some MSW, wood	57'830	11.3%	9.0%	Design Fuel 12.8%
Riverside	9.6	3 x 195'000	MSW, C&I	146'250	25.0%	20.0%	
TIRME Mallorca	10	4 x 104'000	MSW, C&I, C&D, Hospital waste, sewage sludge, tyres	67'100	13.0%	10.4%	

water content 20%

APPENDIX 7
GREEN STAR CONSTRUCTION & DEMOLITION WASTE REPORTING CRITERIA

Green Star

Construction & Demolition Waste Reporting Criteria

greenstar Developed by the Green Building Council of Australia

Table of Contents

VERSION CONTROL

Version	Release Date	Description of Changes
1.0	*21 June 2013*	*First release*

Executive Summary

This document details the reporting criteria and auditor requirements which accompany the Construction and Demolition Waste credit in Green Star rating tools released in June 2013.

The Green Star Construction And Demolition Waste Reference Group, which was comprised of experts in the waste management industry from 47 organisations across the country, including 24 GBCA members, has contributed advice and expertise to the development of the construction and demolition waste management 'Reporting Criteria' and has helped to inform the functionality of the new 'Construction and Demolition Waste' credit.

All Green Star rating tools include a Construction and Demolition Waste credit which aims to encourage and reward management practices that minimise the amount of construction and demolition waste from base building and/or interior fitout works that is disposed to landfill. The credit requires the use of waste contractors and waste processing facilities that have been independently verified for compliance with minimum standards of reporting. The introduction of such compliance standards and checks aims to ensure contractors and facilities are operating with environmentally responsible due diligence on behalf of Green Star projects.

Verification of compliance with these reporting criteria would be carried out by 'Suitably Qualified Auditors' who are engaged directly by a Green Star project applicant's waste contractor/s and waste processing facilities. An auditor's report is to be provided to Green Star projects by the waste contractor as supporting evidence for the project's 'Construction and Demolition Waste' credit claim. Only waste reports that have been generated by waste contractors whose compliance has been verified will be accepted in a Green Star project's 'Construction and Demolition Waste' credit submission.

About the Green Building Council of Australia and Green Star

The Green Building Council of Australia (GBCA) is the nation's authority on sustainable buildings and communities. Our mission is to accelerate the transformation of Australia's built environment into one that is healthy, liveable, productive, resilient and sustainable. We work together with industry and government to encourage policies and programs that support our mission. We educate thousands of people each year on how to design and deliver sustainable outcomes for our buildings and communities. And we operate Australia's only national, voluntary, holistic rating system for sustainable buildings and communities - Green Star.

Green Star was developed for the property industry in order to:

- Establish a common language;
- Set a standard of measurement for green buildings;
- Promote integrated, whole-building design;
- Recognise environmental leadership;
- Identify building life-cycle impacts; and
- Raise awareness of green building benefits.

Definitions

The following definitions apply to the Green Star 'Construction and Demolition Waste' credit and the Green Star construction and demolition waste management 'Reporting Criteria' (this document):

Applicant
Refers to the waste contractor and/or waste processing facility commissioning an evaluation by an auditor.

Construction and demolition waste
The waste material produced during the construction, renovation, demolition or deconstruction of buildings and their infrastructure. Construction and demolition waste materials typically include concrete, wood, metals, plasterboard, cardboard, plastics, asphalt, and mixed site debris like soil and rocks and excludes spoil/fill and hazardous and prescribed materials.

Compliance Verification Summary
A signed and dated document issued by a 'Suitably Qualified Auditor' that verifies and summarises the waste contractor's or waste processing facility's (auditee's) compliance with the Green Star 'Reporting Criteria'. A Compliance Verification Summary is valid for 12 months from the date of issue and must be current for the duration of the time that an auditee provides waste services and waste reports to a Green Star project.

Green Star Construction and Demolition (C&D) Waste Management Reporting Criteria
Are criteria that establish the minimum acceptable standard of operations and reporting for waste contractors and waste processing facilities that provide services and reports to Green Star projects. Waste contractors and waste processing facilities that provide waste management and reporting services to Green Star projects must achieve independent verification of their compliance with the criteria. Such verification of compliance is a prerequisite for the recognition and acceptance of the waste reports that are provided within Green Star 'Construction and Demolition Waste' credit submissions. The Reporting criteria are detailed in sections three, four and five of this document.

Landfill
Refers to a site where waste materials are disposed of by way of burial between layers of soil.

Residual Waste
Refers to the material remaining after the resource recovery process has taken place. In accordance with waste hierarchy principles, this remaining material has no other viable fate than to be used as fuel for energy recovery or committed to landfill.

Suitably Qualified Auditor
Refers to an auditor who has the relevant knowledge, skills and experience necessary to provide advice to applicants on the issues addressed in the Reporting Criteria. It does not refer to 'Appointed Auditors' as defined under various State Environment Protection Acts. Auditors must be independent with a particular focus on how they manage conflicts of interest with applicants (i.e. they must be an external, independent, third-party auditor). They must also provide evidence of their qualifications as defined in this document. See section seven of this document for further information.

Waste Contractor
Refers to the company or person(s) engaged by a builder, developer or owner of a structure to manage the containerisation, collection and transportation of construction and demolition waste from a construction site to recyclers or waste processing facilities. Waste contractors must provide their customers with reports on the contents, dates, volumes or weights of construction and

demolition waste, as well as the waste processing facility destinations and registration numbers of the vehicles transporting waste from the site to processing facilities.

Waste Processing Facility
Is a lawfully operating facility that receives construction and demolition waste for processing. The facility recovers recyclable materials from the waste stream, including for energy, thereby minimising the amount of residual waste committed to landfill. Waste processing facilities include resource recovery facilities, transfer stations and waste-to-energy facilities where waste is sorted. Reprocessing facilities are also included in this definition. ‘Reprocessing facility’ refers to businesses that trade in specific waste material types for the purpose of transforming (recycling) it into new products. Examples include metal, concrete, paper and plastic recyclers. Any of the above listed facilities operating on the same site as a landfill are included under this definition, however landfill itself is not.

Reporting Criteria

The reporting criteria outlined in this document support the Green Star 'Construction and Demolition Waste' credit, and attempt to provide additional assurance to Green Star customers, by creating auditable pathways to ensure:

1. Waste Contractors (transport and handlers) servicing Green Star buildings:
    - Provide accurate reporting on waste collection and diversion from landfill; and
    - Take all of a project's construction and demolition waste to waste processing facilities that meet the Reporting Criteria.
2. Waste processing facilities that accept Green Star project construction and demolition waste:
    - Operate legally with approved Development Approvals (DAs), and the relevant environmental licenses, etc;
    - Have auditable systems in place to prepare accurate reports on inbound and outbound waste; and
    - Undertake annual reporting of the independently verified gross diversion rates of waste from landfill, and the percentage of residual waste committed to landfill from their operations.

The following table summarises the reporting criteria, referencing the page of the document these criteria can be found.

INTRIM PERIOD

A 12 month interim period for establishing compliance with the Reporting Criteria commenced with the release of the Green revised Green Star 'Construction and Demolition Waste' credit and this Reporting Criteria. Allowances for interim measures are provided for some, but not all criteria. The Reporting Criteria list which components are subject to such allowances.

