LOUISE KEATS		**OBJECT**	Submission ID: 218455
Organisation:	*N/A*	Key issues:	*Social impacts,Other issues*
Location:	*New South Wales 2576*		
Attachment:	*Attached overleaf*		

Submission date: 11/25/2024 4:25:11 PM

My submission is attached as a PDF document. Thank you for your consideration.

Independent Planning Commission
Level 15, 135 King Street
Sydney NSW 2000

Moss Vale Plastics Recycling Facility
SSD-9409987

Dear Commissioners

I am writing to express my strong opposition to application SSD-9409987.

I am an Author and Health Writer with tertiary legal and science qualifications (see below) and a resident of the Southern Highlands. My youngest child attends a creche in Moss Vale and my middle child attends school at [redacted]. I have grave concerns about this proposed development.

The development represents a real threat to residents of both the Southern Highlands and Sydney. My key concerns relate to health and environmental risks arising from microplastic and other toxic pollution.

MICROPLASTIC POLLUTION

Plastics recycling as a source of microplastic pollution

Numerous scientific studies confirm that plastic recycling is a source of microplastic pollution, even when mitigation measures are in place.[1] As a recent review article has noted:[2]

> "Recycling facilities have been identified as potential hotspots and contributors of toxic and hazardous waste, however, there is limited attention to chemical or particle release from plastic recycling facilities. Despite the current and emerging technologies to recycle plastic waste, non-recoverable tiny plastic particles (microplastics) cannot be addressed with existing collection methods due to their exceptionally small size. Further, the size reduction and washing during mechanical recycling facilities tend to release significant microplastics into the environment ... Ideally, plastic recycling facilities are equipped with filters to prevent and mitigate environmental contamination, but it partially mitigates microplastic release and is not a comprehensive solution. Additionally, the leaching of harmful plastic chemicals during and after recycling also poses a significant threat."

In the case of a UK plastics recycling plant that scientists assessed last year, the post-filtration microplastics released into wastewater amounted to **6 per cent of the total plastic processed**.[3] Of note, the study found that microplastics <5μm were generally not removed by the facility's filtration system. There were also high levels of microplastics in the surrounding air.

This state-of-the-art facility was described as a best-case scenario, with the authors noting that other facilities might be causing worse pollution.[4] Other research, including studies from China, Norway, South Korea, Turkey and Vietnam have similarly found that plastics recycling facilities are a significant source of microplastics pollution.[5]

Closer to home, Australian scientists have recently shone a light on the high levels of microplastic pollution caused by recycling with a 2023 study confirming the "production of large amounts of microplastics from the plastic recycling industry through its operational processes, which may be a significant source for microplastic pollution."[6] This study also found that **microplastic generation rates vary considerably according to plastic type**, with brittle plastic materials (polycarbonate and PET) generating more microplastics during the shredding process than ductile materials.

In the most recent study examining microplastic pollution from plastics recycling facilities, Turkish researchers highlighted that all of the research carried out in this area **was likely underestimating the quantity of microplastics emitted due to nanoplastics escaping through the filters used in studies**. As the authors noted: "To sum up, all of the studies claim that there might be much more microplastics smaller than the narrowest sieve size."[7]

Airborne microplastics

Each of the studies cited above focused primarily on microplastic pollution emitted in waterways, rather than air. Researchers have noted that further studies into airborne microplastic pollution are needed to quantify the scale of this pollution from recycling facilities.

What is known is that airborne microplastics can travel long distances from their source via atmospheric transport.[8] Furthermore, airborne microplastics and microplastics deposited on land can be washed into waterways via stormwater and surface runoff. In this way, airborne microplastics originating from the PlasRefine site are more than a local issue. Their passage into local waterways, which feed into Warragamba Dam, make them relevant to many millions of Australians.

Further research needed

Despite strong evidence of plastics recycling as a source of microplastics pollution, this remains a relatively new area of scientific study. As such, it is appropriate that the **precautionary principle** be applied until the scale of the potential environmental pollution can be properly quantified.

Of most concern, the research concludes that it is the **smallest nanoplastics that are most prone to escaping filtration mechanisms**.[9] However, as discussed below, it is these smaller particles that are most damaging to human health.[10]

PlasRefine: microplastic estimates

The proponent initially told us during their community engagement sessions that that "there would be virtually no opportunity for microplastics to escape" from their buildings. In later documentation, they conceded there would be microplastic emissions, both airborne and in wastewater. However, it appears they have understated the quantity of these emissions.

