Pacific Environment Limited

Consulting • Technologies • Monitoring • Toxicology

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RE: Luddenham Memorial Park – Additional information for JRPP

1 INTRODUCTION

The Joint Regional Planning Panel (JRPP) meeting held on 26 September 2013 has requested the following additional information in relation to the air quality impacts of the proposed Luddenham Memorial Park:

- *Further information on the future air quality in the locality having regard to the mercury scrubber technology proposed to be installed in the crematorium emissions system.*
- *A management plan demonstrating that the proposed facility will not pose material risks to the environment (primarily water and air), human health and nearby land uses. The plan is to include provision for monitoring against predicted outcomes and public reporting of performance and monitoring results at specified intervals. That plan is to provide for independent auditing of compliance by relevant expert(s) whose qualifications and experience are to be approved by Council and funded by the facility operator.*

An Environmental Management Plan (EMP) has been prepared by Martens & Associates, with input provided by Pacific Environment for air quality management, specifically related to the operation, management, maintenance and performance of the cremator and associated emissions abatement system.

The purpose of this letter is to provide a further detail on the proposed mercury abatement system and how it would be operated in accordance with international best practice.

To provide context, a short summary of the air quality modelling results are presented, noting that modelling results in the Air Quality Impact Assessment were provided without the additional proposed mercury abatement system.

We have additionally provided suggested conditions of approval (shown in **Appendix A**) to assist Council and/or the JRPP in developing appropriate development conditions.

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2 AIR QUALITY ASSESSMENT

In August 2013 a revised air quality impact assessment (AQIA) was completed for Luddenham Memorial Park (**Pacific Environment, 2013**). The primary objective of the revised report was to provide a consolidated AQIA which incorporates revised modelling results and the recommendations from various peer reviews. Recommendations for air quality management are also updated to include the proposed pollution control, including mercury abatement.

Predicted ground level concentrations for NO_2, PM_{10}, $PM_{2.5}$, SO_2 and CO were assessed at the nearest sensitive receptor. Predicted ground level concentrations for toxic pollutants (i.e. Mercury (organic), PAH, Arsenic, Beryllium, Cadmium, Chromium III, Chromium VI, Copper, Formaldehyde, HCl, Lead, Nickel, dioxins and furans, Acetaldehyde, Antimony and Zinc) were assessed at and beyond the site boundary.

The modelling results indicate that compliance is achieved at all off-site receptors for all pollutants and all averaging periods. For most pollutants, the incremental modelling predictions were less than or equal to 1% of the relevant air quality criteria. The exceptions were NO_2 (4% of the air quality criterion at nearest receptor), dioxins and furans (9% of the air quality criterion at the site boundary) and mercury (32% of the air quality criterion at the site boundary).

The modelling results presented in the AQIA did not include pollution control / emissions abatement. The proponent is committed to international best practice pollution control for the cremator and will install a mercury abatement system that will include a scrubber and fabric filter, described further below.

3 MERCURY ABATEMENT

The proponent is committed to international best practice pollution control for the cremator and will install a mercury abatement system. For the purpose of this report, international best practice is defined based on Best Available Technology (BAT) with reference to:

- Process Guidance Note 5/2 (12) Statutory Guidance for Crematoria (DEFRA - UK Department for Environment, Food and Rural Affairs) (**Defra, 2012**).
- European Commission BAT (Best Available Techniques) Reference Document (BREF) for waste incineration (**EC, 2006**)

Defra, 2012 requires that all new crematoria in the UK are fitted with mercury abatement and by end of 2012 at least 50% of all existing crematoria in the UK are fitted with mercury abatement. No such policy exists in Australia; therefore the proponent is committed to international best practice for mercury abatement. The mostly commonly applied BAT for mercury abatement are:

- Wet scrubbing with addition of sulphur, activated carbon or oxidants to the scrubbing liquor (reported removal efficiency of 85% (**EC, 2006**)).
- Dry scrubbing - Adsorption with activated carbon injection plus fabric filtration (reported removal efficiency of 95% (**EC, 2006**)).

In the UK, BAT for crematoria is the use of a dry scrubber, comprising cooling, capture and collection. After cooling dry lime or sodium bicarbonate and activated carbon is injected into the gas stream and the mercury is adsorbed onto the surface of these particles. The gas stream then passes through a baghouse fabric filtration system where the particles are captured and collected for removal (**Defra, 2012**).

In accordance with best practice guidance and BAT, the proposed mercury abatement system for the Luddenham crematorium is a Luhr Filter mercury scrubber, the specifications of which are shown in **Figure 1**. The system has been designed to fit to the proposed Major Furnace model HD90 series cremator as outlined in the Air Quality Impact Assessment.