During the 12-month interim period, non-conformities and corrective actions issued by the auditor in relation to the compliance requirement of some criteria will be accepted on the basis of a signed 'Interim Measure Declaration' from the applicant containing the following:

1) Where reporting systems are insufficient or non-existent, but where equipment certification or enough historical data exist to carry out thorough evaluation of compliance with a criterion, the auditor may issue a corrective action to resolve the situation. The criterion will assume the status of 'Interim Period Pending Compliance' and be stated as such on the applicant's Compliance Verification Summary during the interim period. Interim Measure Declarations must be provided on official company letterhead, be signed by a company director and containing the following:
    - each non-conformance and corrective action, as issued by the auditor;
    - a statement that the non-conformances and corrective actions are understood by the applicant and that the corrective actions must be effected before the end of the interim period;
    - the steps the applicant commits to undertake in order to institute the corrective action(s);
    - the timeframe in which the corrective actions will be implemented and confirmed through a re-audit of the outstanding matter; and
    - a confirmation that the applicant understands that the consequences of not implementing all corrective actions, and the verification of such, by way of a re-audit before the end of the interim period, will be a ruling of non-compliance with the Reporting Criteria, meaning Green Star projects may no longer use their services.
2) During the interim period, and while corrective actions remain outstanding, the applicant's Interim Measure Declaration must be attached to the Compliance Verification Summary that they provide to Green Star customers.

Waste Contractors

CRITERION AIM

To ensure that the waste contractors that service Green Star building sites provide accurate reports on both the amount of construction and demolition waste removed from site and where such waste is disposed.

COMPLIANCE REQUIREMENT

The waste contractor must provide accurate monthly and cumulative waste reports that detail both the total weight of waste removed from their customers' construction sites, as well as the waste processing facilities where all loads are disposed. Reporting accuracy must be within an average five per cent margin of error.

AUDITOR VERIFICATION GUIDANCE

Auditors should verify compliance by sampling customer records for at least three medium to large size job sites (select Green Star projects if available). The two-part methodology set out below should be used to determine the accuracy of a waste contractor's reporting practices. Worked examples of the calculation methodology to determine reporting accuracy are provided for parts I and II. It is the Waste Contractor's responsibility to collate and present all inbound waste dockets forwarded by waste processing facilities.

In order to award compliance with the criterion, the average percentage variation findings for both Part I and Part II must be within a five per cent margin of error.

Collecting audit documentation:

1. Choose a three month sample operating period or 50 records covering a continuous period where less than 50 records have been generated in any continuous three months period, for each job site;
2. Obtain copies of waste contractor's waste reports to customer for sample periods;
3. Obtain waste contractor's disposal docket records for sample jobs over sample periods;
4. Obtain copies of the corresponding inbound waste dockets from the waste processing facilities for sample jobs over sample periods; and
5. Where the contractor waste report provides waste disposal figures in volume, but disposal dockets are reported in weight, the auditor must convert results to mass using the same volume-to-mass conversion factors applied by the contractor or receiving facility.

PART I: COMPARING CUSTOMERS' WASTE REPORTS WITH WASTE CONTRACTOR'S DISPOSAL DOCKETS:

1. Compare the waste disposal weight totals stated in the waste reports issued to customers against the waste contractor's disposal docket weight totals for each sample job;
2. Check that the waste processing facilities stated in the waste reports correspond with the waste processing facilities used by the waste contractor(s), as evidenced by the disposal dockets. Also check that the amounts disposed correspond with the amounts stated in the customer's waste report;

3. Record variations in the respective totals for each sampled job as a percentage of the difference to the total reported to the customer. Average the percentages and state if the variation in reporting for each sample job complies with the five per cent margin of error allowance. Where major discrepancies in the reporting arise (for example where dockets show waste disposed at facilities not reported to customer or no disposal dockets are provided to support figures in customer waste reports) then the discrepant amount should be carried forward as a whole and added to the totals component of the 'Kg Variation in Comparison of Records' column. This figure will be used in the percentage variation calculation for that sample job (see example below for clarification); and

Sample Job 1	Sample Period Reported Total Waste disposed	Sample Period Disposal Dockets totals	kg Variation in comparison of records	Percentage Variation in total reported to docket records
Waste Processing Facility 1	2500 kg	1800 kg	-700 kg	-38.89%
Concrete & Brick Recycler	4000 kg	2950 kg	-1050 kg	-35.60%
Waste Processing Facility 2	3166 kg	2800 kg	-366 kg	-13.1%
Back Yard Boys Waste Disposal	not reported	2616 kg	2616 kg	100%
Plasterboard Recycler	2500 kg	2000 kg	-500 kg	-25%
TOTAL DISPOSED	**12166 kg**	**12166 kg**	0 kg 2616 kg	~~0 %~~ **-27.39%**
Percentage variation between reported totals and disposal records of corresponding totals				**0 %** **-27.39%**

Non-Compliant reporting issue! See guidance item Part I (c) for protocol

Non-Compliant reporting accuracy margin of error

Sample Job 2	Sample Period Reported Total Waste disposed	Sample Period Disposal Dockets totals	kg Variation in comparison of records	Percentage Variation in total reported to docket records
Waste Processing Facility 1	3000 kg	2900 kg	-100 kg	-3.45%
Concrete Recycler	3000 kg	3000 kg	0 kg	0%
Waste Processing Facility 2	3000 kg	2850 kg	-150 kg	-5.26%
Metal Recycler	1000 kg	900 kg	-100 kg	-11%
TOTAL DISPOSED	**10000 kg**	**9650 kg**	**-350 kg**	**-3.63**
Percentage variation between reported totals and disposal records of corresponding totals				**-3.63%**

Compliant reporting accuracy margin of error

Sample Job 3	Sample Period Reported Total Waste disposed	Sample Period Disposal Dockets totals	kg Variation in comparison of records	Percentage Variation in total reported to docket records
Waste Processing Facility 1	2122 kg	2000 kg	-122 kg	-6.1%
Concrete Recycler	500 kg	600 kg	100 kg	16.67%
Waste Processing Facility 2	3500 kg	2900 kg	-600 kg	-23.1%
TOTAL DISPOSED	**6122 kg**	**5500 kg**	**-622 kg**	**-11.31%**
Percentage variation between reported totals and disposal records of corresponding totals				**-11.31%**

Non-Compliant reporting accuracy margin of error

4. Take the average percentage variations in reporting from each sample job and state whether or not the average variation of all sampled jobs complies with the five per cent margin of error allowance. This figure determines the applicant's compliance with part II of the criterion.

	Sample Period Reported Total Waste disposed	Sample Period Disposal Dockets totals	kg Variation in comparison of records	Percentage Variation in total reported to docket records
Sample Job 1	12166 kg	9550 kg	-2616 kg	-27.39%
Sample Job 2	10000 kg	9650 kg	-350 kg	-3.63%
Sample Job 3	6122 kg	5500 kg	-622 kg	-11.31%
Average percentage variation between reported totals and disposal records of corresponding totals				**-14.11%**

Non-Compliant reporting accuracy margin of error

PART II: COMPARING WASTE CONTRACTOR'S DISPOSAL DOCKETS WITH WASTE PROCESSING FACILITY RECORDS:

1. Compare the waste contractor's disposal docket weight totals for each sample job against the corresponding inbound waste dockets from the waste processing facilities for the sample jobs over the sample periods;
2. Record variations in the respective totals for each sampled job as a percentage of the difference to the total waste received as reported in the waste processing facilities records.