A letter dated 30 October 2024, from Dr Mark Bowman (GHD Technical Director for Environment and Contaminants) to the IPC sets out PlasRefine's position in relation to wastewater microplastic emissions.

It states that PlasRefine "proposes to build its own wastewater treatment plant (WWTP) on site, which would be a dissolved air flotation (DAF) plant, and as such, effective in removing microplastics from water ... A DAF process is capable of removing more than 90 percent of suspended solids, including any entrained microplastics".

It further states that "At 10 kl/day discharge, the PlasRefine facility would contribute 0.4kg/day" of microplastics to wastewater. In sum, PlasRefine alleges that it will emit only 400 grams of microplastics per day via wastewater.

There are four reasons that this figure appears to be an underestimate, as follows.

1. Excludes all nanoplastics

Microplastics are typically defined as fragments of any type of plastic less than 5 mm in length.[11] Nanoplastics are a type of microplastic even smaller in size, usually between 1 and

1000 nanometres (1000 nanometres is 1 micrometre – sometimes called a "micron"). PlasRefine's wastewater analysis takes into account only those microplastics that form part of the waste's "suspended solids".

The term "suspended solids" is generally defined as **particles larger than 2 micrometres**, although depending on which standard is applied and which filter is used, it may include particles as small as 1.5 micrometres.

Particles below this size – that is, **all nanoplastics** – are classed as "dissolved solids". These are **completely excluded** from PlasRefine's wastewater estimations.

However, we know from the emerging science that it is these tiny **nanoplastics that are most damaging to human health**.[12]

Worryingly, although nanoplastics are emerging as a serious health and environmental health threat, the science is still so new that Government regulation lags behind. To date, no Australian legislation exists to control the release of nanoplastics into the environment. In the absence of such regulation, the precautionary principle should be applied when determining developments, such as this, that may be a significant source of nanoplastic pollution.

2. Based on low-quality science

PlasRefine has not provided any reference for their microplastic wastewater emission estimate of 400 grams/day. This figure is at odds with the Australian and international research cited above.

PlasRefine states that its DAF process "is capable of removing more than 90 percent of suspended solids, including any entrained microplastics".

The only research they cite is a 2016 study by Carr et al (which PlasRefine describes as a "recent" study). This study found that existing wastewater treatment processes remove microplastics effectively. However, this study only examined microplastics larger than 45 micrometres which meant that all nanoplastics and many microplastics were not even considered by the study.

Furthermore, the Carr study has been discredited by a 2019 review article that assessed the quality of the study and **ranked it as low data quality**, scoring its overall data quality at 6 out of a possible 18.

Additionally, more recent studies have revealed a wide discrepancy in WWTP microplastic removal effectiveness. Of relevance, a 2021 study estimates the effectiveness of DAF WWTP at removing microplastics at 32 to 38 per cent - a long way off PlasRefine's 90 per cent estimate.

3. Inconsistent with scientific studies

It is clear from the studies set out above that mechanical plastic recycling contributes significant quantities of microplastics to the surrounding environment, even when best practice mitigation measures are adopted.[13]

Applying the 6 per cent figure from the UK study cited above to the PlasRefine facility suggests that its annual wastewater microplastic emissions could amount to up to 7200 tonnes – not the 400g/day (ie, 145.6kg/year) put forward by the proponent.

4. Does not consider microplastic count

Within the current scientific literature, there is variation in the way microplastics loading rates are reported, that is, either by **weight** or by **count**. Although determining the weight of particles is a simpler method, it does not represent the entire picture.[14]

In a 2023 Australian study into plastics recycling and microplastic pollution (cited above), Stapleton et al highlighted that when weight data is the only data available, it suggests that larger microplastics would be those of greatest concern (being heavier). However, when particle count is also available it clarifies that **microplastics in the smaller size range (nanoplastics) have a higher abundance**.[15]

Of concern, PlasRefine has not in its wastewater analysis considered microplastic count, it has only considered weight. For example, in his letter to the IPC dated 30 October 2024, Dr Mark Bowman refers only to microplastic emissions in gram weight, not particle count.