Figure 1 provides details on how the mercury scrubber would work, with abatement achieved by introducing absorbent materials (lime, bicarbonate and activated carbon) into the Luhr Filter Conditioning Rotor reaction chamber. The flue gas from the cremator enters cone shaped conditioning rotor reaction chamber (shown in **Figure 1**) where mercury reacts with the sorbent material and is removed from the gas stream. The injection socket for the absorbent is also clearly shown in **Figure 1**.

The flue gas then passes through a Luhr fabric filter which removes the particulate matter from the flue gas, further cleaning the flue gas prior to discharge. The fabric filter or bag house is located above the conditioning rotor reaction chamber (shown on the drawing in **Figure 1**). The clean air outlet is also shown, which is then directed to the exhaust point.

Spent absorbent (which includes the removed mercury fume) is collected in the collection bin, shown on the diagram and the collected particulate matter in the fabric filters is also routinely collected and removed.

Mercury abatement such as the system proposed for the Luddenham crematorium is routinely installed in crematoria in the UK and waste incineration facilities in Australian and the UK. Luhr Filter has been designing robust solutions for air pollution control in the Australian market for over 30 years. They are associated with Luhr Filter GmbH & Co KG of Germany, a global leader in the industry for over 70 years.

The injection of activated carbon as the sorbent has the added benefit of reducing emissions of dioxins and furans while the fabric filter unit also captures the majority of particles and other metals.

In summary, the proposed emissions abatement system will achieve:

- Reduction in mercury emissions by 90%-98% (**EC, 2006**; **Defra, 2012**).
- Added benefit of reducing dioxin and furan emissions (through carbon injection) to achieve limit of 0.1 ng/m^3 (**EC, 2006**)
- Added benefit of reducing particulate matter and other metals (typically by more than 90%).

