

Information Requested

Seqwater acknowledges the applicant's responses regarding limited emissions of perfluoroalkyl and polyfluoroalkyl substances (PFAS, as well as PFOS, PFOA, PFHxS, PFNA, and PFBA, referred to as '*PFAS-type substances*' in this advice) and particulate pollution as a result of the development, noting these emissions are accurate and estimated to be small.

Despite this, Seqwater's concerns are focused the cumulative human health impact of these compounds on the safety of drinking water – both in terms of additionality of concentrations, the extended timeframes that need to be considered, and the scale of source catchments. Whilst it is acknowledged that these particulates are found in background levels in the surrounding environment, this does not justify further degradation as a result of the development. Whilst it is acknowledged that removal of PFAS-type substances to non-detectable limits by filtration systems for the smokestack may not be proposed due to difficulty or impossibility, deferring this difficulty further downstream to Seqwater's treatment responsibility is not reasonable, particularly considering:

- The criticality of drinking water and difficulty in removing these through existing treatment processes
- Technologies in the removal of PFAS-type substances from drinking water being relatively new and untested
- Cumulative contributions of PFAS-type substances and a need to proactively, rather than reactively protect water quality
- Recently revised limits for PFAS-type substances in the Australian Drinking Water Guidelines and limited certainty on whether existing treatment processes will be capable of meeting these long-term
- The expectation that future water treatment upgrade costs will be borne by Seqwater and customers.

While the proposed operation is not directly adjacent to source catchment waterways, the airborne emissions are dispersed and settle on catchment land over a long period of time then can be transported into waterways that provide water to our drinking Water Treatment Plants (WTPs). As the compounds are long lived and persistent, the cumulative impacts are considered a risk to these catchments. While the concentrations might be low, the contamination occurs continuously and over the long-term potentially resulting in chronic exposure to these particulates. Seqwater has existing and future downstream WTPs that take raw water from the Logan River catchment and supply drinking water to the community everyday, which is an arrangement that must retain certain and safe for the foreseeable future.

Both the HHRA Report and the Planning Report assert that the quantity of PFAS will decrease within residual waste to be used as fuel for the facility, however, do not provide justification for this assertion. As reported by the Federal Government in a report for the Department of Climate Change, Energy the Environment and Water titled: Hazardous Waste in Australia 2025 (Appendix A), reported PFAS-contaminated waste has risen from near-zero to over 100,000 tonnes in the last eight years. The report specifies that this trend is most clear in Victoria and Queensland which are states that house most of the infrastructure for managing PFAS waste nationally. The report denoted that PFAS waste arisings are likely to be underestimated. The Parliamentary Inquiry into the extent, regulation and management of PFAS investigated the impacts of PFAS in Australia, including within waste streams from households and other uses. The committee noted compelling evidence that costs associated with PFAS removal and wastewater treatment are much greater than the costs required to produce PFAS chemicals and the products that contain them. Accordingly, the monitoring and control of PFAS in waste is paramount, considering the cumulative impacts on our catchments. Recommendations from the report include requirements for legacy PFAS contamination within waste streams to be reduced, however given the findings of Appendix A and the substantial increases in PFAS in waste streams, this will remain an ongoing issue.

Being responsible for providing safe and reliable drinking water, Seqwater is under increasing pressure regarding the monitoring and treatment of PFAS-type substances in both raw and treated drinking water supplies. There are a number of risks associated with these increases including population health, reputational risks and increased cost to the consumer of managing the risk through water treatment plant upgrades.

No. 35	Issue: PFAS-type substances
Accordingly, Seqwater maintains significant concerns with regard to the emerging and potential cumulative impacts that PFAS-type substances will have on the surrounding catchment in terms of drinking water quality.	
The proponent is requested to submit an amended Human Health Risk Assessment Report including:	
• Consideration of the above discussion, including Hazardous Waste in Australia 2025 report • Amended assumptions regarding the quantity of PFAS expected in residual waste over the life of the development • Amend the resulting data based on the above • Assumptions for all per- and poly- fluoroalkyl substances which have a health-based guideline value included in the Australian Drinking Water Guidelines (version 4, 2025), including perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorohexane sulfonic acid (PFHxS) and perfluorobutane sulfonic acid (PFBS) • Integrate additional measures that reduce PFAS, PFOS, PFHxS and PFBS in runoff leaving the site (at all discharge points) to the equivalent health-based limits prescribed in the ADWG (Table 10.6, page 221) – e.g. improved carbon or other filtration/capture/treatment technology for the emissions stack, as well as methods within the cycle of waste processing proposed at the site, including stormwater management, transport, incineration, removal and storage of materials - or provide further justification and reasoning as to the proposed location of a facility producing and discharging these contaminants within a drinking water catchment. Any international examples and case-studies sought to be used must be within a drinking water catchment for relevance.	