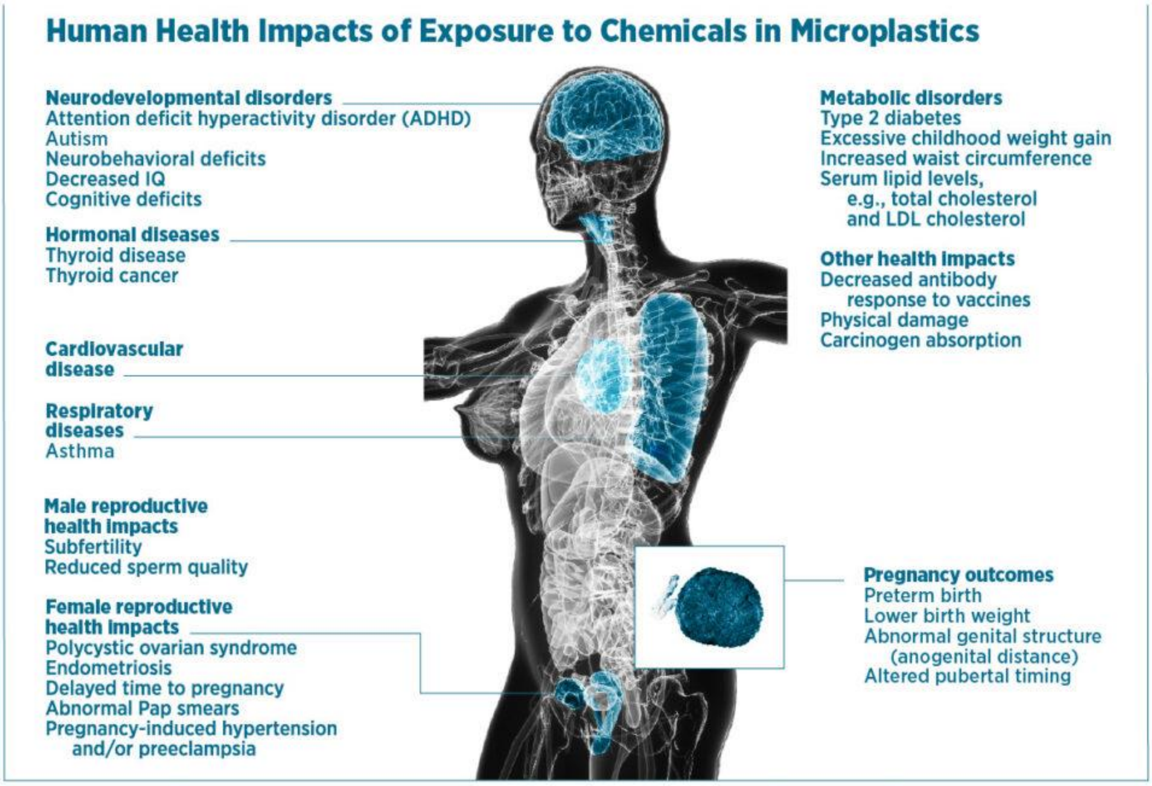
Doing so results in **significant underestimation of microplastic emissions**. As Stapleton et al state: “this study highlights how the weight and count analysis can produce significantly different results”.

Nanoplastics are so light that they can sit suspended in water and the atmosphere indefinitely.[16] Measuring these particles by weight only, as the proponent has done, results in a inadequate estimation of their environmental and health impact.

Health impacts of microplastics

Microplastics are bioaccumulative. Scientists have – only recently – discovered that they accumulate in every human organ, including the lungs, liver, bone marrow, reproductive systems and brain.[17] They have even been found in breastmilk and placenta.[18]

