



**ENERGIOS**

*“The Proven Gasification Technology”*

## FUEL SPECIFICATION

**PROJECT:** Dandenong Australia  
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## INTRODUCTION

The objective of this specification is to define the parameters that form the basis of design for the Energos Energy from Waste (EfW) plant.

Waste will by its nature vary in quality and the Energos EfW plant can tolerate typical variations, within MSW and Commercial Wastes. The terms and conditions of the supply contract will deal with consequences of variations in the fuel quality.

In the event that the overall content of heavy metal in the fuel leads to a breach of the IED (2010/75/EC) limit for emissions to air for Cd+Tl or Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V, there will be a requirement to identify the source of the element(s) that caused the breach and to seek to eliminate them from the waste. Consequences of a breach will be dealt with within the terms and conditions of the supply contract.

Waste has to be pre-treated to be utilised as fuel in the EfW plant. The pre-treatment shall secure a specific particle size of the fuel and remove non-combustible matters like metal objects. Different waste fractions shall also be well mixed to ensure a homogenous fuel with respect to net calorific value and other properties.

Wastes classified as hazardous in EU Decision 2001/118/EC shall not be mixed into the fuel.

## 1. FUEL SPECIFICATION

### 1.1 Fuel characteristics

Fuel characteristic requirements are specified in Table 1.

**Table 1 Fuel characteristics**

Component	Unit	Value
Net calorific value	[MJ]/kg]	8 - 18
Moisture content	[weight % (wet)]	< 60
Ash content	[weight % (dry)]	6 – 32
Nitrogen content	[weight % (dry)]	< 1.5
Sulphur content	[weight % (dry)]	< 0.4
Chlorine content	[weight % (dry)]	< 1.0
Fluorine content	[weight % (dry)]	< 0.01

NCV (Net Calorific Value) is the Lower Heat Value (LHV) of the wet (“as received”) fuel. Lower Heat Value is sometimes referred to as the “lower enthalpy of combustion” and is defined as “the difference in enthalpy of a compound and that of its products of combustion in the gaseous state, all at 298 K and 1 atm”. That is, the reference temperature is 25 °C and each product of combustion, including water, is in its gaseous state.

## 1.2 Contamination in fuel

Maximum contents of contamination in fuel are specified in Table 2.

Limit values for the elements in Table 2, Cadmium [Cd] to Vanadium [Va], are defined to ensure that regulatory requirements with respect to emissions to air are not breached. The EU directive (2000/76/EC) stipulates the maximum emissions of

- Cd+Tl
- Hg
- Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V

**Table 2 Contamination in fuel**

Component	Unit	Maximum value
Cadmium [Cd]	[mg/kg (dry)]	25
Thallium [Tl]	[mg/kg (dry)]	7
Mercury [Hg]	[mg/kg (dry)]	2
Antimony [Sb]	[mg/kg (dry)]	750
Arsenic [As]	[mg/kg (dry)]	15
Lead [Pb]	[mg/kg (dry)]	450
Chromium [Cr]	[mg/kg (dry)]	500
Cobalt [Co]	[mg/kg (dry)]	45
Copper [Cu]	[mg/kg (dry)]	500
Manganese [Mn]	[mg/kg (dry)]	300
Nickel [Ni]	[mg/kg (dry)]	120
Vanadium [V]	[mg/kg (dry)]	120

## 1.3 Density requirements

Fuel bulk density requirements are as follows:

- higher than 250 kg/m<sup>3</sup>
- lower than 350 kg/m<sup>3</sup>



## **1.4 Particle size of fuel**

Fuel particle size requirements are as follows:

- 90 % by weight less than 150 mm
- 97 % by weight less than 200 mm
- Particle volume less 300 cm<sup>3</sup>

## **1.5 Content and size of metal objects**

Content of non-combustible hard objects (like rock, concrete and metal objects) in the fuel shall be less than 0.5 % by weight. Maximum weight of any non-combustible hard object with a length exceeding 40 mm shall not exceed 350 g.

15<sup>th</sup> August 2019

Great Southern Waste Technologies  
19 Thomas Murrell Crescent  
Dandenong South VIC 3175  
Att: Craig Gilbert – Project Director

Dear Craig,

HRL Technology Group P/L (HRL) has conducted a review of the Dandenong audit report and data, and compared the combustion/chemical parameters found in this report with the Energos fuel specification" Appendix D - Fuel Specification" and have found the following conclusions:

- With regard to the Energos fuel specifications "Table 1 – Fuel characteristics" the following conclusion can be drawn from the data derived from the 1<sup>st</sup> audit completed by HRL Technology Group P/L (HRL):
  - Audit 1: The average of each key parameter obtained through this 1<sup>st</sup> audit is within the requirements and specifications of the Energos fuel specification except for Net Wet CV which generated an average of 7.2MJ/kg. Fluoride was not determined in this 1<sup>st</sup> round of audits and thus not data is available for assessment against the Energos specifications.

It is important to consider the impact from the addition of C&I and the impact from the introduction of any FOGO programs, as this would increase the NWCV. It may also impact on the other parameters depending on the levels within the C&I material.

- With regard to "Table 2 – Contaminates in fuel" and the critical trace elements levels such that the IED limits are not exceeded, the following conclusion can be drawn from the data derived from the 1<sup>st</sup> audit completed by HRL Technology Group P/L (HRL):
  - Audit 1: The average trace elements levels are obtained through this 1<sup>st</sup> audit are within the requirements and specifications of the Energos fuel specification,

Yours sincerely

A handwritten signature in black ink, appearing to read 'Nicholas Miller', with a horizontal line extending to the right.

Nicholas Miller  
Business Unit Leader – Analysis Services  
HRL Technology Group P/L