Average the percentages and state if the variation complies with the five per cent margin of error allowance. Where major discrepancies in the reporting arise (for example where waste processing facility records do not exist or cannot be obtained to support a waste contractor's docket) then the discrepant amount shall be carried forward as a whole and added to the totals component of the 'Kg variation in WC Dockets and WPF Records' column. This figure will be used in the percentage variation calculation for that sample job (see the example calculation for Sample Job 1 below for clarification); and

Sample Job 1	Sample Period WC Disposal Dockets totals	Sample Period WPF Receiving Dockets totals	kg Variation in WC Dockets & WPF records	Percentage Variation in total WC docket to WPF records
Waste Processing Facility 1	1800 kg	1800 kg	0 kg	0%
Concrete & Brick Recycler	2950 kg	2950 kg	0 kg	0%
Waste Processing Facility 2	2800 kg	2800 kg	0 kg	0%
Back Yard Boys Waste Disposal	2616 kg	no record	-2616 kg	100%
Plasterboard Recycler	2000 kg	2000 kg	0 kg	0%
TOTAL DISPOSED	**12166 kg**	**9550**	**-2616 kg**	**-27.39%**
Percentage variation between reported totals and disposal records of corresponding totals				**-27.39%**

Non-Compliant reporting issue! See guidance item Part II (b) for protocol

Non-Compliant reporting accuracy margin of error

Sample Job 2	Sample Period WC Disposal Dockets totals	Sample Period WPF Receiving Dockets totals	kg Variation in comparison of records	Percentage Variation in total WC docket to WPF records
Waste Processing Facility 1	2900 kg	2900 kg	0 kg	0%
Concrete Recycler	3000 kg	3000 kg	0 kg	0%
Waste Processing Facility 2	2850 kg	2500 kg	-350 kg	-14%
Metal Recycler	900 kg	900 kg	**0 kg**	**0%**
TOTAL DISPOSED	**9650 kg**	**9300 kg**	-350 kg	**-3.76%**
Percentage variation between reported totals and disposal records of corresponding totals				**-3.76%**

Compliant reporting accuracy margin of error

Sample Job 3	Sample Period WC Disposal Dockets totals	Sample Period WPF Receiving Dockets totals	kg Variation in comparison of records	Percentage Variation in total WC docket to WPF records
Waste Processing Facility 1	2000 kg	2000 kg	0 kg	0%
Concrete Recycler	600 kg	600 kg	0 kg	0%
Waste Processing Facility 2	2900 kg	2900 kg	0 kg	0%
TOTAL DISPOSED	**5500 kg**	**5500 kg**	**0 kg**	**0%**
Percentage variation between reported totals and disposal records of corresponding totals				**0%**

Compliant reporting accuracy margin of error

3. Take the average percentage variations in reporting from each sample job and state whether or not the average variation of all sampled jobs complies with the five per cent margin of error allowance. This figure below determines the applicant's compliance with Part II of the criterion.

	Sample Period WC Disposal Dockets totals	Sample Period WPF Receiving Dockets totals	kg Variation in comparison of records	Percentage Variation in total WC docket to WPF records
Sample Job 1	12166 kg	9550 kg	-2616 kg	-27.39%
Sample Job 2	10000 kg	9650 kg	-350 kg	-3.76%
Sample Job 3	5500 kg	5500 kg	0 kg	0%
Average percentage variation between reported totals and disposal records of corresponding totals				**-10.38%**

Non-Compliant reporting accuracy margin of error

SUMMARISING FINDINGS FROM REPORTING ACCURACY AUDIT AND AWARDING CRITERION COMPLIANCE:

In order to award compliance with the criterion, the average percentage variation findings for both Part I and Part II must be within the five per cent margin of error allowance.

In the example calculation, the applicant's records for the audited sample jobs and periods were found to exceed the five per cent error margin allowance. Therefore, in this example, the applicant is non-compliant with the criterion.

Part I	Part II
Average Percentage Variation in Reporting Accuracy between Customers' Waste Reports and Waste Contractor's Disposal Dockets	Average Percentage Variation in Reporting Waste Contractor's Disposal Dockets and Waste Processing Facility Receiving Records
-14.11%	**-10.38%**

INTERIM MEASURE

There are no interim measures available for this criterion.

Waste Processing Facilities: Criterion One

CRITERION AIM

To ensure that waste processing facilities servicing Green Star building sites are legitimately operating businesses that are recognised by the relevant regulatory authorities.

COMPLIANCE REQUIREMENT

The waste processing facility must hold current licenses or development consent for the activities it undertakes (for example storage, handling, transfer or processing of construction and demolition waste) by the appropriate regulatory authorities. This may include approved Development Applications (DAs) and Environment Protection Agency licenses.

AUDITOR VERIFICATION GUIDANCE

Compliance should be verified by undertaking the following steps:

1. Sight the facility's licenses or development consent approvals; and
2. Confirm the development consent approval is current and conditions are complied with to the extent relevant to resource recovery.

Non-conformances for this criterion are not permitted. Corrective actions may be issued by the auditor but shall result in criterion non-compliance until the corrective action has been verified by the auditor.

In some areas specific licensing for the storage, handling, transfer and processing of construction and demolition waste may not be required. The auditor should seek independent confirmation that such licensing requirements do not exist.

INTERIM MEASURE

There are no interim measures available for this criterion.

Waste Processing Facilities: Criterion Two

CRITERION AIM

To ensure that waste processing facilities servicing Green Star building sites have the capacity to prepare accurate reports on the source and fate of all inbound waste received as well as all outbound waste diverted from and to landfill.

COMPLIANCE REQUIREMENTS

All of the following requirements to support auditable and accurate reporting systems must be met to comply with this criterion:

Requirement 1 - Clear separation of waste processing facility from landfill:

Waste processing facilities must operate as a separate facility to landfill. Where the waste processing facility is located on the same site as a landfill then access between the waste processing facility and landfill must be clearly separated (for example by controlled road access, fences or weighbridges). This separation ensures all waste input, as well as recyclables and residual waste outputs, are clearly traceable to and from the waste processing facility and reported separately from general solid waste landfill inputs not passing through the waste processing facility's resource recovery process.

Requirement 2 - Clear tracking system to separate residual waste from recyclables (weighbridge):

The waste processing facility must have at least one weighbridge to quantify and provide an auditable trail for weights of inbound waste as well as weights of outbound recyclables and residuals. If the waste processing facility is located on the same site as a landfill then it must have separate weighbridge receipts. If the auditor cannot verify to their satisfaction that there is clear separation of recycling from residual, compliance with this criterion cannot be awarded.

Requirement 3 - Certified weighbridge and operational procedures:

The waste processing facility must hold a current weighbridge maintenance certificate (certified annually) for the use of an appropriate weighbridge ensuring the weighbridge is fit for purpose and regularly maintained. The facility must also have weighbridge operational procedures in place to create and maintain weighbridge records on the following information for waste materials received, outgoing recyclables and residual waste:

- vehicle registration and date and time received;
- weight of vehicle and material incoming;
- source of material incoming (for example customer numbers);
- weight of vehicle and material outgoing;
- fate of material outgoing (by product type, including residual waste to energy recovery or landfill and the entity/customer removing it); and
- any rejected loads.

Requirement 4 -Source and fate of inbound and outbound waste:

The waste processing facilities must be able to account for the source of all inbound waste and fate of all outbound recyclables and residual waste.

