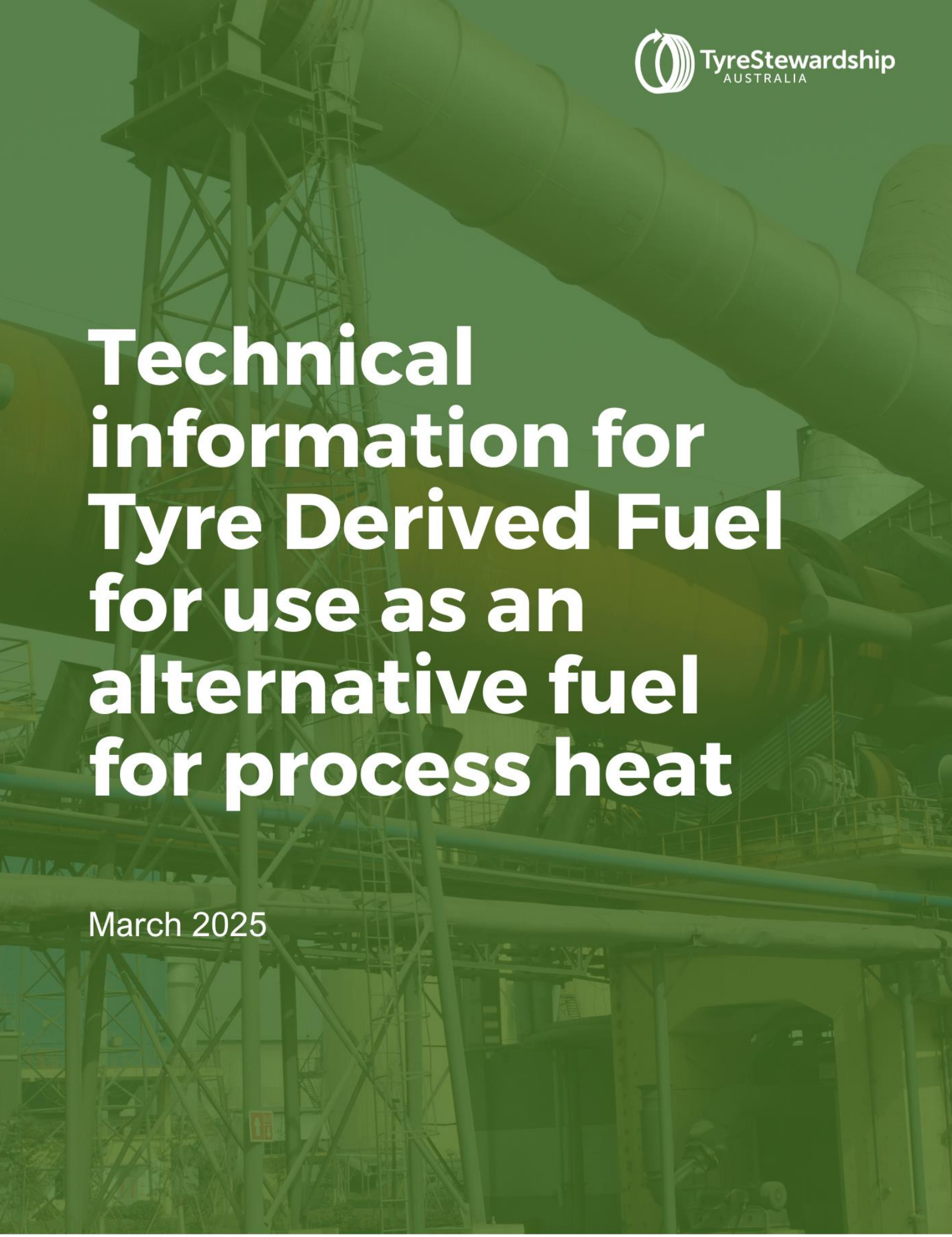

TyreStewardship AUSTRALIA

Technical information for Tyre Derived Fuel for use as an alternative fuel for process heat

March 2025

TyreStewardship AUSTRALIA

Australian Government Accredited Product Stewardship Scheme

Technical information for Tyre Derived Fuel for use as an alternative fuel for process heat

Purpose:

TSA has prepared the following summary document, which includes the different technical aspects that are relevant to Tyre Derived Fuel (TDF).

Background:

TDF is produced from tyres through shredding of end-of-life tyres, generally to a size range of between 50 – 150 mm.

TDF can be added as a solid fuel to replace fossils fuels, for combustion in cement kilns, and in other fuel burning appliances, provided fit for purpose feed systems and emission controls are in place.