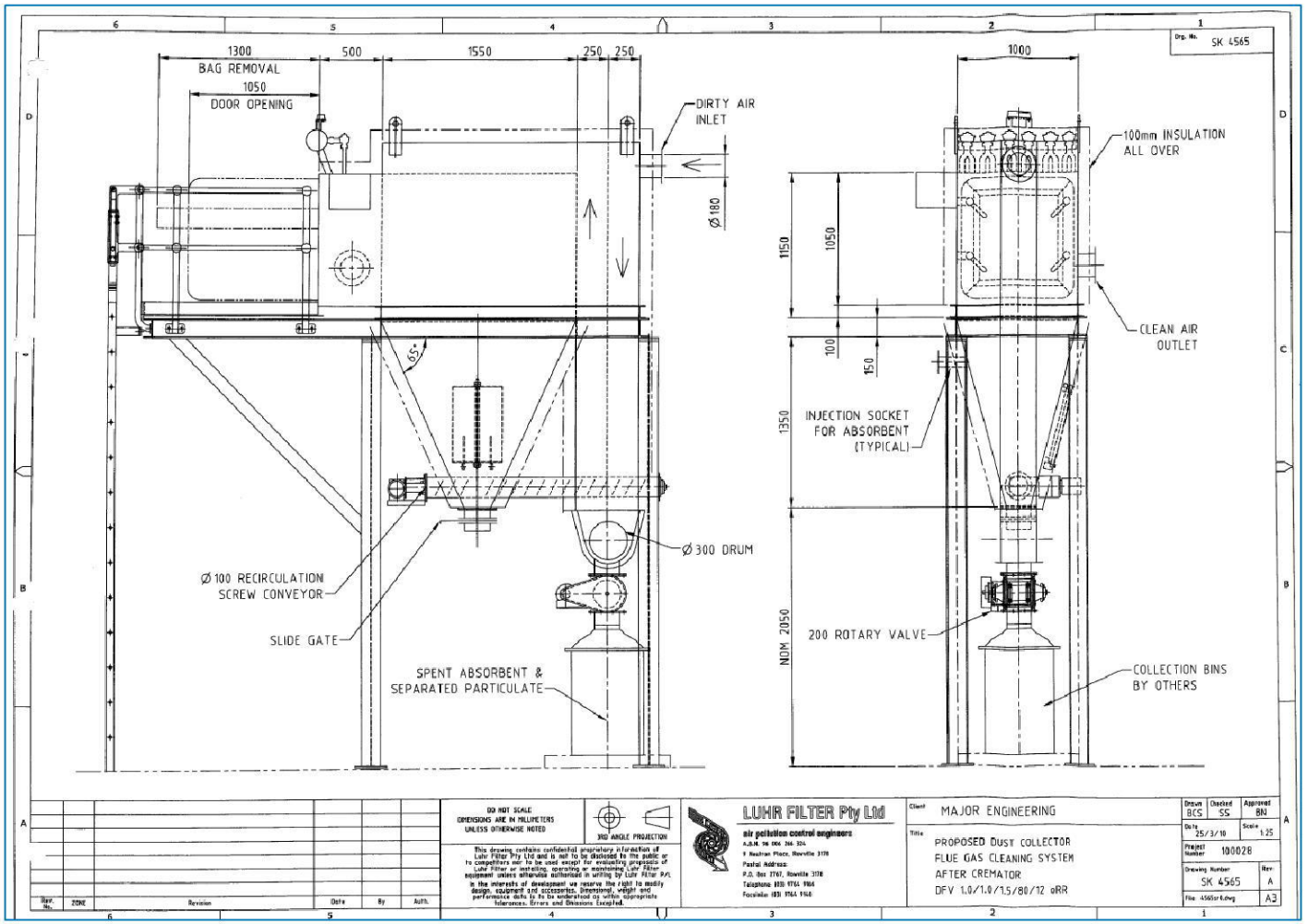

Figure 1: Technical Specification of the Proposed Mercury Scrubber

As discussed, model predictions in the AQIA for maximum 1 hour average mercury concentrations are presented without mercury abatement. With the implementation of greater than 90% mercury abatement, mercury concentrations would be substantially lower. **Figure 2** provides a graphical representation of the predicted mercury concentrations compare with the most stringent health based standard, with and without abatement.

With abatement the mercury concentrations at the nearest residence would be less than 1%-3% of the NSW EPA criterion.

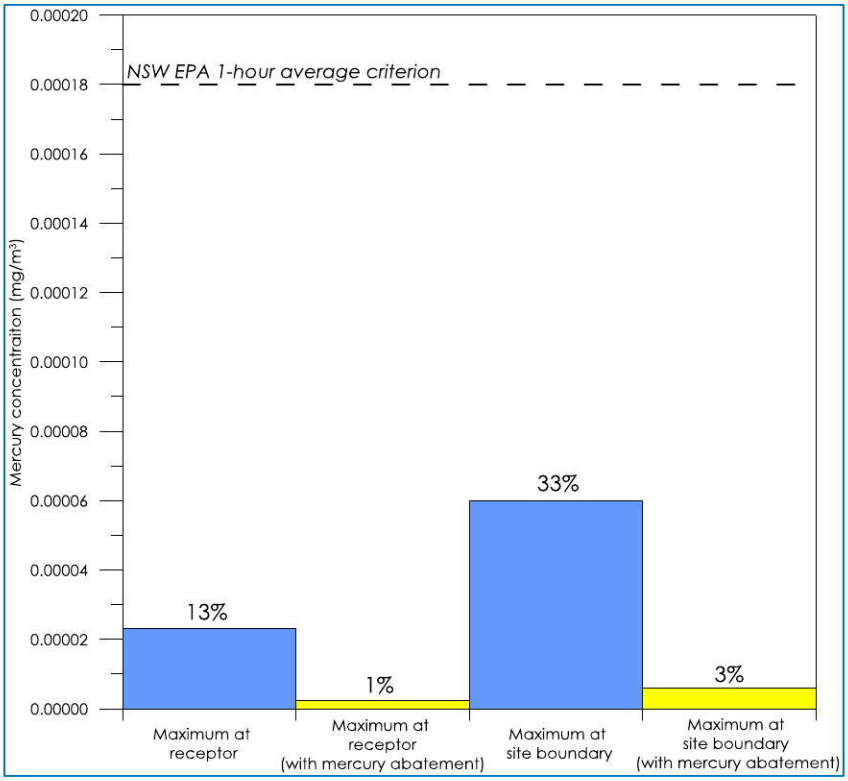

Figure 2: Mercury abatement comparison

4 CONCLUSION

The emissions from the Luddenham crematorium will comply with the most stringent health based guidelines for mercury and all other pollutants, even without the additional mercury abatement system, which the proponent has committed to.

The air quality impact assessment demonstrated that the crematorium emissions would comply with the most stringent health based standards and would not result in any significant degradation in ambient air quality without the proposed mercury abatement system.

In addition to this, the proponent is committed to international best practice through the installation of a mercury abatement system, comprising of a scrubber (with carbon injection) and bag filtration unit.

This will further reduce mercury emissions by over 90-98% (from an already very low base) and particulate matter (including metals) and dioxin and furans to meet stringent health based guidelines.

