Inquiry: Inquiry into the development and expansion of waste-to-energy (WtE) infrastructure in Victoria

Hearing Date: 26 May 2026

Question[s] taken on notice

Directed to: Janek Vahk

Received Date: 16 June 2026

Additional questions on notice from David ETTERSHANK

1. **Question Asked:**
   Do you have any concerns about the mixing of incinerator wastes such as bottom ash and fly ash with durable (but not indestructible) engineering materials such as concrete, road making materials?

   Response: Yes, there are serious and well-documented concerns. Independent peer-reviewed research consistently shows that incinerator bottom ash (IBA) is neither chemically inert nor stable over the long term, and its incorporation into construction materials creates significant risks that current regulation does not adequately address.

   First, bottom ash contains appreciable quantities of toxic elements - including lead, cadmium, arsenic, antimony, chromium, copper and zinc - classified as of high concern under EU hazard criteria, alongside persistent organic pollutants (POPs) such as dioxins, PCBs, brominated flame retardants, and per- and polyfluoroalkyl substances (PFAS). These substances can leach into surrounding soil and groundwater across a wide range of conditions and timescales. This risk is compounded when ash is embedded in engineering materials, because the engineering materials themselves are not permanent: concrete carbonates and ages over decades, road surfaces crack and erode, and as they do, the toxic substances they contain are progressively released into the environment.

   Second, there are structural safety concerns. Bottom ash contains residual aluminium which reacts with water and calcium hydroxide to produce hydrogen gas, causing swelling and cracking of concrete structures. Recent research has shown that swelling can continue for seven to ten months due to sulphate-hydrate crystallisation, with vertical expansion rates exceeding 18% - far beyond acceptable engineering limits. The 2017 Nortrader incident, in which a cargo of unprocessed IBA caused two explosions on a ship due to hydrogen gas accumulation, illustrates that these risks are not theoretical.

Third, the leaching tests currently used to approve bottom ash for construction use do not reflect real-world conditions. They use distilled water at fixed pH and assess only a limited range of substances over short timescales. They do not account for the influence of organic compounds in groundwater, changes in pH over time, or the long-term carbonation of cement, all of which accelerate the release of toxic substances. Independent researchers have described these tests as providing at best only a makeshift snapshot rather than a long-term assurance of product integrity and public safety.

Fourth, PFAS and microplastics present in bottom ash are entirely unregulated in this context. The tolerable weekly intake for PFAS set by the European Food Safety Authority is hundreds of times lower than concentrations found in IBA, meaning that construction workers cutting, drilling or grinding IBA-derived concrete products need ingest only one gram of dust to far exceed safe exposure thresholds.

The conclusion of the most recent independent research is that the use of bottom ash in civil engineering applications is premature and inadequately justified, and that its incorporation into the built environment creates a toxic legacy for future generations.

Key references:

- A toxic legacy: Bottom ash in Europe's circular economy
- Toxic Fallout – Waste Incinerator Bottom Ash in a Circular Economy

2. **Question Asked:**
   Is there research about the impacts of burning 'biodegradable' plastics vs traditional petroleum based plastics?

   Response: Yes, and the findings challenge the assumption that biodegradable plastics are a safer input for incineration.

   First, biodegradable plastics are not chemically benign. Research shows that while plant sources such as corn or cane sugar may not themselves be toxic, the chemical processes needed to manufacture bioplastics and the performance additives required to give them their attributes can be quite toxic - leading researchers to conclude that bioplastics should be regulated in the same way as conventional plastics.

Second, burning them still generates hazardous residues. Potentially hazardous emissions such as particulate matter, dioxins, and furans during the incineration of biodegradable plastics are a recognised environmental pollution concern.

Third, incineration negates their climate advantage. A recent lifecycle review found that incineration generates 20% extra greenhouse gas emissions with no environmental benefit because the material is completely combusted, whereas the environmental benefits of biodegradable plastics are only realised when they are properly managed through industrial composting or anaerobic digestion.

Key references:

- Environmental performance of bioplastics: degradation pathways, chemical leaching, and life-cycle implications
- Replacing Traditional Plastics with Biodegradable Plastics: Impact on Carbon Emissions
- The Environmental Trade-offs of Biodegradable Plastics

Additional questions on notice from Rachel PAYNE

Overview of Submission - Zero Waste Europe (268):

Against WtE. Argues that expanding WtE in Victoria risks locking the state into a high-emission and recourse-intensive waste management system that is at odds with the circular economy and poses risks to the environment and health.

Draws on the European experience where there has been a poor climate performance, noting several countries have introduced carbon pricing for incineration. Recommends policies that prioritise prevention, reuse, recycle, waste separation, and improved residual waste treatments e.g., MBRT for better environmental, social, and economic outcomes.

Key Issues:

1. **Victoria is at risk of locking in WtE**. Victoria's infrastructure expansion will need constant feedstock creating structural incentive to keep generating waste.
2. **Policy alignment:** Undermines circular economy goals and investment in more sustainable options, suggests Mechanical Recovery and Biological Treatment (MRBT) is better aligned.

3. **WtE does not eliminate waste, it transforms it into toxic by-products.** Incineration produces ash and hazardous residue (e.g., heavy metals).
4. **Public health and environment risk:** ash and residue can leach into soil and groundwater à potential health risks for communities.
5. **Climate impact and energy efficiency:** Incineration produces 1.11 tonnes of CO_2 per tonne of waste. Low energy efficiency – EU facilities roughly 10-25% net electricity efficiency à below fossil fuel plants averaging 35% coal and 55% gas.

