Submission No 259

INQUIRY INTO PROPOSED ENERGY FROM WASTE FACILITIES

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Submission to the NSW Legislative Council Select Committee on Proposed Energy from Waste Facilities

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Introduction

I am an Associate Professor specializing in environmental engineering and sustainable waste management. My research includes lifecycle assessment (LCA), bioenergy, and the environmental performance of waste treatment technologies. I submit this document in response to the NSW Parliament's inquiry into proposed energy from waste (EfW) facilities, particularly those planned for Tarago and Parkes.

Summary

This submission evaluates the proposed EfW facilities in NSW against environmental, health, technological, and regional planning criteria. Drawing on peer-reviewed research and international benchmarks, I argue that while EfW can contribute to waste management, its implementation must be carefully regulated, transparently monitored, and aligned with circular economy principles. Successful global examples demonstrate the potential of EfW, but also highlight the importance of overcoming economic, social, and environmental challenges.

Response to Terms of Reference (a,-d, g and i):

a. **The performance of the technologies proposed for the Tarago and Parkes Energy Recovery Facilities as compared to leading thermal technologies employed in "state of the art" facilities internationally, noting such technologies as proposed are not employed anywhere else on the Eastern seaboard.**

Overview of Proposed Technologies

Tarago (Woodlawn Advanced Energy Recovery Centre – ARC). Proposed by Veolia ANZ, the ARC will process 380,000 tonnes/year of residual waste. Technology involves high-temperature combustion (>850°C), flue gas cleaning, and bottom ash recovery.
Veolia claims the ARC will meet EU emission standards, referencing its UK facilities [1].

Parkes Energy Recovery Facility [2]. Led by Tribe Infrastructure Group, with technology from Kanadevia Inova (KVI). It will process 600,000 tonnes/year and generate 60 MW of electricity. Technology specifics remain undisclosed, but the consortium claims it is "globally proven".

Comparison with International State-of-the-Art Thermal Technologies

Europe and Asia employ Best Available Techniques (BAT) under the EU Industrial Emissions Directive and UNEP guidelines. Common technologies include moving grate incineration (dominant in Europe), fluidized bed combustion (Japan, Sweden), Gasification and pyrolysis (emerging, limited deployment).

Performance Metrics

METRIC	TARAGO ARC	PARKES PER	INTERNATIONAL BAT FACILITIES[3]
WASTE THROUGHPUT	380,000 t/year	600,000 t/year	500,000–1,000,000 t/year
ENERGY OUTPUT	~30 MW (40,000 homes)	~60 MW (80,000 homes)	Up to 150 MW (150,000 homes)
EMISSIONS CONTROL	Flue gas treatment, APCr stabilization	Claimed advanced filtration	Multi-stage scrubbers, SCR, real-time monitoring
REFERENCE FACILITIES	Staffordshire (UK)	None disclosed	Dozens across EU, Japan, Singapore
ASH RECOVERY	Bottom ash reused in construction	Not specified	Bottom ash recovery, metals extraction
CARBON CAPTURE	Not included	Not included	Emerging in EU (e.g., Oslo's Klemetsrud)

b. The spread of the emissions predicted and the quality of emissions to be generated

Predicted Emissions Spread and Quality from Tarago and Parkes Energy Recovery Facilities are based on provided information by proponents [4, 5]

Tarago (Woodlawn ARC) [4]:

NOx: 2.2 µg/m³ increase over a background of 21.6 µg/m³.

PM10/PM2.5: 91.5 ng/m³ increase over a background of 17.6 µg/m³.

SO_2: 549 ng/m³ increase over a background of 1.5 µg/m³.

Dioxins/Furans: 1.1 femtograms/m³ (fg/m³).

Heavy metals (e.g., mercury, cadmium): picogram-level concentrations.

Parkes Energy Recovery Facility [5]:

PM10: 0.57 mg/m³ vs NSW limit of 20 mg/m³

NO_2: 156 mg/m³ vs NSW limit of 250 mg/m³

Dioxins/Furans: 0.0091 ng/m³ vs NSW limit of 0.1 ng/m³

Values provided in both cases are below national ambient air quality standards, but long-term exposure to persistent pollutants like dioxins, PFAS and heavy metals remains a concern due to bioaccumulation and deposition in agricultural areas [6, 7].

Dispersion and Spread *as provided in* [4]:

Highest concentrations within 2–5 km radius of the stack.

Low ground-level concentrations due to high-temperature stack dispersion.

Potential deposition on soil, crops, and rainwater tanks—especially relevant for rural communities.

Concerns

A systematic review by Cole-Hunter et al. [8] who examined 19 peer-reviewed studies on WtE emissions found that:

Well-designed EfW facilities using sorted feedstock (RDF) emit fewer hazardous pollutants.

Poorly operated facilities may release dioxins, furans, and heavy metals, with serious health risks.

Bottom ash can retain toxic residues, posing risks to soil and water systems.

