MEMO

Job **TNG Energy from Waste Facility, Eastern Creek, Cl, Br and Hydrocarbons in floc waste**
Date **2016-08-30**
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1. Introduction

It has been questioned to give further information on floc waste in Australia regarding compositional and chemical analysis breakdown.
In Australia, the current recycling practises are such that the ELV passes from the last owner to an automobile dismantler either directly or via insurance companies, used car dealers or car repairers. The useful parts that have commercial value are removed to be used in the second hand car market. The residual vehicles, particularly older vehicles, are taken directly to the metal shredders or intermediary scrap metal merchants. The parts are removed and the ELV shredded. The non-metal residual exits the shredder as waste residue, known as shredder floc. This floc waste is mostly disposed as landfill.[1]

At present, there is no legislation for ELVs in Australia.

Usual process is to remove vehicle operating fluids from all End of Life vehicles such as motor oil, transmission oil, brake fluids, hydraulic fluids, cooling water and wash water before they are going to landfill and contaminating the environment.
In worst cases fluids are not removed from the ELVs prior to shredding.

This memo compiles the in the first step the basic information of fluids in vehicles, in the second step the vehicle composition and to calculate the proportion of fluids in the floc waste and its chemical components.

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Ver. 1

[1] Environment Australia, 'Environmental Impact of End-of-life Vehicles: An information paper.' Pg 4:15, 4:16.

2. Summary Fluids in vehicles

The first step is to analyse the different operating fluids in vehicles.

In the table below next to the type of fluids composition and amount information in the vehicles are listed. They are based on Ramboll internet research.

Operating Fluids	Composition	amount
motoroil	90% mineral oil C_xH_x, 10% conditioner	8 l
brake fluid	Polyethylenglycol $C2_nH4_n+2O_n+1$ or Silicon oil $[R1R2SiO]_n$	1 l
transmission oil	90% mineral oil C_xH_x, 10% conditioner	2 l
hydraulic fluid	Mineral oil or Polyethylenglycol $C2_nH4_n+2O_n+1$	2 l
cooling water	98% Water, 2% additives	4 l
wash water	99% Water, 1% organic tenside	8 l
		25 l

Summary Fluids in vehicles (organic and water summarized)

The information in the table above is converted from l to kg and the organics and water contents are summarized.

Operating Fluids	amount	amount	
motoroil	8 l	6.4 kg	28.6%
brake fluid	1 l	0.8 kg	3.6%
transmission oil	2 l	1.6 kg	7.1%
hydraulic fluid	2 l	1.6 kg	7.1%
organic and additives	0 l	0.2 kg	0.7%
water	12 l	11.8 kg	52.9%
	25 l	**22.4 kg**	100 %

Percentage of Fluids to vehicle mass

The average mass of a vehicle according to ICCT investigation in 2014 is 1,390kg[2].
The sum of the operating fluids such as motor oil, brake fluid, transmission oil and hydraulic fluid, as listed in the table above, is 10.4 kg.

The proportion of 10.4 kg fluid to 1,390 kg vehicle mass is 1.6%.

[2] http://www.theicct.org/sites/default/files/publications/EU_pocketbook_2014.pdf, page 8

Vehicle Composition [3]

The second step is to analyse the vehicle composition and to calculate the proportion of fluids in the vehicle composition.

ELV reprocessing in Australia has a recovery rate of approximately 65-75 per cent [4] and involves removing pollutants (batteries, fluids and tyres), dismantling, shredding and metal separation. The material remaining after the separation of metals is called shredder floc.

In the table below a typically shredder floc combination of plastics, rubber, textiles, metals and inert materials such as dirt and glass are listed with the composition range.

Material type	**composition range**	
Plastics	35%	55%
Rubber	10%	20%
Metals	6%	13%
Textiles	7%	15%
Fines (paint, glass, sand)	10%	20%