5 REFERENCES

DEFRA (2012). Process Guidance Note 5/2 (12) Statutory Guidance for Crematoria. UK Department for Environment, Food and Rural Affairs. February 2012.
http://archive.defra.gov.uk/environment/quality/pollution/ppc/localauth/pubs/guidance/notes/pgnotes/documents/pg5-02.pdf

EC (2006). Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for Waste Incineration. European Commission. August 2006.

APPENDIX A. PROPOSED CONDITIONS OF CONSENT

Condition

An Environmental Management Plan (EMP) shall be developed and submitted to the Principal Certifying Authority for approval. The EMP shall provide a comprehensive and complete action and implementation plan to ensure that the anthropological and natural environment is not unacceptably impacted upon by this proposal.

Air Quality

The proposal shall be undertaken in accordance with the recommendation of the (Air Quality Impact Assessment – Luddenham Memorial Park) prepared by Pacific Environment and dated 6 August 2013. In particular the development shall satisfy the following recommendations:

- The cremator shall be of dual chamber type where the secondary combustion chamber shall consistently maintain a minimum temperature of 850 °C for a residence time of at least 2 seconds and minimum 6% O_2 (dry basis) to ensure effective pollution control.
- Automated control of temperature, oxygen, pressure and smoke to ensure optimal operating conditions at all times.
- The development shall have an exhaust stack height of 6.7 metres (set as 1 metre above the roof ridge level), a stack exit temperature of at least 400°C and an exhaust velocity of 15 m/s should be maintained at all times.
- A sampling point for the flue exhaust should be in in accordance with the Australian Standard (AS) 4323.1-1995.
- The fuel used at the cremator shall be natural gas only.
- The proponent will install a pollution abatement system to control particulate matter and mercury emissions to the satisfaction of the regulator.
- The proponent shall maintain equipment and air pollution control devices according to manufacturer's specifications, prepare a written maintenance programme for pollution control equipment and maintain a record of maintenance undertaken, inspection, repair and replacement of parts.

Emission Limits

The cremator flue exhaust will operate at the following emission limits:

Parameter	Concentration limit / operating	Frequency of testing
Total particulate matter	20 mg/m^3	On commissioning and annual thereafter
Hydrogen Chloride (HCl)	30 mg/m^3	
Carbon monoxide (CO)	100 mg/m^3	
Oxides of nitrogen	350 mg/m^3	
Mercury	0.05 mg/m^3	
VOCs	20 mg/m^3	
Metals (Type 1 and 2	1 mg/m^3	
Dioxins or furans (PCCD/F)	0.1 ng/m^3	

Note a: All measurements should be made concurrently with oxygen, temperature and flow parameters.

Monitoring

- The operator shall continuously monitor temperature (primary chamber and exit of secondary combustion zone), oxygen and opacity (both at exit of secondary combustion zone) and implement an automated control system to ensure optimal operating conditions. 'System should be calibrated annually. Trigger alarms should be put in place when parameters are outside of the required range to ensure that combustion efficiency is optimised (e.g. when temperature falls below 850°C).
- Flue gas testing shall be carried out at commissioning for the pollutants listed above and annual

thereafter. All testing will be completed in accordance with the NSW EPA Approved Methods for Sampling and Analysis of Air Pollutants in NSW.

- The frequency of monitoring should be reviewed after 3 years and reduced if all measurements less than 50% of the prescribed limits.
- Visual inspections and olfactory tests at the site boundary should also be undertaken routinely during start-up, shutdown and peak operations to ensure equipment and operational processes are working as they should be or where smoke is noted during operation. Emissions from cremations should be free from visible smoke during normal operations. A log of these daily checks should be maintained and include the result and the prevailing weather conditions.
- The Operator will maintain liaison with funeral directors and casket manufacturers with a view to encourage use of casket material that minimise environmental risks in the combustion process. Funeral directors will be required to provide a written log of the casket contents and insist on compliance with the ACCA *Guideline Contents of Coffins Delivered for Cremation*.
- A full set of operating manuals shall be available in the cremator building and training should be provided to the operators for optimal performance and routine trouble shooting. This shall include at minimum a maintenance and cleaning programme that will include effective preventative measures for equipment associated with air emissions with scheduled cleans completed approximately twice per year.
- An Environmental Contingency Plan shall be prepared in case of an inadvertent stoppage of the incinerator during the cremation process.
- The proponent shall obtain warranty from the supplier of the creator to ensure effective incineration is achieved.

The development shall fully comply at all times with the requirements of the *Protection of the Environment Operation (Clean Air) Regulation (2010*)