31 October 2023

Karen Marler
Director Environmental Solutions (Chemicals, Land and Radiation)
Regulatory Practice and Environmental Solutions Division
biosolids.review@epa.nsw.gov.au

Dear Karen Marler,

RE: BIOSOLIDS REGULATORY REVIEW ISSUES PAPER – PUBLIC CONSULTATION

The Australian and New Zealand Biosolids Partnership (ANZBP) welcomes the opportunity to provide feedback to the NSW Environment Protection Authority (EPA) on the Biosolids Regulatory Review Issues Paper and Technical Findings Report. Our response to the questions in the issues paper is provided in Appendix 1.

BACKGROUND

The ANZBP is a member-based collaboration of water utilities, consultants, academics and government bodies committed to the sustainable management of biosolids – a residual resource from the wastewater treatment process. It is our mission to support sustainable biosolids management for all utilities across Australia and New Zealand. The ANZBP is acutely aware of the role water utilities play in protecting the environment, safeguarding public health and achieving circular economy objectives for society.

The wastewater sector is an essential service, treating sewage from domestic and trade waste (including commercial, industrial and landfill) sources to recover valued resources (including biosolids and recycled water) for beneficial reuse. In an increasingly resource constrained world, the capacity to return the valuable nutrients (including phosphorus, nitrogen, carbon and a range of micronutrients such as calcium and magnesium) and beneficial microbes in biosolids to soils is a critical pillar of global sustainability and the circular economy. Australia produces almost 1.5 million wet tonnes of biosolids per year, with an estimated 83% being beneficially used in agriculture, landscaping, forestry or mine rehabilitation (Biosolids Production and End Use Survey, ANZBP, 2021).

ANZBP supports the development of a risk-based approach to ensure sustainable management of biosolids for protection of public health and the environment. We also support a systems approach which considers the entire biosolids cycle and connected externalities, including source control to reduce direct exposure of consumers from contaminants in everyday household products, to reduce contaminant concentrations in wastewater, and to reduce the burden on water utility customers to fund 'end of pipe' treatment infrastructure.

In achieving our objectives, ANZBP promotes an approach to biosolids management that balances the multiple considerations of public health, resource recovery, cost considerations and the significant direct and indirect environmental benefits of beneficial use of biosolids, with the risks associated with managing contaminants in the environment. We advocate for regulation to support this balance based on robust, field-demonstrated evidence proportional to the wider risks, exposures and background environmental levels of contaminants. We also advocate for source control to address the root cause of contaminants entering the environment.

SUMMARY OF FEEDBACK

Overall Impact. NSW produces 400,000 wet tonnes of biosolids per annum, of which an estimated 370,000 are beneficially used in land application programmes. The proposed rigid, limits-based approach will result in almost all of the beneficially used biosolids being diverted to landfill. This equates to an estimated 40 truck-and-trailers per day.

Landfill Capacity. The ANZBP estimates that that NSW landfills will not have the capacity to receive this quantity of biosolids.

Regulatory Impact Statement. We recommend the EPA undertake a Regulatory Impact Statement to evaluate the potential costs, risks and benefits of the new biosolids regulatory approach across NSW, given the significant consequences likely to result from the proposed changes. The ANZBP offers our assistance to provide data and expertise to this process. The ANZBP notes that:

- Landfill disposal of organic materials is inconsistent with the EPA's goals and objectives and other state government and EPA policies, including the Waste and Sustainable Materials Strategy 2041, Circular Economy Policy, and the Waste Avoidance and Resource Recovery Act 2001.
- The ANZBP believes physical landfill capacity does not exist in NSW to take the volume of biosolids.
- Planning and construction of thermal treatment technologies across NSW would take a decade or more.
- Utilities would have no alternative but to breach their effluent limits on their wastewater discharge due to the lack of downstream capacity for biosolids reuse / disposal.
- The proposed changes discussed in the Issues Paper, Technical Findings Report and supporting documents are likely to result in significant implications across the biosolids value chain, impacting wastewater treatment infrastructure requirements, monitoring and reporting, beneficial reuse contractors, end-user markets.
- Disposal of biosolids to landfill will prevent the opportunity to recycle carbon and essential plant nutrients, especially phosphorous, which occurs in finite concentrated reserves, but on which all life depends. This will come at the expense of associated benefits for soil health and crop productivity typically associated with biosolids land application.
- Disposal of biosolids to landfill will increase reliance on mineral fertilisers, with the associated negative environmental impacts of soil carbon depletion, increased greenhouse gas emissions and environmental surface and groundwater quality deterioration.
- The impact of introducing the proposed contaminant requirements is likely to cause irreversible damage to land application markets and the water industry in general.
- The proposed changes to the biosolids regulatory approach have the potential to cause complex, cascading and unforeseen consequences to the biosolids and organic waste recycling industries. Cost benefit analysis is required to fully understand the economic implications of any proposed changes to the regulatory approach.
- Consideration should be given to implications for water utilities at different scales, noting small regional Councils may be impacted quite differently to larger utilities.

