Tullamarine Closed Landfill
Flare Emission Testing Report

Western Avenue, Westmeadows VIC

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Purpose of this Presentation:

- Present the findings of the Kleinfelder 2015 Flare Emission Testing Report;
- Provide some context for this report in terms of Landfill Gas management at the site.

Works Undertaken by Kleinfelder:

- Review of flare outlet analytical data;
- Screening of data against assessment criteria;
- Reporting of findings.

Background to Gas Collection and Flaring

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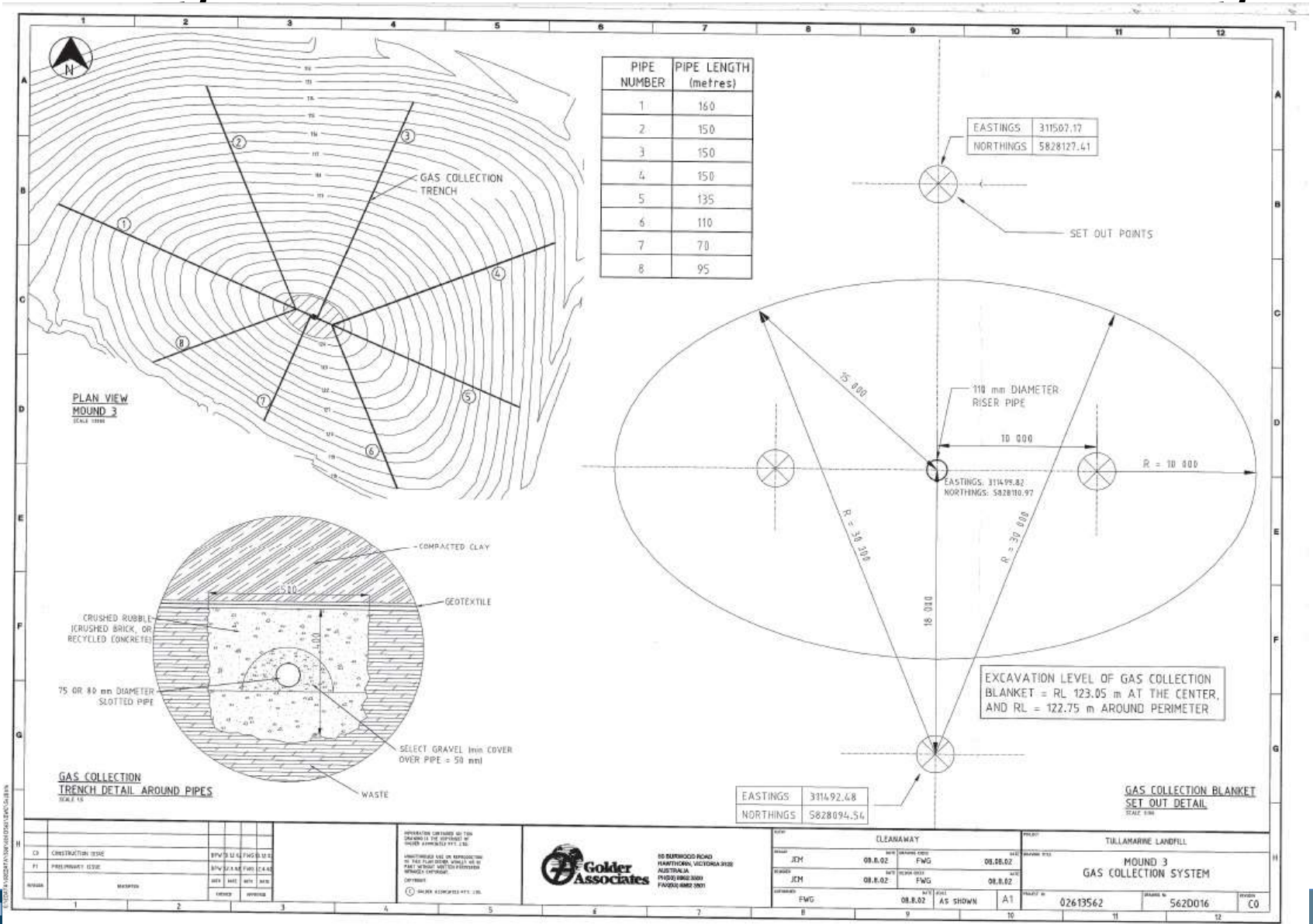