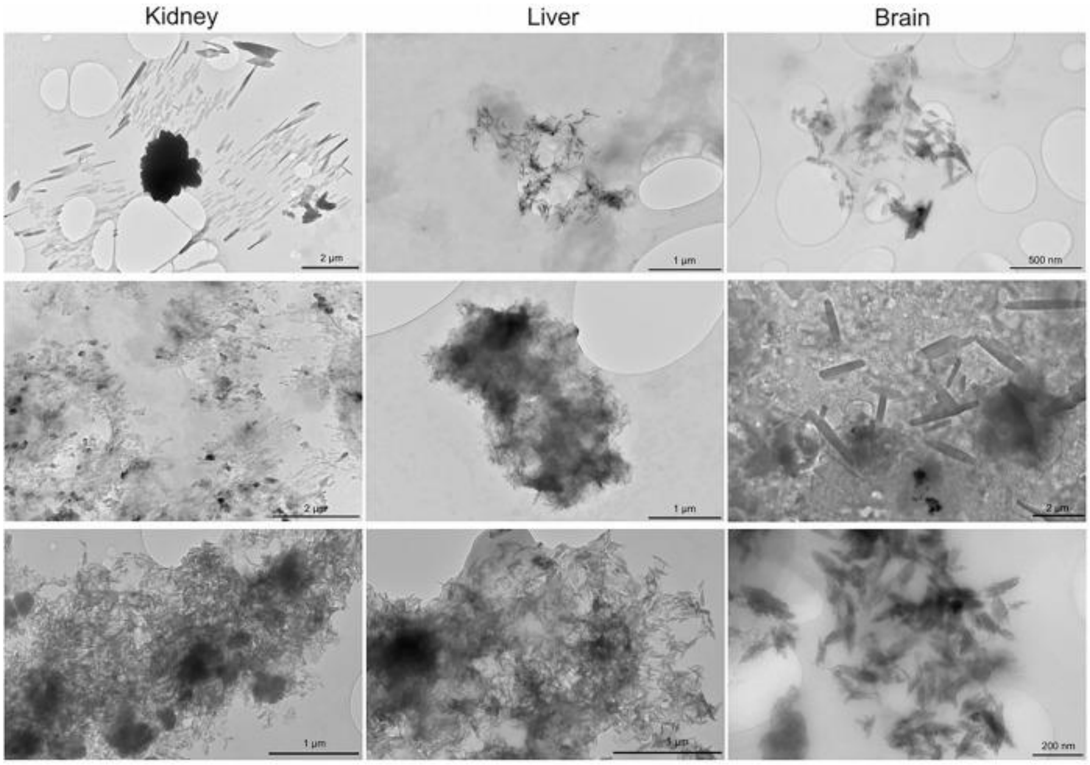
The research is still emerging, but links have been found between microplastic exposure and a wide range of health problems including dementia, cancer, asthma, lung disease, liver disease and infertility.[19] The visual below depicts some of the human health impacts of exposure to microplastics.[20]



Source: Based on visuals from a 2021 report by the United Nations Environment Programme, titled “From Pollution to Solution”).

However, it is the **impact on the brain** that is arguably the most disturbing. A 2024 US study has revealed that the brain is a super accumulator of microplastics, with up to 20 times more microplastics found in the brain than other organs.[21] Worse still, microplastics seem to play a leading role in neurodegenerative disease, like Alzheimers and Parkinsons. The same study revealed that brains of people who died from dementia had 10 times more microplastics than healthy brains.[22]

This research has also shown that the human brain is now 0.5 per cent microplastics **– that's one heaped teaspoon of plastic in an average adult brain**. What's also striking is that human brain samples from 2024 had about 50 per cent more plastic than brain samples from 2016. This trend mirrors the rising level of microplastics found in the environment, suggesting that as plastic pollution increases, so does the plastic accumulation in our organs.[23]



Example images of solid nanoparticulates derived from kidney, liver and brain samples. Shard-like appearances, with dimensions ranging from micrometer to nanometer sizes, suggest an aged, friable polymer composition.[24]

Health risks arise not just from the microplastics themselves but also from the additional chemicals they act as vectors for, such as BPA and PFAS. These substances also accumulate in the body increasing cancer risk and causing damage to hormones, thyroid function, cognition and fertility.[25]

PlasRefine initially told us during their community engagement sessions that: "It has been identified that the facility would not produce any air emissions, microplastics or VOCs." However, we know from the excellent Australian and international research cited above that this cannot possibly be true.

Even if we end up with a best-case scenario and only a small fraction of the total plastic processed makes its way into our environment, given the enormous scale of PlasRefine's operation (120,000 tonnes of plastics will be processed each year), this will still amount to thousands of tonnes of microplastics in our air and waterways each year.

These **microplastics are invisible** and residents from the Southern Highlands and Sydney would be **completely unaware** that they would be breathing and drinking them, along with the PFAS forever chemicals they carry.