Risk-based approach. The ANZBP supports the development of a risk-based, place-based approach to managing biosolids that balances resource recovery, cost and the significant direct and indirect environmental benefits of beneficial use of biosolids with the risks associated with managing contaminants in the environment. The ANZBP supports a regulatory approach that stipulates the desired outcomes (e.g., maximum allowable soil contaminant concentrations to protect environmental and human health) and provide fit-for-purpose frameworks to ensure these outcomes are achieved (e.g., methods for calculating maximum biosolids application rates considering the specific characteristics of the reuse application including receiving soil properties), rather than biosolids concentration limits that are designed to mitigate risks for almost all conceivable scenarios.

Systems approach. The ANZBP supports a systems approach which considers the entire biosolids cycle and connected externalities, including the broader social and economic benefits of biosolids reuse. The proposed changes to the biosolids regulatory approach have the potential to cause complex, cascading, and unforeseen consequences to the biosolids and organic waste recycling industries. A systems approach can help explore both the intended and unintended consequences of decisions.

Source control. The ANZBP recommends State and Federal governments and regulators prioritise source control measures, rather than relying on 'end of pipe' limits in isolation. Source control, including banning the import, use and manufacture of these contaminants, is the only effective way to ensure they are permanently removed from our ecosystems. Greater control over the import, use and manufacture of these chemicals is needed to remove the burden on communities having to pay for high cost 'end of pipe' treatment and management.

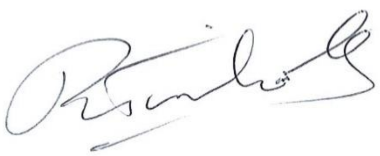
Evidence-based approach. The ANZBP urges the EPA to ensure regulatory and policy settings are based on proportionate scientific evidence. Our understanding is that there is limited data and scientific evidence of impacts within the local NSW context for limits proposed on emerging contaminants. In addition, some proposed changes to metals ignore their typical concentrations at plant nutrient value. Copper and zinc, for example, are seen as contaminants in biosolids, while in many situations where the soil is deficient, they are needed as nutrient supplements. Further relevant and context-specific robust field evidence should be gathered before introducing significant changes to the regulatory approach. This should include evidence on the exposure of contaminants in biosolids relative to wider sources of environmental exposure.

Appropriate transition arrangements. The implications of potential regulatory changes include the need to plan, design and construct significant new infrastructure which will take years or more. It is critical that appropriate transition arrangements are developed in consultation with industry, and clear guidance is provided regarding future regulatory requirements to enable informed investment decisions such as technology selection.

The ANZBP is committed to supporting this regulatory review process and to working collaboratively through engagement with members and with the EPA, particularly in relation to monitoring and research aimed at delivering robust field data; assessing potential implications for industry; and identifying appropriate and proportionate risk management approaches and transition arrangements.

The ANZBP welcomes further discussion and collaboration with the EPA on the development of a new Biosolids Regulatory Approach for NSW. Please contact ANZBP Advisory Committee Chair, Rob Tinholt, at rob.tinholt@water.co.nz or +64 21 284 7537, or Vice Chair, Lauren Randall at lauren.randall@hunterwater.com.au or +61 43 9748 396 with any enquiries regarding this submission.

Yours sincerely,



Rob Tinholt

Chair, ANZBP Advisory Committee

Appendix 1 – Issues Paper Response

Question 1: What is your experience with the end use of biosolids? Are you directly affected by the biosolids end-use market? If so, how?

The ANZBP is a member-based collaboration of water utilities, consultants, academics and government bodies committed to the sustainable management of biosolids – a residual by-product from the wastewater treatment process. It is our mission to support sustainable biosolids management for all utilities across Australia and New Zealand. The ANZBP is acutely aware of the role water utilities play in protecting the environment. The wastewater sector is an essential service, treating sewage from domestic and trade waste (including commercial, industrial and landfill) sources to recover valued resources (including biosolids and recycled water) for beneficial reuse.