GUIDANCE

The key issue that this criterion attempts to address is assurance of a clear and quantifiable percentage of diversion of waste from landfill back to productive reuse. Paramount to this outcome is clear separation and accountability for the weights of outbound recyclables and residuals. The transparency of reports generated by a single weighbridge that is shared between a waste processing facility and landfill operation is questionable and difficult to audit thereby potentially compromising the accuracy of a waste processing facility's waste diversion rate claims.

Where a waste processing facility is located on a landfill site, best practice operation includes the separation of weighbridges and access points for the respective landfill and recycling facilities. However, there are operational protocols and computer systems that can be implemented to better control separation and produce separable weighbridge receipts from a single weighbridge that is shared between landfill and waste processing facilities.

Figure 1. below provides an illustrated example of best practice operation of a waste processing facility which operates on a landfill site, as well as the intent of this criterion's guidance on the source and fate of waste inputs and recycled/residual outputs described in the compliance requirements.

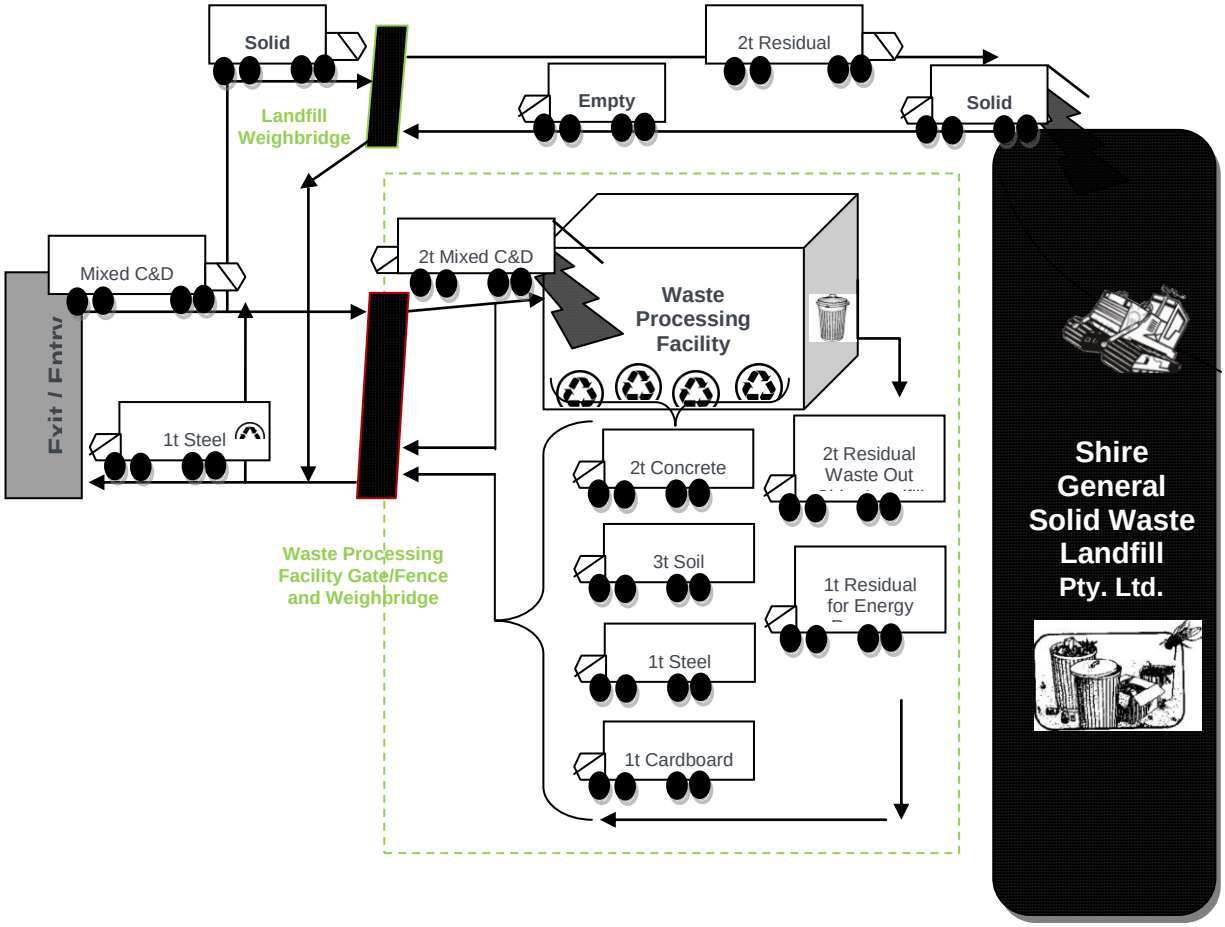

Figure 1. Separately operating waste processing facility on a shared landfill site with clear tracking of waste inputs and recycled / residual outputs by source and fate.

AUDITOR VERIFICATION GUIDANCE

Compliance should be verified by undertaking the following steps (see notes on non-conformance allowances in 'Interim Measures' section):

1. **Ensure there is clear separation of waste processing facility from landfill:**

   Verify that the applicant waste processing facility operates as a 'separate facility' from adjacent landfill operations in accordance with the intent of Requirement 1 of Criterion Two.

2. **Ensure there is a clear tracking system to separate residual waste from recyclables (weighbridge):**

   To award compliance with this component of the criterion, the auditor must verify that there is clear separation of recycling from residual as follows:

   a) Verify that the applicant has at least one weighbridge; and

   b) Verify that the applicant is able to quantify and provide an auditable trail for weights of waste into as well as recyclables and residuals out of the waste processing facility.

   If the site includes a landfill, in addition to the above, the auditor must verify that the applicant has the capability to:

   a) Produce separate weighbridge receipts for landfill and recycling operations by having separate weighbridges in place and in operation; or

   b) Effectively control the separation of recyclables and residual waste through existing operational protocols and technologies which enable the production of separate weighbridge receipts where a single weighbridge is shared between the waste processing facility and landfill.

3. **Verify the certification of weighbridge and operational procedures:**

   a) Sight the applicant's weighbridge maintenance certificate(s);

   b) Ensure that the certificate is current and valid and that there is evidence of annual maintenance certification; and

   c) Verify that the applicant has weighbridge operational procedure(s) in place that address, at a minimum, the weighbridge operational procedures listed in Requirement 2 of Criterion Two.

4. **Verify the Source and Fate of Inbound and Outbound Waste**

   a) Where applicants are awarded compliance with requirement of Requirement 3 of Criterion Two, then compliance with Requirement 4 of Criterion Two can be fulfilled on a deemed-to-satisfy basis at the auditors discretion; and

   b) Deemed-to-satisfy compliance shall be awarded on the basis that the weighbridge operational procedures outlined in Requirement 3 of Criterion Two establish sufficient record keeping protocols to facilitate the production of detailed reporting on the source and fate of the waste processing facilities' inbound and outbound waste. Where the auditor deems that this is not the case they may issue corrective actions as they see fit to ensure that the intent of the criterion is satisfied.

INTERIM MEASURE ALLOWANCES

Interim measure allowances are provided for Requirements 2 and 3 of Criterion Two, on the basis that they are major infrastructure and system requirements upon which all other subsequent reporting and performance measures associated with the reporting criteria rely.

Facilities that comply with Requirements 1 and 2, but not with Requirements 3 and 4 of Criteria Two could still provide services to Green Star projects during the interim period. Waste processing facilities failing to comply with Requirements 1 and 2 may implement corrective actions and undergo re-audits during the interim.