Fuel testing:

For a full fuel analysis testing suite, the typical testing requirements are:

- Proximate Analysis – Moisture, Volatile Matter, Ash, Fixed Carbon
- Ultimate Analysis – C, H, N, S, (Cl), Ash, O
- Calorific Value
- Inorganics
- Ash Analysis
- Trace metals

Greenhouse Gas Emission Factors:

In 2022, the Federal Government updated the National Greenhouse and Energy Reporting (NGER) Scheme legislation, specifically to create two new fuel types for end-of-life tyres to cover passenger tyres and truck and off-road tyres, allowing NGER reports to reflect emissions more accurately from TDF combustion. The updated amendments can be found here.

For passenger car tyres, the new designated energy content factor is 32 GJ/t and the new CO_2 emission factor is 62.8 $kgCO_2^{-e}$/GJ. For truck and off-the road tyres, the new designated energy content factor is 27.1 GJ/t and the new CO_2 emission factor is 55.9 $kgCO_2^{-e}$/GJ. The changes in legislation came into force on 1st July 2022.

The following tables outline various technical specification information that may be relevant to kilns and fuel burning appliances, obtained from numerous literature sources. The assumption is that the tyres are made up of passenger car tyres, unless otherwise specified.

Table 1: Ultimate analysis of TDF derived from the literature.

Ultimate Analysis *	wt%
C	72.5
H	7.0
S	1.3
N	1.9
O	1.7
Ash#	15.6
H_2O	0
Total	100

Table 2: Proximate analysis of TDF derived from the literature.

Proximate Analysis*	wt%
Volatiles	70.0
Fixed Carbon	14.4
Ash#	15.6
Moisture	0
Total	100

*Quoted values are estimates are based on a literature survey (1)

#Ash is the non-combustible component of the TDF – including steel belts/bead wire. For a truck tyre this wt% is much higher at around 28%.

Table 3: Other technical specifications for Tyre Derived Fuel derived from the literature.

TDF Characteristics	Value	Reference
Bulk density (t/m^3) **For tyre shred approx 50 mm x 50 mm**	~ 0.6	(1)
Ferrous metal (wt%) **A component of the ash content present is steel belt and bead wire**	~ 12.2 (Passenger) ~ 25.5 (Truck)	(1)
Zinc content (wt%)	1-2	(2)
Chlorine content (wt%)	0.05 – 0.1	(1,2)
Sulphur content (wt%)	~1.3	(1, 2, 3)
Biomass content (wt%)	~ 23.1 (Passenger) ~ 31.5 (Truck)	(1)
Net calorific value (GJ/t)	~ 31.3 (Passenger) ~ 26.4 (Truck)	(1,2)
~ indicates quoted values are averages of a survey of literature values.		

Table 4: Estimated metal content of tyre materials.

Metal	Composition (mg/kg)
Antimony	<10
Arsenic	10
Cadmium	10
Chromium	90
Cobalt	100
Copper	200
Lead	50
Manganese	700
Mercury	<5
Nickel	60
Thallium	<5
Vanadium	<10
Quoted values are estimates are based on a literature survey (1)	

Key factors to consider when using these values:

1. Specific physical aspects of TDF supply have not been included as this will be dependent on processing infrastructure at each recycling plant.

2. The results provided are typical. The exact compositional make-up of a tyre is dependent upon their brand/type/age which varies according to the manufacturing process and raw materials used.

3. Irrespective of origin, passenger car tyres and truck tyres have systemic compositional differences.

4. The data in the table is based on TDF derived from passenger car tyres. Values for the four components Ash content, Ferrous metal, Biomass and Calorific Value have also been included for truck tyres. As the percentage of the total TDF supply derived from truck tyres increases the values for these components will change in direct proportion. The other quoted values will change, but not significantly.

5. For a passenger car tyre, ash is made up of ~80-85% Fe, ~10% Zn and the balance a mixture of Ca, Al, Si. (1)

6. The significant metal components in tyres are iron and zinc (see table 3). A breakdown of other metals present in TDF is presented in table 2.

References:

1. Tyre emission factors report and review - TSA internal information – More information can be requested via Tyre Stewardship Australia. https://www.tyrestewardship.org.au/ (2021)

2. United Nations: Environment Programme. Basel Convention Series: Technical Guidelines on the Identification and Management of Used Tyres/Secretariat of the Basel Convention. October http://www.basel.int/meetings/sbc/workdoc/old docs/tech-usedtyres.pdf (2002)

3. M. Juma, Z. Koreňová, J. Markoš, J. Annus, Ľ. Jelemenský Institute of Chemical and Environmental Engineering, Faculty of Chemical and Food Technology, Slovak University of Technology, Pyrolysis and Combustion of Scrap Tire https://www.researchgate.net/publication/26499998_Pyrolysis_and_combustion_of_Scrap_tyre (2006)

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