Biosolids end-use markets directly affect water utility operating costs and ability to contribute to the circular economy through beneficial use biosolids. Market risks (current and emerging) also influence long-term biosolids management strategies and inform significant investment decisions for utilities.

Land application of biosolids has been occurring across Australia and New Zealand for decades and there has always been a strong demand for biosolids due to the many benefits they offer. These include:

- the ability to increase soil water holding capacity and therefore resilience of crops in a drying environment (Fernandez-Getino *et al.*, 2012; Cucina *et al.,* 2019).
- the ability to increase readily available organic carbon content in soil (POX-C) (Figure 1, Figure 2 and Figure 3), the food source for soil microbial activity and a key contributor to soil health (Snyder, 2021).
- the contribution to recycling critical plant macro and micronutrients, especially phosphorous, which occurs in finite concentrated reserves, but on which all life depends (International Energy Agency, 2021).
- ability to restore critical soil structure elements and microbial populations of soils that have been damaged by the recent history of mineral fertiliser use (Chan, 2008).
- the ability to contribute to increased crop yields compared to synthetic fertilisers (McLaughlin *et al.*, 2008; Pritchard *et al.*, 2010; Figure 4).
- the capacity to substitute for mineral fertiliser, contributing to reduced carbon dioxide (CO_2) emissions throughout the fertiliser value chain from mining/production, though transport, to nitrous oxide (NOx) emissions (Menegat *et al.,* 2022).
- the function as a slow-release fertilizer, eliminating, or at least significantly reducing, leaching of nutrients from cropping land, with offsite benefits for surface and groundwater quality and aquatic habitat health (Pritchard *et al.*, 2010).
- the contribution to reduction in erosion and sediment export from farmland and grazing land through the capacity to improve soil structure, water infiltration and crop cover, with offsite benefits for fresh and marine aquatic environments (National Soil Strategy – DAWE, 2021).
- the capacity to increase soil carbon sequestration, contributing to a reduction in atmospheric greenhouse gas concentrations and global warming (Snyder, 2021).

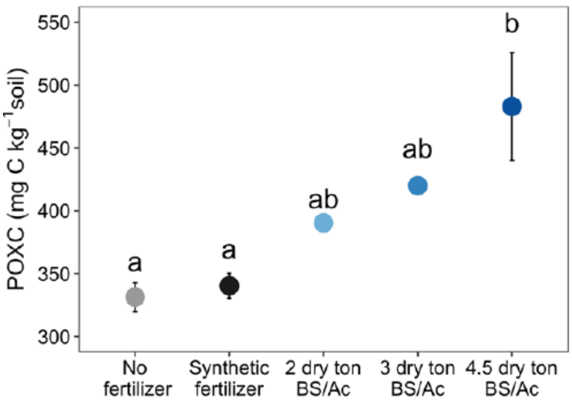


Figure 1: Increase in readily available carbon content (POX-C) comparison (Brown, 2023)

As shown in Figure 1, biosolids out-performs synthetic fertilisers for increasing readily available carbon content in soils for crop uptake and has better performance at the higher application rate of 4.5 dry tonnes per hectare.

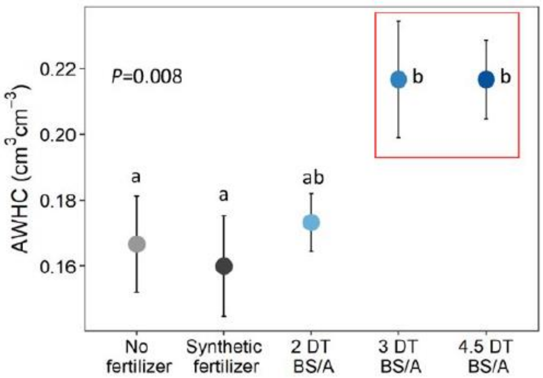


Figure 2: Increase in average water holding capacity (AWHC) in soils due to biosolids application (Brown, 2023)

Similarly, improvements in water holding capacity in soils can be seen with increased biosolids application rates, whereas a loss in water holding capacity can be seen when conventional fertilisers are applied (Figure 2).

The soil improvement due to biosolids over conventional fertiliser can clearly be seen in crop yields where higher rate applications have a better performance and more lasting effect in the years following application (Figure 4). The continued application of conventional synthetic fertilisers has been shown to be detrimental to soil health globally, while the direct application of biosolids to land plays a key role in restoring microbial communities and rejuvenating soil structure to enable ongoing sustainable farming practices (Zeldovich, 2021; Masters, 2019).