Please refer to the ‘Interim Measure’ section of this document for full details of what is required of the applicant and auditor to claim interim measure allowances.

Waste Processing Facilities: Criterion Three

Rates of Waste Diversion and Residual Waste Committed to Landfill

CRITERION AIM:

To encourage waste processing facilities that service Green Star building sites to provide independently-verified publicly available reports on the percentages of gross waste diversion from landfill and residual waste committed to landfill on an annual basis.

COMPLIANCE REQUIREMENTS:

Requirement 1 -The waste processing facility must undergo an independent annual facility-wide audit to establish and verify its:

a) Gross diversion rates of input waste from landfill; and

b) Percentage of residual waste output that is committed to landfill.

Requirement 2 - The waste processing facility must make these performance figures publicly available or, at a minimum, make them easily available upon request from Green Star customers or waste contractors acting on behalf of Green Star projects.

GUIDANCE

General Note: This criterion directly supports Green Star 'Construction and Demolition Waste' credit submission claims by providing builders, head contractors and Green Star Accredited Professionals (GSAPs) with publicly available and independently verified data regarding the diversion rates and residual waste contributions to landfill from specific waste processing facilities.

Waste-to-Energy: Residual waste diverted from landfill for the purposes of energy recovery is a valid recycling pathway. However, for the purposes of these Reporting Criteria, a waste processing facility's diversion of waste for energy recovery is limited to 50 percent of the facility's total input.

This 50 percent cap is based on the GBCA's position that energy recovery from construction and demolition waste streams is not an acceptable substitution for recycling in its own right, but rather a complementary management solution for wastes that would otherwise go to landfill. As a consequence, waste processing facilities that divert waste streams for the production of non-standard fuels for waste-to-energy purposes should not rely on this waste diversion pathway for the majority of their recycling output.

Figure 2. provides an example of residual waste diversion from landfill to illustrate the 30 per cent limit for waste-to-energy purposes described above.

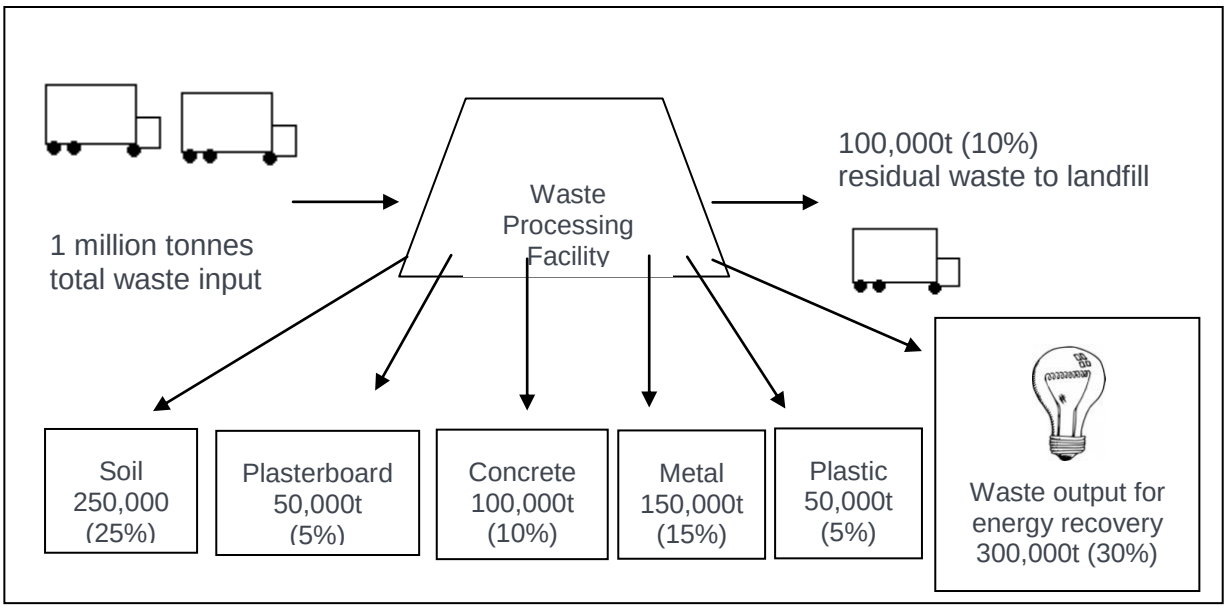

Figure 2: Example meeting the 50% Limit on Residual Waste Diversion for Waste to Energy Purposes

AUDITOR VERIFICATION GUIDANCE

Auditors must determine a facility's annual gross diversion rate of input waste from landfill and annual percentage of residual waste output committed to landfill by examining the applicant's cumulative waste balance reports. Assess these reports by cross checking:

- the quantities of inbound material;
- the quantities of recovered/reprocessed/recycled materials diverted from landfill; and
- the quantities of outbound residual waste sent to landfill.

Compliance with this criterion cannot be awarded where insufficient data or reporting procedures exist to determine the facility's annual gross diversion rates of input waste from landfill and annual percentage of residual waste output committed to landfill.

INTERIM MEASURE

An interim measure allowance is available for compliance Requirement 1 in this criterion, but only for reprocessing facility applicants (for example metal, concrete, paper and plastic recyclers). This interim measure is provided on the basis that some of these operators may not have sufficient systems in place to produce reliable waste balance reports because they have never before been required to generate such reports on a regular basis.

Where data or reporting procedures are insufficient to determine a reprocessing facility's annual percentage of residual waste output committed to landfill, then a default value of 50 per cent waste diversion to landfill may be awarded until the end of the interim period, or until the applicant can provide at least six months of operational waste balance data to the auditor for a re-audit of the criterion.

Please refer to the 'Interim Measures' section for full details of what is required of the applicant and auditor to claim this interim measure allowance.

Scheduled Review of Reporting Criteria

The GBCA aims to review policy initiatives like the reporting criteria that support Green Star rating tools every 18-24 months. Such reviews typically take into consideration the uptake of the initiatives by the affected industries and seek to measure the benefits and costs to participating industries, GBCA members and Green Star users. These reviews aim to update criteria to improve their applicability towards best practice and usually involve the adjustment of criteria benchmarks.

Notice of Intent to Introduce ISO 14001 Certified Environmental Management Systems in Future Revision:

Future versions of these reporting criteria may include a requirement for waste processing facilities to hold current ISO 14001 certification for their environmental management system (EMS).

In the initial development of the reporting criteria the GBCA agreed to postpone the introduction of this criterion based on feedback from industry stakeholders asserting that this measure would prove too restrictive in the short term.

It is the intent of the GBCA to introduce ISO 14001 certification as a criterion in the reporting criteria when the criteria are next reviewed and updated. Waste processing facilities are therefore encouraged to plan for and implement ISO 14001 certified EMS in their operations as soon as possible.

Auditor Competencies and Responsibilities

AUDITOR QUALIFICATIONS

Verification of compliance with the Reporting Criteria must be carried out by Suitably Qualified Auditors who are engaged directly by the waste contractors and waste processing facilities (Applicants).