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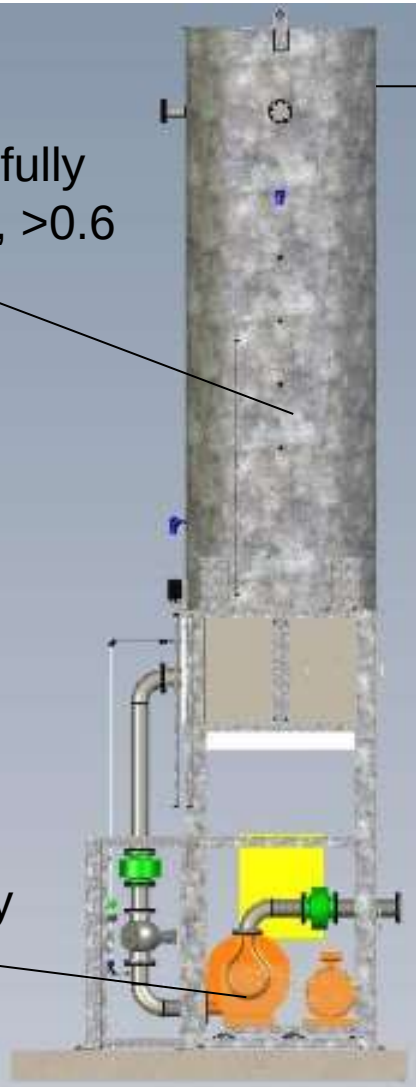

Emissions

Combustion occurs within fully enclosed chamber (900°C, >0.6 sec residence)

Under vacuum provided by ‘blower’

LFG from the landfill

Kleinfelder 2015 Flare Emission Testing Report:

- Flare Sampling Completed by Ektimo in 2015;
  - (compliant with EPA Publication 440.1 – A Guide to the Sampling and Analysis of Air Emissions and Air Quality)
- Analysis Completed by Ektimo, Australian National Measurement Institute (ANMI) and EnviroLab;
- Review of Quality Assurance / Quality Control completed by Kleinfelder.

Regulatory Framework

- Two State Environmental Protection Policies (SEPPs) are applicable to this assessment:
  - Air Quality Management SEPP (2001) and
  - Ambient Air Quality SEPP (1999).
- Ambient Air Quality SEPP adopts requirements of the National Environment Protection (Ambient Air Quality Measure 2003 (NEPM).

According to the SEPPs, the following beneficial uses are to be protected throughout Victoria:

- Life, health and well-being of humans;
- Life, health and well-being of other forms of life, including the protection of ecosystems and biodiversity;
- Local amenity and aesthetic enjoyment;
- Visibility;
- The useful life and aesthetic appearance of buildings, structures, property and materials; and
- Climate systems that are consistent with human development, the life, health and well-being of humans, and the protection of ecosystems and biodiversity.

Assessment Criteria:

- Air Quality Indicators defined as the Following Classes:
  - Class 1 – Common Air Pollutants.
    - Have many sources and can be widespread in the air environment;
    - Include nitrogen dioxide, sulphur dioxide, carbon monoxide, PM10 and lead.
  - Class 2 – Hazardous Substances.
    - May threaten air beneficial uses based on toxicity, bioaccumulation or odour;
    - Generally source specific however can also be widespread.
  - Class 3 – Extremely Hazardous Substances.
    - Highly toxic or highly persistent;
    - Will almost always be restricted to local area around a source.
  - Unclassified – Substances considered to impact local amenity and aesthetic enjoyment only.

Assessment Criteria:

- Sourced from the Air Quality Management SEPP;
- Odour based criteria for 17 of the analytes monitored;
- Toxicity based criteria for 50 individual analytes and two chemical group mixtures (TEQs):
  - Dioxins and Furans;
  - Polycyclic Aromatic Hydrocarbons (PAHs).