Other health concerns

In addition to the microplastic-related concerns outlined above, plastic recycling is also linked to health harms from the emission of other toxic substances.

For example, in a Japanese study, researchers found that a plastics recycling and reprocessing facility was emitting VOCs which were negatively impacting local residents' health.[26] VOCs were measured and found at two points: one 100m and the other 500m from the facility. The concentration of total VOCs was higher in the vicinity of the factory and the prevalence of mucocutaneous and **respiratory symptoms was the highest among the residents within 500m of the factory**.

The Minderoo-Monaco Commission on Plastics and Human Health has highlighted some of the health hazards of mechanical recycling facilities (such as PlasRefine) in particular (emphasis added):

> "Depending on the plastic type, melting during the extrusion process can emit toxic chemicals into the workplace air, including VOCs (e.g., vinyl chloride, styrene, formaldehyde, benzene) and PAHs. Melting plastic pellets recycled from waste plastic releases additives such as phthalates and VOCs **in considerably higher quantities than are released from melting virgin plastic pellets**. These toxic chemicals are also being released during the granulation step of mechanical recycling. Workers employed in mechanical recycling operations can be directly exposed to **carcinogenic metal(loid)s** such as arsenic, cadmium, and chromium present in recycled plastic pellets via skin contact and through inhalation of contaminated airborne dust. ....
>
> Plastic production workers are at increased risk of leukemia, lymphoma, hepatic angiosarcoma, brain cancer, breast cancer, mesothelioma, neurotoxic injury, and decreased fertility. ... Plastic recycling workers have increased rates of cardiovascular disease, toxic metal poisoning, neuropathy, and lung cancer."

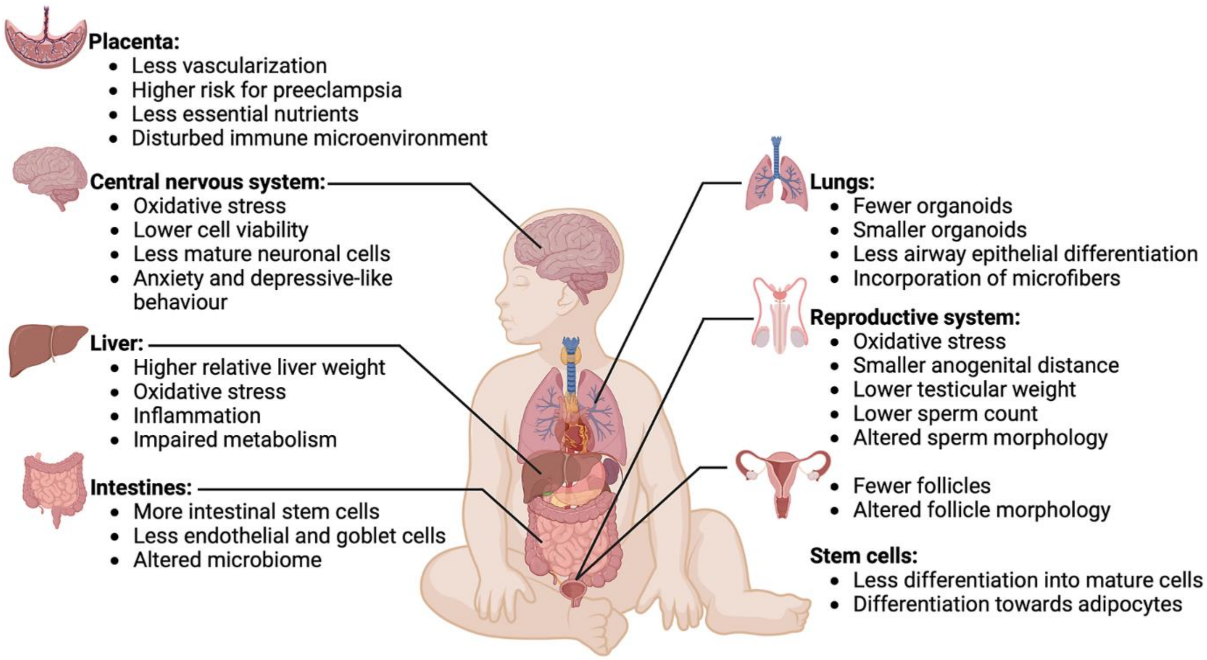
The following extract from *The Minderoo-Monaco Commission on Plastics and Human Health* also reveals that **nearby residents are especially at risk**:[27]

> "Residents of 'fenceline' communities adjacent to plastic production and waste disposal sites experience increased risks of premature birth, low birth weight, asthma, childhood leukemia, cardiovascular disease, chronic obstructive pulmonary disease, and lung cancer."