Questions on Notice:

3. Question Asked:

How are emissions and hazardous residues from WtE facilities regulated and monitored in European jurisdictions, and how can this better inform Victoria's regulatory approach?

Response: In Europe, waste incineration has been regulated since 2010 under the Industrial Emissions Directive (IED), which requires post-combustion gases to be heated to at least 850°C for a minimum of two seconds, and sets pollutant limit values for stack emissions and wastewater from air pollution control systems. However, the IED sets no limits on the toxic content of bottom ash itself - it only requires that the ash have a total organic carbon content below 3% or loss on ignition below 5%.

In practice, even these operational requirements are frequently not met. Independent studies of bottom ash from incinerators in Italy found that only 4 out of 46 samples met the IED's loss on ignition limit of 5%, with median values ranging from 10 to 20% and maxima reaching 26%. Studies from England similarly found loss on ignition values ranging from 6 to 22% across three incinerators. This suggests that non-compliance with operating conditions may be more common than officially acknowledged.

Regulation of the use of bottom ash as a secondary material is highly fragmented across Europe. Some countries prohibit its use entirely; others use all that they produce. Testing protocols vary widely, cover only a limited range of substances, and are not harmonised. In the UK, the main classification protocol was developed by the waste industry's own trade association and contains multiple provisions that allow material demonstrably exceeding hazardous thresholds to be classified as non-hazardous.

For Victoria, the key lessons from the European experience are: first, that operational emissions standards alone are insufficient - toxic residues must also be regulated; second, that industry-led self-certification creates significant risks of under-reporting; third, that any regulatory framework must be based on independent science and must cover the full lifecycle of ash residues, not only their immediate generation.

4. **Question Asked:**
   You highlighted mechanical recovery and biological treatment (MRBT) combined with improved sorting as a better alternative to WtE. Has this been implemented anywhere internationally at scale, and is this viable at the scale required in Victoria?

   Response: Yes, MRBT has been implemented at scale in a number of European countries, particularly in Spain, Portugal, Italy, Germany and Austria. These systems combine mechanical sorting to recover recyclable materials with biological treatment - either composting or anaerobic digestion - of the organic fraction. They are capable of processing large volumes of residual municipal solid waste and have been demonstrated to achieve higher resource recovery rates than incineration while producing lower greenhouse gas emissions and avoiding the generation of toxic ash residues.

   MRBT facilities are modular and scalable, and do not require the long-term contractual lock-in that typically accompanies WtE infrastructure - a critical consideration given Victoria's stated circular economy goals. Unlike incineration, MRBT does not create structural incentives to maintain or increase waste generation in order to supply feedstock to facilities with guaranteed throughput requirements. It is therefore better aligned with upstream prevention, reuse and recycling objectives.

   Links:
   - Building a bridge strategy for residual waste
   - Reducing waste management’s contribution to climate change: From post-landfilling methane capture to pre-landfill methane prevention
   - Nothing left behind: modelling Material Recovery and Biological Treatment’s contribution to resource recovery and fighting climate change
   - Carbon in an electrified future: Technologies, trade-offs and pathways
   - Alternative Residual Waste Treatment

5. **Question Asked:**

Are there any proven safe reuse pathways for bottom ash?

Response: The only reuse pathway for bottom ash that can currently be considered legally and technically validated in Europe is the extraction of metals - ferrous and non-ferrous - which can be counted towards recycling targets. This is the sole pathway recognised under EU waste law as constituting recycling.

The use of the remaining 'mineral fraction' as a substitute for aggregate in roads or concrete cannot be considered a proven safe pathway. Independent research across multiple European countries - including Sweden, Austria, Germany, Italy, the Netherlands and the UK - has consistently shown that processed bottom ash, even after metals extraction, ageing and in some cases washing, fails to meet regulatory limit values for the leaching of toxic substances in one or more jurisdictions. Swedish researchers concluded that none of the sorting fractions they tested achieved regulatory limits, and that it is unlikely these materials can be refined to reach those limits. The primary driver for the use of bottom ash in construction is the high cost of disposal for industry, rather than any demonstrated environmental benefit.

Key references:

- A toxic legacy: Bottom ash in Europe's circular economy

6. **Question Asked:**
How do lifecycle emissions of incineration compare with landfill when methane capture is included?

Response: While landfill with standard gas capture performs worse than incineration in the short term - even at 50% lifetime capture rates (the UK benchmark) - this reverses when biological pre-treatment is applied. Figure 6 in the Zero Waste Europe report shows that switching from conventional landfill to MRBT saves 0.96 tonnes CO_2 equivalent per tonne of waste, and switching from incineration to MRBT saves 0.63 tonnes CO_2 equivalent per tonne.

The reason incineration is not the clear winner it appears is twofold. First, incinerators release fossil-derived carbon from plastics as permanent CO_2 emissions. Second, as Figure 7 illustrates, when landfill methane is largely eliminated through biostabilisation, the MRBT "temperature line" sits below incineration in all years - not just the long term - because the short-term methane spike from conventional landfilling is flattened. Gas capture alone cannot achieve this; a lifetime capture rate of around 80% or more would be needed to match incineration without pre-treatment, well above the typical 50% observed in practice.

The conclusion is that the real lever is not improving gas capture at landfills, but preventing methane generation in the first place through biological stabilisation before waste ever reaches the landfill.

Key references:

- Building a bridge strategy for residual waste
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