The California Association of Sanitation Agencies (CASA) sees biosolids as critical to achieving every goal of California's healthy soils initiative for sustainable agriculture action plan due to its ability to improve carbon sequestration, soil tilth, reduced need for irrigation, increased crop yield and reduce d use of fossil fuel intense inorganic fertiliser (Kester, 2023).

The ANZBP is conscious of protecting its members' end use markets and ensuring the ongoing viability of the land application of biosolids due to its significant value to society in ensuring food security and sustainable living into the future.

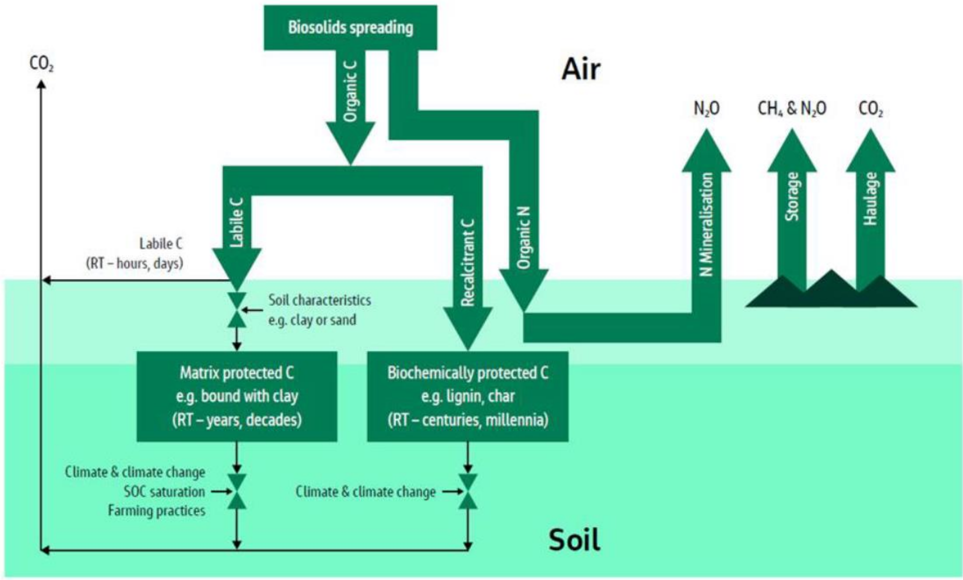


Figure 3: Schematic of carbon emissions and benefits from biosolids to land (McLeod and Lake, 2020)

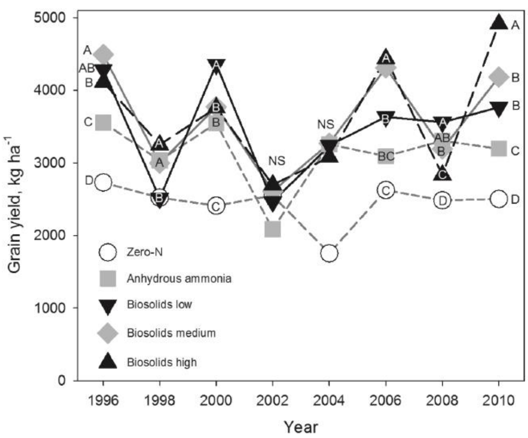


Figure 4: Increase in crop yields due to biosolids application (Brown 2023)

The proposed regulatory changes are likely to have significant impacts on water utilities, their customers and biosolids end use markets. The potential impacts include:

- increased costs due to reduced application rates requiring more land, more biosolids application rate (BAR) assessments, increased diversion of biosolids to composting and landfill, and capital upgrades to add treatment processes that aim to remove contaminants.
- further transport distances (fuel and chain of responsibility issues that push drivers outside same day transport routes).
- additional equipment float (i.e., transport of excavators, water trucks and spreaders to farms) as well as additional equipment use per tonne of biosolids applied.
- increased carbon emissions (for the reasons listed above and increases to transport and spreading with no additional carbon soil benefit).
- reduced economies of scale that make land application prohibitive i.e., the increased costs listed above versus the volume of biosolids to be applied at each site make it commercially unviable to land apply

biosolids. Increased surveillance costs for the Trade Waste program that would be passed onto commercial and industrial customers.