Table 1 Average shredder floc composition

Vehicles composition including fluids in vehicle

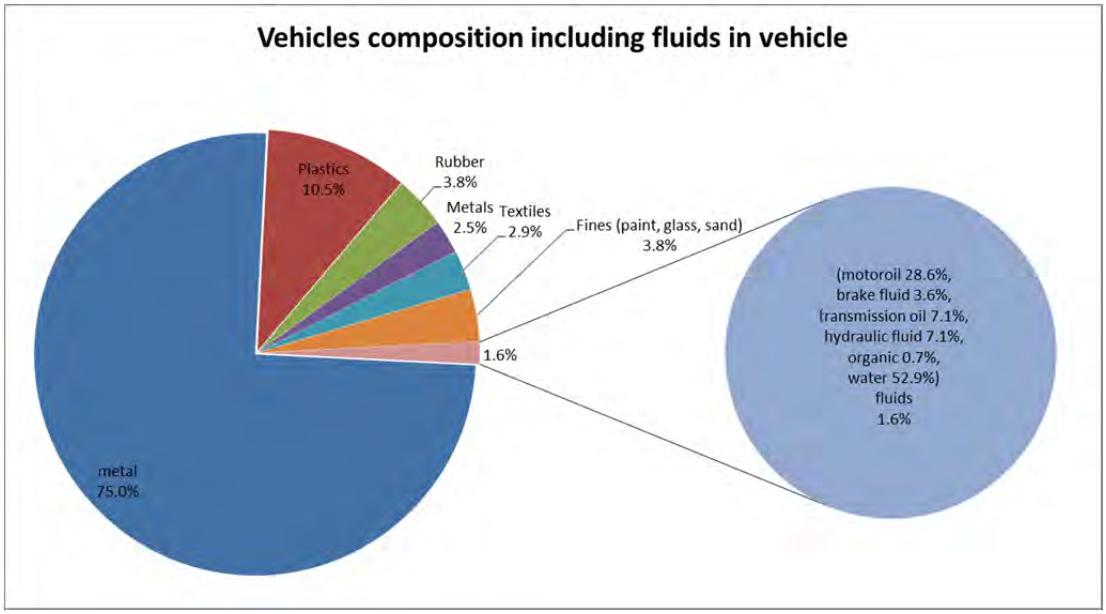
For the calculation the metal content of an ELV is assumed with 75%. The first step is to convert the shredder floc composition based on 25% to total vehicle mass.
Below the converted material percentage of the shredder floc based to total vehicle mass:

Material type	
Plastics	13.8%
Rubber	5.0%
Metals	3.3%
Textiles	3.8%
Fines (paint, glass, sand)	5.0%

[3] values from http://www.sustainability.vic.gov.au/-/media/resources/documents/publications-and-research/research/market-analysis/market-analysis-shredder-floc-sep-2014.pdf. Table 1: Average shredder floc composition
[4] Environmental Impact of End-of-Life Vehicles: An Information Paper", last modified 2002, http://www.environment.gov.au/archive/settlements/publications/waste/elv/impact-2002/index.html.

Below the amounts of the converted composition for a vehicle including metal, shredder floc material and without and with fluids.

Material type	without drainage	with drainage
Metal	75.0%	75.0%
Plastics	10.5%	11.2%
Rubber	3.8%	4.1%
Metals (Zinc, Copper, Aluminium, Lead etc.)	2.5%	2.6%
Textiles	2.9%	3.0%
Fines (paint, glass, sand)	3.8%	4.1%
Fluids (motor oil 28.6%, brake fluid 3.6%, transmission oil 7.1%, hydraulic fluid 7.1%, organic 0.7%, water 52.9%)	1.6%	0.0%
	100.0%	100.0%



3. Chemical Components in Floc Waste

3.1 Hydrocarbon

A report on the investigation of the material composition from shredder plants[5] shows that the overall levels of hydrocarbons in the floc waste is in the average of 28 g/kg ≙ 2.8%.

Based on the values from the above table “Summary Fluids in vehicles (organic and water summarized)” the sum of all fluids except water is 10.4 kg (motor oil, brake fluid, transmission oil, hydraulic fluid). Related to average vehicle weight of 1,390kg, the average hydrocarbon percentage in the Australian floc waste is 2.99%.

Conclusion
The hydrocarbon level calculated in report and evaluation in this memo come to same result.

3.2 Polychlorinated Biphenyl (PCB)

In the same report the average value for Polychlorinated Biphenyl is 120 mg/kg. (page 26)

3.3 Brom

The analysed average Brom content in floc waste is 0.02 g/100g. (page 24)

[5] Bericht über die Untersuchung der stofflichen Zusammensetzung und des Auswaschverhaltens von Rückständen aus Shredderanlagen (RESH) im Hinblick auf deren Entsorgung in Reaktordeponien, Umweltschutzlabor 1995, page 25, table 9