Similarly, **newborns and young children** are another cohort at elevated risk:[28]

> "Infants in the womb and young children are two populations at particularly high risk of plastic-related health effects at every stage of the plastic life cycle. Because of the exquisite sensitivity of early development to hazardous chemicals and children's unique patterns of exposure, plastic-associated exposures are linked to increased risks of prematurity, stillbirth, low birth weight, birth defects of the reproductive organs, neurodevelopmental impairment, impaired lung growth, and childhood cancer. Early-life exposures to plastic-associated chemicals also increase the risk of multiple noncommunicable diseases later in life. ... Plastics' disproportionate impacts on children's health are seen in ... children who live adjacent to plastic waste disposal sites ..."

This visual below depicts some of the health effects of plastics chemical exposure in babies:



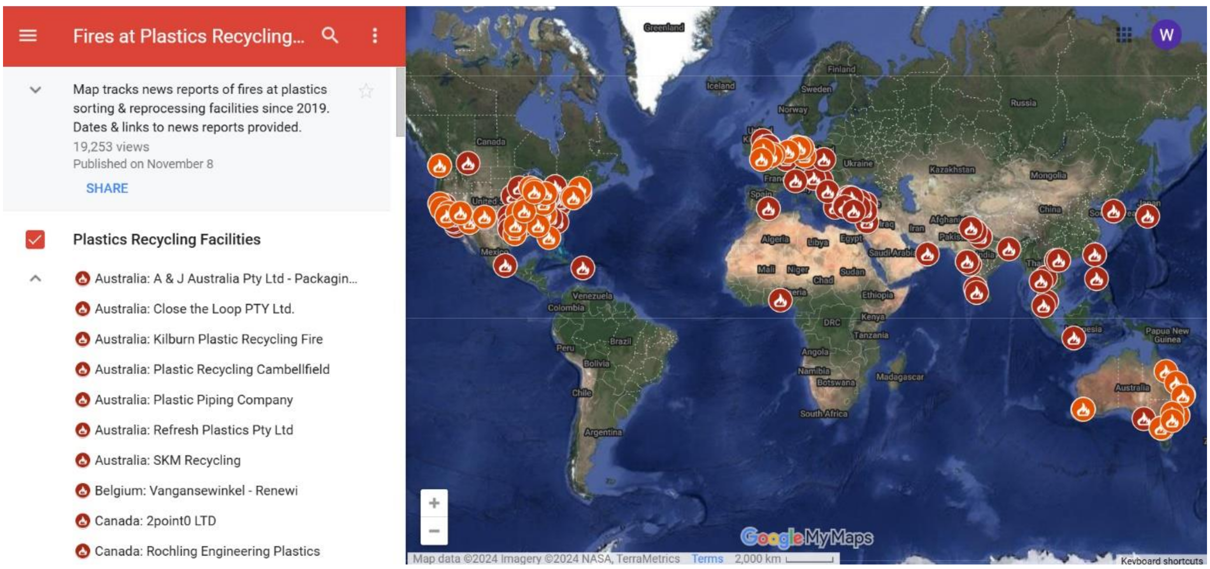
Overview of effects of microplastics exposure on various organs and tissues of a developing fetus. Microplastics have detrimental effects on development of the placenta, central nervous system, liver, intestines, lungs, reproductive system and stem cells. [29]

Notably, while these health concerns exist at all times during the operation of plastics recycling and reprocessing facilities, they become significantly elevated in the case of fire.

FIRE RISK

Consent conditions allow Plasrefine to store up to 20,000 tonnes of unprocessed mixed plastic waste on the site at any one time. No amount of control measures could prevent the highly toxic substances stored in the site from entering the surrounding atmosphere and waterways in the case of fire.

Fires are common in plastics recycling facilities due to the high flammability of plastic products.[30] This Google map document is a compilation of [plastics recycling fires since 2019](). It indicates that there have been 100 such fires globally (see screenshot image below).