It is critical the new biosolids regulatory approach is pragmatic, proportionate, practical and inspires confidence in all stakeholders and the public. The impact of introducing overly conservative requirements cannot be overstated and has the potential to cause irreversible damage to land application markets and the biosolids industry in general. We are already seeing anecdotal evidence of biosolids end users starting to move away from biosolids and rely on synthetic fertilisers while fertiliser prices continue to increase. Some biosolids contractors also appear to be starting to favour other (unregulated) organics markets, possibly due to the current regulatory uncertainty around biosolids land application. If biosolids are perceived as unsafe by farmers, agricultural industries, and the public, then any form of reuse will become compromised, if not impossible. Aside from the increase in biosolids management cost as end users and contractors leave the industry, the potential damage to end use markets due to perceived risk is likely to be irreversible and it may be near impossible for the industry to recover from, even if the regulatory approach is later updated. Further, the potential for undue stress for farmers who believe their land may be contaminated from previous biosolids application should not be underestimated, nor the legal ramifications of this concern.

This type of damage can potentially be avoided by adopting a risk-based approach and practical, fit-for-purpose solutions to manage potential and perceived risks. If the EPA desires biosolids reuse to continue, then a more measured and flexible approach will be required. It is hoped this submission highlights the important impacts that need careful consideration in the development of the new regulatory approach and provides some practical suggestions for alternative solutions.

Question 2: What are your views on our current regulatory approach to the use of biosolids? How could our approach be improved or made more effective? What aspects should be retained?

Current biosolids regulation and guidance in NSW was developed in collaboration with experienced industry professionals and agronomists based on the best available knowledge at the time, including the US EPA Biosolids Guidelines, and has been used as the basis for developing regulation in some other states. The existing framework has served the water industry and the community well to date in terms of providing a framework for beneficial reuse of biosolids on land. ANZBP understands that as new risks and opportunities emerge, and our understanding and experience grows, regulators need to respond to these changes to ensure the regulatory approach remains fit-for-purpose and continues to protect human health and the environment. ANZBP supports the development of a risk-based and evidence-based regulatory framework that is centred around a systems approach, to ensure biosolids land application remains environmentally and financially viable into the future.

Sampling regimes that allow continuous sampling are necessary to sustain viable land application operations. The continuous sampling method enables biosolids produced at plants with onsite (also referred to as “continuous”) dewatering to be graded, classified and moved offsite based on historical monitoring data. This method is used for biosolids grading at many plants across NSW. If this method is not allowed in future and batch sampling is required, significant biosolids storage area would be required to store biosolids while laboratory analysis and grading occurs. It can take up to two weeks for laboratory analysis result to be received for analytes listed in the current guidelines, or even longer for the emerging contaminants EPA propose to regulate moving forward. In 2021, more than 80,000 dry tonnes (or 400,000 wet tonnes) of biosolids were produced in NSW. This equates to more than 1,000 wet tonnes of biosolids each day. To store three to four weeks’ worth of biosolids would require in the order of 23,000 to 31,000 tonnes of storage. The land area required to provide this amount of storage would be prohibitive. Most utilities do not own sufficient land on which to construct these storages, and most available land is already heavily encroached by urban development, so significant land acquisition would almost certainly be required to minimise odour risks during storage. The cost to construct bunded, covered, odour-controlled storage areas for all plants across NSW would be significant. Batch sampling would also increase the frequency of sampling for many plants, which would significantly increase monitoring costs, especially with the addition of the emerging contaminants which are very costly to analyse. These additional storage and monitoring costs would ultimately be borne by the community. We recommend the future regulatory approach retain both the continuous and batch sampling methods, providing flexibility for plants of all sizes and configurations.

The continuous sampling regime can be problematic when there is an outlier in the data set, which might be caused by a specific contaminant event at an STP. Once the contaminant is cleared from the system, biosolids can be classified as contaminant grade C for some time before the sampling calculation returns to grade B because of the use of the standard deviation rule. It would be useful to incorporate additional guidance for dealing with outliers when using the continuous sampling method.

The current regulatory approach has its challenges in that it is a 'one size fits all' approach to regulation. Biosolids land appliers have managed to work within this limitation due to the high demand for biosolids and the availability of land, however, this may not be possible under the proposed regulatory changes.