Response

The Human Health Risk Assessment (HHRA) has been reviewed and updated to respond to Seqwater's comments regarding PFAS-type substances, cumulative catchment impacts and the potential implications for drinking water. Refer HHRA Revision E – Appendix E Drinking Water Catchment Discussion.

Hazardous Waste in Australia 2025

It is acknowledged that the recently published *Hazardous Waste in Australia 2025* report indicates an observed increase in reported PFAS-contaminated waste arisings over the last few years. The *Hazardous Waste in Australia 2025* information does not materially change the HHRA conclusions regarding PFAS risk, as the assessment is based on dispersion-based exposure modelling using measured stack emission data. The calculations assume that the same level of emissions occur for the life of the plant i.e. there is no decrease in PFAS in the feedstock.

Pathway Analysis

It is important to note that BERC does not create PFAS. PFAS is present within the incoming waste stream. In the absence of energy from waste, this waste would typically be disposed of to landfill. Landfills are recognised as a potential long-term source of PFAS through leachate generation.

Table 1 summarises the potential PFAS pathway and the corresponding controls implemented to minimise the potential for PFAS release to the environment.

Table 1: Pathway Analysis

Pathway	Discussion and Control Measures
Transport	All incoming waste transport vehicles are required to arrive at the facility with covered loads to prevent loss of material during transit. This control minimises the potential for PFAS-containing particulates or residues to be released into the environment prior to controlled processing.
Storage of Waste	No waste is stored outside the waste bunker. The waste bunker is specifically designed to prevent any contaminants, including PFAS, from escaping into the surrounding environment. It comprises a thick reinforced concrete structure (approximately 1

	m thick) constructed as a multi-layered impermeable system. This includes engineered reinforced concrete, a waterproofing additive or membrane and a protective topping layer. These multiple barriers are designed to contain all liquids within the bunker, preventing seepage into soil or groundwater while also stopping external groundwater from entering the bunker. The structure is further engineered to maintain very tight crack control, using increased reinforcement and specialised concrete mixes to ensure long-term water resistance and chemical durability Together, this results in a robust, sealed containment system that prevents all contaminants including any PFAS that may be present in waste from leaching into the environment.
Process Water	There is no process wastewater discharge from site. Any water used in operational processes is contained, treated, or reused within the facility.
Stormwater Management (IBAA Area)	Stormwater from the IBAA (incinerator bottom ash) handling area, is collected and directed to a dedicated retention basin. The water in the basin can be pumped into above ground tanks for storage for reuse within the IBA treatment area. As a contingency, when the storage capacity in the basin or above-ground tanks is reached, excess runoff water may either be directed to the waste bunker or taken off-site via tanker for treatment at a wastewater treatment plant, in order to maintain suitable freeboard to accommodate further rainfall events.
Air Pollution Control Residue (APCr)	As part of the flue gas treatment process, activated carbon is injected to capture contaminants, including PFAS compounds, which adsorb onto carbon particles. These are then collected within the Air Pollution Control Residue (APCr) stream. Air Pollution Control residues (APCr) are managed through a fully contained, multi-stage treatment, curing and storage system designed to prevent releases to land, water and air. • Enclosed handling and storage: APCr is collected, conveyed and stored within sealed systems (fully enclosed conveyors and silos), preventing exposure to the external environment and eliminating dust or fugitive emissions during handling. • Stabilisation to reduce leachability: The EfW building includes an internal APCr stabilisation area where APCr is mixed with cement and other binders to form a cementitious material. This process significantly reduces permeability and immobilises contaminants, limiting the potential for any leaching. • Contained curing process: The treated APCr is transferred as a slurry into sealed, waterproof bulk bags, where it cures into concrete blocks. Encapsulation within these bags prevents dust generation, liquid release, or spills during curing. • Controlled storage environment: Curing occurs in a dedicated, undercover three-sided building, providing additional protection from rainfall and environmental exposure while maintaining containment. • Secure post-curing storage and disposal: Once cured, the stabilised APCr remains within sealed bags during temporary storage and is then transported off-site to a suitably licensed landfill that meets acceptance criteria for contaminant concentration and/or leachability. Together, these controls ensure APCr is physically contained and chemically stabilised, preventing contaminants from being released into the surrounding environment at all stages of handling, treatment, storage and disposal.
Stack Emissions	There are multiple controls for PFAS in stack emission: 1. Combustion Controls: Energy from waste facilities operate at 850 degrees, which has been demonstrated to achieve destruction of several PFAS compounds. It is noted that literature indicates that some PFAS compounds may require higher temperatures for complete destruction. 2. Flu gas Treatment: a. Lime: Lime injection removes acid gases and also assists in capturing combustion by-products and products of incomplete combustion b. Activated Carbon: Activated carbon is a well-established technology with a high capacity to adsorb a wide range of organic contaminants, including PFAS and PFAS breakdown products, allowing them to be removed.