Suitably Qualified Auditor – refers to an auditor who has the relevant knowledge, skills and experience to provide advice to applicants on the issues addressed in these Reporting Criteria. It does not refer to 'Appointed Auditors' as defined under various State Environment Protection Acts. Auditors must be independent from and have no conflicts of interest with applicants (i.e. they must be an external, independent, third-party auditor). They must also provide evidence of their qualifications in one of the following ways:

Certification

- The auditor must be a RABQSA Certified Environmental Auditor with 'Auditor Grade' status or above and hold current valid certification at the time of audit;
- The auditor must be able to demonstrate a minimum of three years experience in the waste management sector in a brief CV, or have the 'Scope of Waste Management' included in their Certification with RABQSA.

OR

Qualifications Statement

- The auditor must demonstrate their professional skills, knowledge and experience in waste management in a 'Qualifications Statement' that provides affirmative responses to all of the questions listed below.
- The auditors' responses to the following questions shall be used by the applicant and, in some cases Green Star Certified Assessors, to determine the suitability of their qualifications for the purposes of carrying out audits against the Reporting Criteria:

1. Knowledge: Can the person demonstrate they have relevant knowledge in waste management or environmental compliance auditing in a related field through the completion of a qualification? If no formal qualifications exist, can the person, through alternate means, establish that they understand the current state of knowledge on the criteria, best practice waste management principles and legislation?
2. Industry experience: Has the person worked in the waste management industry, with waste processing facilities of like size and structure or dealt with similar issues as those addressed in the criteria?
3. Professional activity: Can the person demonstrate recent professional activity in the field of waste management in which they intend to provide advice? How long has the person been professionally active?
4. Reputation: Is the person reputable and able to provide referees who can attest to the quality and utility of their work?

5. Professional association: Is the person a member of a professional association that relates to environmental or waste management, that requires the attainment and continuing development of knowledge, skills and experience?
6. Communication skills: Is the person able to explain to clients what they need to do to achieve compliance with the criteria and write reports that are easy to understand?
7. Legislative understanding: Is the person familiar with local waste legislation?

(Adapted from WorkSafe Victoria 2008)

Several items of feedback from the Construction and Demolition Waste Reference Group indicated concern over accepting non-RABQSA certified auditors, even those with significant demonstrated industry experience, to undertake audits for applicants. These concerns centre around the lack of accountability (to a professional body like RABQSA) of uncertified auditors in the instance of unethical behaviour, and the greater potential for fraudulent outcomes that might result.

CONFLICTS OF INTEREST

The auditor must have no conflicts of interest with applicant companies. Any issues that may be construed as a potential conflict of interest must be disclosed in the audit report and Compliance Verification Summary. An explanation must also be provided that clearly demonstrates the independence of the services provided by the auditor for the compliance verification job.

Previous and existing independent external auditing business relationships (i.e. ISO 14001 auditing and certification services) are not regarded as a conflict of interest, however, the auditor must disclose all such auditing relationships in the Compliance Verification Summary.

COMPLIANCE VERIFICATION SUMMARY

The Compliance Verification Summary is the auditor's primary deliverable to the applicant. This document is issued by a Suitably Qualified Auditor and verifies and summarises the applicant waste contractor or waste processing facility's compliance with these Reporting Criteria. It is valid for 12 months from the date of issue and must be current for the duration of the time that the applicant provides waste services and waste reports to a Green Star project. Compliance Verification Summaries must:

- state the applicant's compliance or non-conformance with each of the criteria;
- provide a summary of the corrective action(s) required of the applicant in cases where non-conformance is identified;
- be signed and dated by the auditor; and
- include a copy of the auditor's RABQSA Certification and CV or Qualification Statement.

Applicant's Responsibilities

APPOINTING AN AUDITOR

It is the responsibility of the applicant to ensure that the auditor they appoint complies with the definition of Suitably Qualified Auditor, as provided in the 'Auditor Qualifications' section above.

Prior to appointing an auditor, the applicant should obtain a copy of the auditor's certification and brief CV demonstrating that individual's experience in the waste sector, or Qualification Statement, and make an assessment of the auditor's qualifications against the Auditor Competency and Responsibilities requirements.

Auditors must be given access to any records, facilities and staff that they deem necessary to carry out the audit and audits must be conducted at every 12 months as a minimum.

It is appropriate to ensure relevant auditor competencies via clauses in waste contracts.

WASTE CONTRACTOR RESPONSIBILITY

Waste contractors hired to provide waste management and reporting services to a Green Star project must provide the head contractor or Green Star consultant with a copy of their Compliance Verification Summary. They must also ensure that the waste processing facilities they plan to use for disposal of the construction and demolition waste from the Green Star building's construction site hold current valid Compliance Verification Summaries.

The GBCA recommends that waste contractors keep a record of all Compliance Verification Summaries from all waste processing facilities used for the Green Star project they are engaged to service and that these records are provided to the head contractor or Green Star consultant as early as possible after engagement by the project.

Compliance Verification Summaries will be used by Green Star project teams, along with regular waste reports from the waste contractor, as supporting evidence for the project's 'Construction and Demolition Waste' credit claim. Only waste reports generated by compliant waste contractors and waste processing facilities will be accepted.

NO DIRECT GBCA INVOLVEMENT WITH AUDITOR SELECTION OR AUDIT PROCESS:

In order to maintain transparency the GBCA will not provide confirmation that an auditor is suitably qualified. The GBCA must have no direct involvement in the application of the reporting criteria.

RESPONSIBILITY OF APPLICANT AND GREEN STAR BUILDING CONTRACTOR / GREEN STAR CONSULTANT

During the assessment of a Green Star building's 'Construction and Demolition Waste' credit, Green Star Certified Assessors will review the auditors' qualifications as attached to the applicants' Compliance Verification Summaries in order to confirm that they meet the definition of Suitably Qualified Auditor.

Green Star – Construction & Demolition

Waste Reporting Criteria

Compliance Verification Summary

"Waste Processing Facilities"

Company Name: Dial A Dump Industries

ABN: 75 131 565 583

Facility Name: Genesis Recycling Facility

Address: Honeycomb Drive, Eastern Creek, NSW

Overall Findings:

Criterion One	**Compliant**
Criterion Two	**Compliant**
Criterion Three	**Compliant**

Auditor: **Robyn Pearson**

Peer Review: **Jo Drummond**

Date: **4th November 2014**

Criterion One and Two:

***Compliance*:**

The waste processing facility must hold current licenses or development consent for the activities it undertakes.

The licence is current and conditions are complied with to the extent relevant to resource recovery.

Evidence:

EPA Licence: Genesis Eastern Creek EPA Licence No. 20121 issued 08/06/2012. A variation was granted on the 5/06/2014. Status of the Licence is "issued".

The License approves the following activities:

- Composting
- Resource Recovery
- Waste Storage

The site may not accept putrescible waste or asbestos.

The site has received two EPA penalty notices, dated 10/09/2012 and 04/10/2012. No other EPA breaches are recorded by the EPA.

A site visit was held on the 2nd July 2014. Previous site visits have been completed by the auditors as part of generator compliance audits. On each occasion activities observed were in compliance with the resource recovery requirements of the licence.

In the opinion of the auditor, current observed activities are in line with licence conditions.

Note: A full EPA compliance audit is not within the scope of this review.

Conclusion: Evidence requirements 1 and 2 have been met.

Rating: COMPLIANT

***Criterion Two*:**

To Ensure the facility has the capacity to prepare accurate reports on the source and fate of all inbound waste received as well as outbound waste diverted from and to landfill.