EfW facilities generally emit less health-relevant air pollutants than coal, but risks vary by waste type and operational quality.

c. health impacts from currently operating older technology waste incinerators as compared to the proposed newer technology

Older incinerators, particularly those built before the 2000s, have been consistently linked to a range of adverse health outcomes due to their higher emissions of toxic pollutants such as dioxins, furans, heavy metals, and particulate matter. These pollutants are known to contribute to:

Tait et al. [7] found significant associations between proximity to older incinerators and increased risks of cancers and reproductive dysfunctions. The review emphasized that older technologies often lacked adequate emission controls and maintenance, exacerbating health risks. Similarly, Bottini et al. [6] conducted a meta-analysis showing a slight increased risk for respiratory diseases and weak associations with non-Hodgkin lymphoma among populations living near municipal solid waste incinerators (MSWIs).

Newer incinerators, especially those developed post-2000, incorporate advanced pollution control technologies such as:

Selective catalytic reduction (SCR)

Activated carbon injection

Baghouse filters

Continuous emissions monitoring systems

These upgrades significantly reduce emissions of harmful substances. According to Choi et al. [9], newer incinerators are considered relatively safer, with fewer reported health effects. However, some studies still link them to diseases such as soft tissue cancers and respiratory disorders, albeit at lower incidence rates. Roberts & Chen [10] attempted to quantify the health risk from a medium-sized incinerator and found the annual risk of death due to emissions to be extremely low (1 in 4 million), suggesting that modern incinerators pose minimal direct mortality risk when properly maintained. Tait et al. [7] caution that while newer technologies may reduce exposure, the latency of certain diseases (e.g., cancers) and insufficient long-term data make it difficult to conclusively determine safety. They advocate for a precautionary approach and emphasize the importance of waste minimization.

While newer incinerator technologies offer improved emission controls and reduced health risks, evidence still supports caution, especially in densely populated areas. Older incinerators are clearly associated with more severe health impacts, and transitioning to newer systems should be accompanied by rigorous monitoring, transparent reporting, and community engagement.

d. the impact on agriculture locally and across the wider region

PFAS are a class of synthetic chemicals known for their chemical stability, resistance to degradation, and bioaccumulate in tissues. PFAS can enter agricultural systems via [11]:

Atmospheric deposition from incinerator emissions
Contaminated biosolids applied as fertilizer
Irrigation with PFAS-contaminated water
Feed and forage grown on contaminated soil

Recent studies show that high-temperature incineration may not fully destroy PFAS compounds. Björklund et al. [12] detected PFAS in flue gas, bottom ash, and treated process water from a EfW plant. Björklund et al. found that:

Short-chain PFAS (C4–C7) were most abundant.

Flue gas concentrations ranged from 4.0–5.6 ng/m^3.

Annual PFAS release estimated at 13–47 g, depending on waste mix.

PFAS incineration may pose risks to agricultural land and food safety, especially when combustion is incomplete or waste streams are poorly characterized. Peer-reviewed studies confirm that PFAS can persist in flue gas, ash, soil, crops, and livestock, leading to bioaccumulation and potential human exposure. A precautionary approach, robust monitoring, and policy support are essential to protect farming communities.

g. Impacts of waste-dumping over a number of decades in the Tarago region

Soil and Water Contamination

Long-term landfilling is associated with leaching of organic and inorganic pollutants, including Heavy metals, Persistent organic pollutants (POPs), Nutrient overload. These contaminants can percolate into groundwater, accumulate in soil, and enter the food chain, affecting crops and livestock. Peer-reviewed literature evidence confirms that even engineered landfills pose risks due to liner failure, leachate migration, and gas emissions [13].

Agricultural and Ecosystem Impacts

The Tarago region supports beef, lamb, canola, and viticulture, all of which are vulnerable to soil degradation from heavy metals and acidic leachate; crop contamination via airborne deposition and irrigation; livestock exposure through contaminated feed and water and PFAS bioaccumulation in forage and animal tissues.

EPA sampling in 2024–2025 detected elevated PFOS levels in surface waters near Woodlawn, exceeding ecological guidelines. Further the EPA reported *"elevated pollutants, with water quality typically poorest at the sampling sites closest to the licenced facilities within the Precinct and improving with distance downstream. Sampling sites closest to the licenced facilities within the Precinct had some of the highest concentrations of salinity, nutrients, total dissolved solids (TDS) and total positive PFAS."* [14].

i. Alternative solutions to reduce and manage residual waste produced by Greater Sydney, and

To reduce and manage residual waste in Greater Sydney, the following integrated strategies are recommended [15-19]:

- Expand source separation to reduce contamination and improve recycling.
- Consider anaerobic digestion and composting for organic-rich waste.
- Deploy EfW selectively, ensuring alignment with carbon trading and renewable energy goals.
- Use LCA approach for evaluating alternatives and proposed EfW plants.
- Be aware of keyhole vision by focusing on reducing carbon emissions or increasing EfW share as these can be misleading in the absence of evaluation of other environmental and health impacts.
- Adopt holistic framework, adaptive waste management.

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