- c. Baghouse: The baghouse captures particulate matter from the flue gas, including contaminants that are attached to particles. Any PFAS bound to the activated carbon for example would be removed and become part of the air pollution control residue.

Collectively, these controls represent the best available techniques currently applied to energy from waste facilities. Importantly, there are currently no additional proven air pollution control technologies that could reasonably be added to further improve PFAS capture beyond what is already proposed at BEREC.

Stack Emissions - International Literature

It is acknowledged that there is limited direct measurement data available for PFAS emissions from energy from waste facilities internationally. However, what data is available indicates that these facilities either have no measurable amounts or extremely low amounts of these chemicals in the emissions. A summary of the literature is outlined in Table 2.

Table 2- International Literature

Study	Finding
Björklund et al. ¹ (Sweden)	Max PFAS level recorded was 9.5 ng/m³. The concentration of PFAS was measured on three occasions at this facility and the highest value for any of these sampling events was used in this assessment – the average of all three samples was 7.3 ng/m³. Note: These samples were taken before the final emission treatment phase. Average of 35% decrease in PFAS was noted after final treatment stage. The measured individual PFAS emissions for this facility were made up of the following: • PFBA – 2.8 ng/m³ – i.e. 30% of total sum • PFHxA – 6.1 ng/m³ – i.e. 64% of total sum • PFHpA – 0.15 ng/m³ – i.e. 1.6% of total sum • PFOA – 0.39 ng/m³ – i.e. 4% of total sum • PFBS – 0.04 ng/m³ – i.e. 0.4% of total sum • PFOS – not detected.
Norfors Usserød Power Station ² (Denmark)	No measurable levels of PFAS in the emissions when samples taken after all treatment processes have been applied – the limit of reporting for this study was 0.5 ng/m ³
German Pilot Study ³	Fluoropolymer Reduction Rate for Products of Incomplete Combustion >99.99% demonstrated mineralization of fluoropolymers via incineration. Only PFOA detected in stack gases (0.20 ng/m³) slightly above the LOQ (0.09 ng/m³). Noted that external contamination is the likely source of the PFOA detection. There was no discernible effect of temperature on the mineralization of fluoropolymer and testing at 860 °C versus 1095 °C did not show evidence of an increase in PFAS emissions.

¹Björklund, S, Weidemann, E & Jansson, S 2023, 'Emission of Per- and Polyfluoroalkyl Substances from a Waste-to-Energy Plant—Occurrence in Ashes, Treated Process Water, and First Observation in Flue Gas', Environmental science & technology, vol. 57, no. 27, 2023/07/11, pp. 10089-10095
 Björklund, S 2024, 'Exploring the occurrence, distribution and transport of per- and polyfluoroalkyl substances in waste-to-energy plant', Doctoral thesis, comprehensive summary thesis, Umeå University, Umeå. viewed 2024, . Björklund, S, Weidemann, E & Jansson, S 2024, 'Distribution of Per- and Polyfluoroalkyl Substances (PFASs) in a Waste-to-Energy Plant—Tracking PFASs in Internal Residual Streams', Environmental science & technology, vol. 58, no. 19, 2024/05/14, pp. 8457-8463.

² <https://norfors.dk/ikke-fundet-pfas-i-roeggassen>

³ [Mineralization of fluoropolymers from combustion in a pilot plant under representative european municipal and hazardous waste combustor conditions - ScienceDirect](#)

French facilities ⁴	The French have data available for analysis of PFAS in atmospheric emissions from energy from waste facilities, hazardous waste facilities and cement kilns. Two of these French EfW facilities reported detections of PFOS above the limit of reporting. The limits of reporting for PFOS in these facilities were in the range 0.04-2 ng/m³. The measured concentrations of PFOS at these two facilities were 0.085 ng/m³ and 0.034 ng/m³.
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Stack emission – Assumption adopted for BERC

The air quality assessment adopted a conservative approach to the evaluation of PFAS emissions. The 9.5 ng/m³ PFAS concentration, reported in a Swedish study and measured upstream of the final air pollution control stages, was selected as the basis for emissions modelling. BERC was then assumed to emit PFAS continuously at this concentration. This emission rate was incorporated into the air quality model to predict deposition rates across the study area.