Evidence:

1. Clear separation of waste processing facility from landfill.

Where the waste processing facility is located on the same site as a landfill then access between the waste processing facility and landfill must be clearly separated. Ensuring all waste input as well as recyclables are clearly traceable to and from the processing facility. This waste must be reported separately from general solid waste landfill inputs not passing through the processing facility.

Findings: The site consists of the resource recovery plant plus a landfill. One weighbridge is used for both facilities. Physically, the two areas are very distinct with vehicles being directed either to the recovery facility or to the landfill.

As trucks enter the weighbridge the driver is provided with a ticket indicating the appropriate disposal point. At each area a "spotter" is located to receive and check the ticket before the load is dumped. The spotter ensures the truck has arrived at the appropriate location as determined at the weighbridge. The spotter also checks the load in more detail to ensure it contains the appropriate materials and no contaminants. (Note the procedures for the "Spotters" has been cited and reviewed as part of this audit).

Conclusion: Evidence requirements have been met.

Rating: COMPLIANT

2. Clear tracking system to separate residual waste from recyclables (weighbridge).

A minimum of 1 weighbridge is required to quantify and provide an auditable trail for weights of inbound waste as well as weights of outbound recyclables and residuals.

Findings: While the current weighbridge dockets do not state the destination of the vehicle this information is recorded in the system allowing detailed reports by disposal point to be requested. A recommendation of this audit is that weighbridge dockets clearly state the destination point of the load. This will be an important evidence criteria for the waste transporters. **Site management have agreed to implement this recommendation.**

Computer reports for each tipping point, (Quadrant) for the previous twelve months were reviewed and reconciled back to the EPA reports as submitted. There are essentially four "types" of loads received:

- 100% general waste – directed to the landfill
- Mixed recycling – directed to the resource recovery plant
- 100% single recoverable material (eg bricks) – directed to the relevant material stockpile quadrant
- General waste with some recyclables – directed to landfill, recyclables recovered where possible and redirected to the resource recovery plant or relevant material stockpile.

In addition, some general waste may be discovered in loads sent to the Resource Recovery area. This material is subsequently diverted to the landfill through the chute. These tonnes are separately recorded.

Each movement is captured within the system and appropriately coded so as to reconcile all incoming materials.

All outbound loads are recorded at the weighbridge. Separate reports detail tonnes by type for all outbound materials.

Conclusion: Evidence requirements have been met.

Rating: COMPLIANT

3. Certified weighbridge and operational procedures.

- *Must hold current weighbridge maintenance certificate (annually certified).*
- *Must have in place weighbridge operational procedures*
- *Records of all incoming loads must show:*
    - *Vehicle registration and date and time*
    - *Weight of vehicle and materials incoming*
    - *Source of material (ie customer name/number)*
    - *Weight of vehicle and material outgoing*
    - *Fate of material outgoing (by product type and the entity removing it*
    - *Any rejected loads*.

Findings: Weighbridge maintenance certificates were cited for both the incoming and outgoing weighbridges:-

- Inwards weighbridge: Standard Scales and Services "Repair and Verification Report" dated 23rd January 2014, Serial number 26002-1 and 26002-2. Status – "Pass".
- Outwards weighbridge: Standard Scales and Services "Repair and Verification Report" dated 23rd January 2014, Serial number 26001-1 and 26001-2. Status – "Pass".

The Weighbridge operating manual, (Microsoft Dynamics AX2009 – Weighbridge User Manual) was reviewed as part of this audit in addition, weighbridge personal were observed performing their duties. The procedures and operating system ensures the following information is captured:

- Truck enters the weighbridge, date and time are automatically recorded.
- Weighbridge operator records truck registration – this triggers details of the customer and provides site option details
- The vehicle is weighed and the load type is selected
- Gross weight is captured
- The destination point, "Quadrant" is recorded
- A docket is printed for the driver
- Once tipped the truck leaves via the outbound weighbridge so that a net weight can be determined.

Weighbridge dockets were reviewed for incoming and outgoing loads, these dockets clearly detail:

  - Vehicle registration and date and time
  - Weight of vehicle and materials incoming (Gross and tare weights shown to determine net weight of load)
  - Source of material (ie customer name/number) – customer name is shown.
  - Weight of vehicle and material outgoing (Gross and tare weights shown)
  - Fate of material outgoing (by product type and the entity removing it).

Conclusion: Evidence requirements have been met.

Rating: COMPLIANT

4. Source and fate of inbound and outbound waste.

The facility must be able to account for the source of all inbound waste and fate of all outbound recyclables and residue waste.

Findings: Weighbridge dockets were cited for inbound and outbound loads. As detailed above all required details are shown. The dockets do not however indicate if the load is inbound or outbound. While this information is captured in the system the gatehouse dockets should also note this in some way.

It is recommended that changes to the gatehouse dockets include an indicator to show inbound versus outbound loads. Management has agreed to this change.

A review of detailed reports clearly shows inbound and outbound tonnes by source (customer) and destination.

Conclusion: Evidence requirements have been met.

Rating: COMPLIANT

Criterion Three

Compliance:

Independent verification of the percentages of gross waste diversion from landfill and residual waste committed to landfill on an annual basis.

Evidence:

1. *Gross diversion rates of input waste from landfill (annually) and Percentage of residual waste output that is committed to landfill (annually).*
2. *This information must be made publicly available or at a minimum, make them available upon request from Green Star customers or waste contractors acting on behalf of Green Star projects.*

Findings: Weighbridge reports for the twelve month period to June 2014 were reviewed. Reports were identified by Quadrant, showing the total tonnes diverted to each area. A reconciliation of the total tonnes received as per the weighbridge report was undertaken to show tonnes diverted to each Quadrant.

This data was then reconciled to the EPA reports for both the resource recovery facility and the landfill.

The total tonnes diverted is able to be calculated utilizing the existing reports.

Based on the year to June 2014, the recovery rate for this facility was able to be calculated and verified.

Conclusion: Evidence requirements have been met.

Rating: COMPLIANT

Appendix A – Auditor Resume

Robyn Pearson

Introduction:

1986 Bachelor of Economics, Macquarie University

1991 – Member of Certified Practicing Accountants of Australia

1995 – Brambles/Cleanaway – Manager of the Ryde Transfer Station, Sydney; Manager of Clinical Waste division, Cleanaway.

1997 – Established Waste Audit and Consultancy Services.

As co-founder of Waste Audit, Robyn has worked for the past 17 years working with companies and government agencies to address effective waste management. Robyn worked with the NSW waste boards to develop the waste auditing protocols used throughout Australia today. She has managed and participated in waste audits from all sectors including:

- Commercial and industrial organisations – sourced based audits;
- Construction and demolition sites – sourced based audits;
- C&I and C&D disposal based audits of landfills and transfer stations;
- Domestic – kerbside audits.

Robyn worked with RABQSA to develop an Auditor qualification for waste auditors. She was one of the first waste auditors in Australia to receive 'Lead Auditor" status.

Robyn has worked with the Green Building Council providing input and feedback on many of the waste protocols. Robyn is currently an invited participant on the City of Sydney "Better Building Partnership" group and is developing a protocol for more transparent, accurate waste reporting.

Qualification Statement

1. Knowledge – As a Certified Practicing Accountant I have strong analytical and auditing skills. Within the Waste industry I have a Certificate IV in workplace Training and Assessment. As a

Director of Sustainable Learning Australia, I developed the learning materials for certificate III and IV in Waste management as part of the national Competencies developed for the waste industry. I personally completed and attained Certificate IV in Waste Management.