Once lit, plastics recycling plant fires are extremely challenging to put out and can burn for days, resulting in highly toxic pollution that will ultimately impact Sydney's drinking water due to the site's location.[31]

In the [Department's assessment report](), it noted (emphasis added):

> "Fire and Rescue NSW (FRNSW) advised that **any toxic smoke from a prolonged fire at the development would rise directly upwards**"

This statement is preposterous, especially in a high wind area such as the Southern Highlands. As is clearly visible from the photographs below of the Richmond, Indiana 2023 plastics recycling fire, the toxic smoke from such fires does not rise directly upwards. **It travels according to the direction of the wind at the relevant time**.

In this case, ash debris from the fire was found "all over the farm" of a resident **9.6 kilometres from the site of the fire**.[32]

Relevantly, in the case of the Indiana fire, residents within an 800m radius were evacuated while residents outside of the evacuation zone **who lived downwind of the fire** were told to shelter in place and turn off any heating or air conditioning, bring pets inside and close all doors and windows. Of note, **evacuation and shelter-in-place orders were subject to change as wind directions changed**.[33]

Photographs of Richmond, Indiana Plastics Recycling Facility fire (2023)

Further evidence of the absurdity of the Department's statement that that any toxic smoke would rise directly upwards can be found in this photograph (below) of a fire at a Texan Plastic Plant. It depicts how smoke from a plastics fire **can return back to ground level**, exposing an even greater number of residents to toxic pollutants.

Photograph of Texas Plastics Plant fire

Pollutants from these smoke plumes would eventually wash into nearby waterways and ultimately into Sydney's drinking water in the case of the PlasRefine facility.

Plastics comprise thousands of different chemicals – more than 13,000 according to the United Nations – with more than 3200 of them known to be hazardous to human health.[34] The toxicity of pollutants from plastics fires should not be understated.

In the case of the Indiana fire mentioned above, **air monitors detected hydrogen cyanide, benzene, chlorine, carbon monoxide and volatile organic compounds in the ground-level smoke**.[35] Of note, hydrogen cyanide, a highly toxic gas, can be fatal depending on the dose and length of exposure, while benzene is known to cause cancers such as leukemia, multiple myeloma and non-Hodgkin lymphoma in some people with long-term exposure. The World Health Organization has said there's no safe level of benzene exposure when it comes to cancer risk.

Environmental health experts noted that that exposure to the chemicals identified in the Indiana fire could lead to breathing problems in the short term or **cancer in the longer term**. Dr Arthur Frank, an environmental and occupational health professor at Drexel University commented in respect of the Indiana plastics fire:[36]

> "If you think back 20 years ago to the World Trade Center, remember that stuff there burned for days and smoke was coming up and we're still seeing now disease from people who worked on that pile. This has got a lot of the same stuff."

Given that significant fire risks exist in respect of plastics recycling and reprocessing facilities, planning authorities need to be extremely thoughtful about where such facilities are located.

In this case, the proposed site falls on **bushfire prone land** as this simple bushfire prone land checking tool on the NSW Rural Fire Service (RFS) website demonstrates. Simply entering the address of the proposed facility (74-76 Beaconsfield Road Moss Vale) into the RFS site clearly demonstrates that the site is indeed on bushfire prone land. However, in the EIS, the proponent has incorrectly claimed that the site is not bushfire prone, apparently by relying on out-of-date bushfire mapping.

Allowing a facility that handles and stores highly flammable and hazardous materials to be situated on bushfire-prone land within 200 metres of residential properties is both irresponsible and dangerous.

Site suitability

This is not the right site for a development of this nature and scale. In light of the significant risks arising from microplastic and other toxic pollution, especially in the case of fire, plastics facilities such as this need to be thoughtfully located in heavy industrial precincts with **adequate buffers** from residents, schools and drinking catchments.

There is an important research facility adjacent to the PlasRefine site (Australian Bio Resources), the nearest resident is less than 200m away, the nearest early childhood centre is 750m and the site is located in a flood-impacted area adjacent to a riparian corridor that runs into Sydney's drinking catchment.

For the reasons outlined above, the Commission should refuse the application as proposed. No amount of mitigation can resolve the fundamental flaw presented by the lack of site suitability. This is simply not the right site.

Yours faithfully

Louise Keats

BA (Hons I), LLB (Hons I), GradDipNut
(currently: Masters Human Nutrition)

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