To further increase conservatism, it was assumed that 100% of the PFAS emissions comprised PFOS. This assumption is conservative, as PFOS is one of the most stringently regulated PFAS compounds and PFAS emissions are typically composed of a mixture of different PFAS species.

It is also important to recognise that only very fine particles will be emitted by the BERC. These types of particles are so small as to generally remain suspended in the atmosphere and dispersed by the wind rather than settling out onto the ground – except perhaps when rain occurs.

Logan River and Wyaralong Dam

The assessment did not attempt to predict PFAS concentrations in the Logan River because atmospheric deposition represents only the first step in this complex environmental pathway. PFAS deposited onto land does not automatically enter waterways. The proportion that ultimately reaches a river depends on numerous factors, including rainfall intensity and frequency, runoff rates, infiltration into soils, soil characteristics, erosion processes, vegetation cover, topography and travel distances to waterways.

Any PFAS that does reach a waterway is then subject to additional processes that influence the resulting concentration in water, including dilution, dispersion, mixing, stream flows and interactions with sediments.

An assessment was undertaken for Wyaralong Dam, considering PFAS deposition directly onto the dam surface. The assessment assumed that all PFAS deposited onto the water surface for one year enters the reservoir and is uniformly mixed throughout the approximately 100,000 ML storage volume. The results of this assessment are shown in Table 3.

Table 3- Results Wyaralong Dam

PFAS Type	PFAS µg/L <i>Note 1</i>	Water Guideline µg/L ⁵	Quantification in laboratory µg/L	Discussion
PFOS	0.000000003	0.008	0.00001-0.0001	2.6 million times smaller than guideline Not measurable
PFOA	0.000000003	0.2	0.00001-0.0001	66.7 million times smaller than guideline Not measurable
PFHxS	0.000000003	0.03	0.00001-0.0001	10 million times smaller than the guideline Not measurable
PFBS	0.000000003	1	0.00001-0.0001	333 million times smaller than the guideline Not measurable

Note 1: Identical concentrations have been presented for each PFAS compound because the assessment conservatively assumed that 100% of the total PFAS emissions comprised that compound. For example, the PFOS result assumes all PFAS

⁴ <https://www.paca.developpement-durable.gouv.fr/premiers-resultats-des-mesures-pfas-dans-les-a16387.html?lang=fr>

⁵ [Australian Drinking Water Guidelines | NHMRC](#)

emissions are PFOS, and the PFOA result assumes all PFAS emissions are PFOA. This approach maximises the predicted concentration for each individual PFAS and therefore represents a conservative assessment.

Predicted PFOS, PFOA, PFHX and PFBS in dam water is well below measurable levels, and many orders of magnitude below Australia's drinking water guideline.

Deposition to Soil

The modelling assumed that PFAS emissions occur continuously over a 70-year period and that all deposited PFAS accumulates in soil without any degradation, runoff or removal processes. In addition, it was conservatively assumed that 100% of PFAS emissions comprise PFOS.

Table 4- Results deposition to soil

Location	Deposition Rate µg/m ² /year	Deposition µg/kg	Soil Guideline for PFOS µg/kg	Quantification in laboratory µg/kg	Discussion
Residential	6.4 x 10 ⁻⁵	0.0003	3 ⁶	0.01-0.1	BERC deposition is 10,000 times smaller than the guideline Not measurable
Average across modelling domain	1.6 x 10 ⁻⁵	0.00008	3	0.01-0.1	BERC deposition is 37,500 times smaller than the guideline Not measurable

These results demonstrate that, PFOS deposition to soil from BERC is negligible relative to both health-based guideline values and laboratory detection capabilities.

Summary

The assessment indicates that PFAS emissions from BERC are unlikely to make a measurable contribution to drinking water exposure pathways. Modelling was based on conservative assumptions and demonstrated that predicted PFAS concentrations in soil and water are many orders of magnitude below applicable guideline values and below laboratory quantification limits. Accordingly, the contribution of PFAS from BERC to drinking water sources is considered negligible.

End of Document

⁶ PFAS NEMP guideline for low density residential land use