Results of Flare Emission Testing:

- 80% of analytes tested for were not detected in either of the two samples collected;
- Six analytes exceeded the air quality criteria (3% of those tested):

Analyte	Class	Criteria (mg/m^3)	Concentration (mg/m^3)	
			Test 1 (120 min)	Test 2 (120 mins)
Acetaldehyde (only odour criteria exceeded)	Class 2 (odour based)	0.0076	0.16	0.18
Chromium	Class 2	0.017	0.015	0.051
Chlorine	Class 2	0.1	0.12	0.1
Total particulate matter	Unclassified	0.05	2.6	5.8
Sulphur dioxide	Class 1	0.45	<0.2	1.7
Sulphuric acid	Class 2	0.033	2.1	1.6

Comparison to Vehicle Emissions:

Table 2: Emission factor summary for road transport vehicles

Engine type	Fuel	Table	Substances	Units
Passenger car	Diesel	Table 9	CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs.	kg/m³
	Petrol	Table 10	Benzene, 1,3 Butadiene, CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
	Petrol	Table 11	Benzene, 1,3 Butadiene, CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/km
	LPG	Table 12	Benzene, 1,3 Butadiene, CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/km
	LPG	Table 13	Benzene, 1,3 Butadiene, CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
	E10	Table 14	CO, Fluoride compounds, NOx, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
LGV[1]	Diesel	Table 15	CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
	Petrol	Table 16	Benzene, 1,3 Butadiene, CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/km
	Petrol	Table 17	Benzene, 1,3 Butadiene, CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
	LPG	Table 18	Benzene, 1,3 Butadiene, CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/km
	LPG	Table 19	Benzene, 1,3 Butadiene, CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
MGV[2]	Diesel	Table 20	CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
HGV[3]	Diesel	Table 21	CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
Very HGV[4]	Diesel	Table 22	CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
Bus[5]	Diesel	Table 23	CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
Buses and trucks	Natural gas	Table 24	CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³
Forklift	LPG	Table 25	CO, Fluoride compounds, NO_x, $PM_{2.5}$, PM_{10}, PAHs, SO_2, TVOCs	kg/m³

1. LGV is light goods vehicle ≤ 3.5 t GVM.
2. MGV is medium goods vehicle < 3.5 t GVM ≤ 12 t.
3. HGV is heavy goods vehicle <12 t GVM ≤ 25 t.
4. Very HGV is heavy goods vehicle >25 t GVM.
5. Bus is heavy bus >5 t GVM.

Table 20: Emission factors (kg/m³) for diesel vehicle exhaust emissions (MGV)[2]

Substance	Emission factor[1] (kg/m³)	Emission factor scientific notation (kg/m³)	Rating
Carbon monoxide	12	$1.21x10^{+01}$	U
Fluoride compounds[6]	0	$0.00x10^{+00}$	U
Oxides of nitrogen	17	$1.71x10^{+01}$	U
Particulate matter 2.5 µm	2.2	$2.25x10^{+00}$	U
Particulate matter 10.0 µm	2.3	$2.33x10^{+00}$	U
Polycyclic aromatic hydrocarbons[4]	0.00084	$8.36x10^{-04}$	U
Sulfur dioxide[3]	0.017	$1.67x10^{-02}$	U
Total volatile organic compounds[5]	2.1	$2.14x10^{+00}$	U

Notes:
1. Source: Reference 2, Table 66.
2. MGV is medium goods vehicle < 3.5 t GVM ≤ 12 t.

- Note: units are in kg/m^3; our assessment is at the mg/m^3 level.
- Our SO_2 = 0.0000017 kg/m^3.
- Our Total Particulate Matter = 0.0000058 kg/m^3.
- Annual calculated emissions of a diesel utility (CO, NO_x, and PM only) = 330kg/year.
- Using the same compounds and operating at 200 m^3/hour, emissions from the flare = 107 kg/year.
- Dept. Environment, Water Heritage and the arts National Pollutant Inventory (NPI 2008).

Where to from Here?

- Our assessment focuses on emissions from a source (flare);
- And conservatively screens against air quality criteria;
- Some analytes did not have applicable assessment criteria;
- And six analytes exceeded our screening criteria;
- Full assessment would consider source (completed), transport pathway and potential receptors.
- It is understood Transpacific will undertake further assessment (Transport Modelling; Ambient Air Sampling)

Questions?

References:

- Australian Government, Department of the Environment, Water, Heritage and the Arts, 2008, *National Pollutant Inventory, Emission Estimation Technique Manual for Combustion Engines Version 3.0,* June 2008.
- Ferreira, A. P., 2013, *Levels of Organochlorins Contaminants of Fish Species from Coastal Area in the South Eastern Brazil,* International Journal of Marine Science, May 2013.
- Silberberg, M. S., 2003, *Chemistry The Molecular Nature of Matter and Change 3rd ed, Mc Graw Hill, 2003.*