I have participated on numerous industry workgroups to assist in the development of auditing and reporting protocols.

Over the past 17 years I have consulted to Industry, National and International Companies and Government agencies in relation to best practice waste management; legislative compliance and waste data and reporting. Over this time i have worked closely with all aspects of the waste industry from disposal and treatment facilities through to transporters and suppliers; compliance and reporting authorities.

2. Industry Experience – I have worked in the waste industry for close to 20 years. Initially with Cleanaway running large transfer stations and processing facilities. During my recent time with Waste Audit I have participated in the auditing of landfills; transfer stations and MRFs for both Government agencies throughout Australia and fro private companies. Waste Audit was the first company to conduct landfill audits (Zero Waste SA 2000) and as a consequence developed the protocols that are still used today.

3. Professional Activity – I currently participate in the Better Building partnership forum providing professional advice in relation to waste management. I work with the NSW EPA and OEH on various waste related projects and often provide feedback on protocols or best practice waste models. I have been asked to provide feedback to the Green Building Council of various waste protocols and have participated in testing new pilot criteria.

4. Reputation – I am well known within the waste industry by regulators ; suppliers and private organisations. I can provide contact details for referees if required.

5. Professional Association – I am a member of the Waste Management Association of Australia. I am a member of the CPA. As a consultant to business and government i am required to keep abreast of industry trends and developments. I am also a trainer for Eccel Environmental who deliver the certificate IV Environmental Management and Sustainability - I deliver the waste module that addresses current legislation and compliance; waste reporting and data management.

6. Communication skills – I have many years experience advising clients and preparing succinct waste audit reports. In my current role as industry trainer I need to effectively deliver key information to participants in an engaging and digestible manner. I have presented at numerous industry conferences and prepare articles for industry newsletters and client internal newsletters.

7. Legislative understanding – as a Consultant I need to be well aware of all relevant legislation. I consult directly with the EPA as necessary in regards the impact and interpretation of legislation, and regularly provide briefings to corporate clients on their compliance requirements and the impacts legislation may have on their operations.

Greenstar

Construction & Demolition Waste Reporting Criteria

Compliance Verification Certificate: "Waste Recovery Facility"

Dial a Dump Industries Pty Limited

ABN: 75 131 565 583
Address: Genesis Recycling Facility, Honeycomb Drive, Eastern Creek, NSW 2766

Overall Findings:

Criterion One	**Compliant**
Criterion Two	**Compliant**
Criterion Three	**Compliant**
Overall Result	**Compliant**

Auditor: **Robyn Pearson** **Signature:** 

Peer Review: **Jo Drummond** **Date:** **4th November 2014**

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the aquis group

APPENDIX 8
NSW EPA/TNG MEETING MINUTES

Meeting Minutes. TNG & EPA Energy from Waste 12 February 2015

Present:

Steve Beaman EPA
Sarah Crossie EPA
Marc Stammbach HZI
Ian Malouf TNG

Chlorine concentrations

In the EU regulation the following is stated in the WID (Waste Incineration Directive): If hazardous waste with a content of more than 1% of halogenated organic substances, expressed as chlorine, is incinerated, the temperature has to be raised to 1100°C for at least two seconds.

In the NSW EfW policy the following is stated: If a waste has a content of more than 1% of halogenated organic substances, expressed as chlorine, the temperature should be raised to 1100°C for at least 2 seconds after the last injection of air.

There is a small, but significant difference between these two texts, with considerable implications for EfW in Australia ("hazardous waste" versus "waste").

PVC is not classified as a hazardous waste in both jurisdictions. Moreover, the WID regulation is not concerned about "chlorine", but about "hazardous waste with halogenated organic substances".

In the European EfW experience it has been found that EfW typically has to cope with concentrations of PVC of around 1% (MSW) with around 0.4% as back ground chlorine (not PVC related). Residual fractions from recycling, C&D and C&I can reach up to nearly 10% in the European experience.

If TNG would find similar chlorine level of around 1% in MSW as per European experience, the current NSW EfW policy would require burning at 1,100°C/2 instead of 850°C/2s. Current technology (from all EfW providers) doesn't allow efficient energy recovery at the higher temperature. In consequence, the energy efficiency requirement of R1>0.65 cannot be achieved. Hence, the NSW EfW Policy will contradict itself unless the wording is changed (back to the European WID).

TNG believes that the text of the NSW EfW Policy needs to be amended to reflect the EU regulation and the European experience of safe EfW at chlorine concentrations of typically around 1% with some waste fractions up to 8%. The issue is of chlorine is purely technical, e.g. the capability of the flue gas treatment to cope with short-term chlorine peaks as well as long-term chlorine concentrations – whatever level they are.

EPA will consider this proposal of a change to the NSW EfW Policy.

Contaminants in Waste Streams

Note 2 of NSW EfW Policy (page 9): "Waste streams proposed for energy recovery should not contain contaminants such as batteries, light bulbs or other electrical or hazardous wastes."

Above is technically impossible to assure. In addition, it is known that even in countries (example Switzerland) with household battery, car battery, fluorescent lamp, electrical and electronics collection schemes a significant proportion (low percentage to plus 30%) are estimated to go to EfW plants, e.g. the only alternative in the absence of landfills (as prohibited).

TNG proposed to either delete this Note 2 or to amend with: "as economically and technically justifiable".

EPA will consider this proposal of a change to the NSW EfW Policy.

Sourcing eligible waste

TNG has quantified the potential amount of eligible waste from "authorised facilities" in the market for EfW. This exercise used publically available documents and the EfW Policy's resource recovery criteria to quantify the scale of each mixed and separated waste stream in the market. The exercise demonstrated that there was enough C&D and C&I material (TNG's target streams) to fuel the facility today.

The tonnes received today by DADI exceed the tonnes required for Lines 1 & 2 (582,000tpa), thus proving that TNG already has access to enough eligible tonnes for the first stage of operation. This data will be provided:

- To EPA with client details (as commercial in confidence and not for publication),
- To DA document without client details (for publication).

TNG proposes to continue the DA process for four lines, but to delay the construction of lines 3 & 4 until the eligible sources of waste required for four lines can be confirmed to the satisfaction of the Department.

TNG will double the capacity of its existing C&D MRF at the Genesis site with a focus on C&I as part of the TNG project.

EPA noted and welcomed these comments.

In TNG's experience up to 90% of C&D waste is already sorted at the construction sites during the demolition stage. TNG has already independent auditing under the GreenStar reporting guidelines in place and will continue to do so and will expand this method to its suppliers.

EPA will consider this proposal.

ASR (Automobile Shredder Residue) – "Flock"

"Flock" waste is not identified as an independent waste stream in the NSW EfW Policy, but classified as commercial waste.

EPA indicated that flock is not excluded from EfW and will likely be included in an amended version of the NSW EfW policy and that the resource recovery threshold would be 25%, in accordance with current metal recycling operations.

Ash composition

The ash composition will be estimated from overseas EfW installations burning similar wastes as TNG.

TNG has engaged Rambol (EfW consultancy) to conduct sensitivity testing utilising the specific waste characterisation identified previously for each target waste source. The results will reflect the actual characterisation and input waste streams into the facility. MRA will review this sensitivity testing against the licenses of appropriate landfills.

EPA welcomed this approach.