Some elements of the current guidelines have been challenging for farmers whereby hard limits on buffer zones and slope restrictions have seen areas of paddocks excluded from application. This has caused frustration to farmers and even withdrawal from biosolids programs due to unnecessary loss of effective grazing and cropping areas and losses in yields. Ironically, this has led to application of leachable mineral fertilisers in buffer zones (often adjoining waterways) where application of biosolids with low to nil leachable nutrients (Pritchard *et al.*, 2010), would better serve protection of waterway health.

ANZBP believes a place-based, risk-based approach (such as a Hazard Analysis and Critical Control Points – HACCP) to the application of biosolids would be more suitable approach to biosolids regulation. This would ensure the highest resource value of biosolids, i.e., soil rehabilitation via direct land application, is not lost by applying worst-case scenarios and overly conservative safety factors.

Following a HACCP approach would provide flexibility to ensure the best environmental outcome is achieved. Examples of where a HACCP approach would be beneficial include:

- **Copper and zinc.** These micronutrients are seen as contaminants under the current regulation, while in many situations they are needed as nutrient supplements where the soil is deficient or needed to prevent disease (zinc supplements for sheep grazing). Understanding the end use market needs and having the ability to be flexible will result in the overall best outcome for circular economy and society.
- **PFAS.** Proposed PFAS limits are derived based on dairy uptake and farmers' children drinking the milk from cows grazing on land recently applied with biosolids. However, in reality, biosolids cannot be applied to paddocks holding lactating animals without significant withholding periods. In addition to this, milk available to the public is diluted across the many producers, significantly reducing the PFAS risk. A HACCP approach could be used to exclude dairy farms from beneficial reuse as a high-risk pathway unless significant controls are agreed and implemented with the farmer.

We support regulation with guideline limits for different applications that are informed and managed by risk assessment rather than the current 'one size fits all' approach. This could include safety factors relevant to different crop and stock applications to ensure resources can be retained at their highest value end use, and an ability to vary from normal practice where a risk assessment eliminates negative outcomes. For example, having the flexibility to apply to different slopes or soil depths where runoff risks are mitigated, such as valleys that do not lead to waterways or low contaminant levels that do not require as much soil to be blended. End use exposure needs to be factored into the regulation as opposed to a single concentration for all scenarios. Guideline limits could then be set to realistic exposure risk pathways rather than extreme worst-case scenarios.

Biosolids are added to improve the soil and are an essential beneficial nutrient and carbon source to sustain food production and environmental health (Brown 2023). Therefore, the resource being recovered should be treated as such, and valued as an essential resource that NSW farms require. This includes bioavailable nutrients, metals, carbon and microbial content. The use of a HACCP approach will also see a positive change in the risk profile while mitigating operational cost increases.

ANZBP would like to see consistency in regulation for different product and reuse markets. For example, food organics and garden organics (FOGO), compost markets and feedlot wastes are not as strictly regulated as biosolids. Pesticides with over 600 times the PFAS present in biosolids can be applied to a farm (Table 1).

Table 1: Average concentrations of PFOS in the analysed insecticide formulations (mg PFAS/kg formulation or ppm, ± standard deviation). The concentrations reported were calculated from the dilution described previously in the 'Insecticide Analysis section'. PFAS with no concentrations above LOQ were not included in this table (Lasee *et al*. 2022)

Sample ID	Formulation type	Active ingredient	PFOS (mg/kg)
1	Liquid concentrate	Abamectin	3.92 ± 0.51
2	Emulsified suspension	Novaluron	9.18 ± 0.34
3	Liquid concentrate	Mineral Oil (Petroleum oil)	8.64 ± 0.67
4	Emulsified suspension	Imidacloprid	13.3 ± 1.4
5	Emulsified suspension	Spiromesifen	19.2 ± 1.2
6	Liquid concentrate	Malathion	17.8 ± 0.7
7	Wettable powder	*Beauveria Bassiana*	0
8	Wettable powder	Pyridalyl	0
9	Emulsified suspension	Spinosad	0
10	Wettable powder	Spinetoram, Sulfoxaflor	0
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As presented by Dr Sally Brown (University of Washington) at the 2023 ANZBP Biosolids conference (Sydney), the approach taken in Michigan USA has effectively reduced the quantity of contaminants of emerging concern in the environment through true source control, via manufacturing and product bans and trade waste controls rather than restrictions or bans on land application as applied in Maine (Figure 5). Land application bans have negative societal impacts by transferring the problems to other areas. This includes the cost of managing these contaminants to the taxpayer.

Similarly, anecdotal evidence indicates that average levels of PFAS in New Zealand biosolids, where bans on importation and use have been in place for around 10 years) are lower than in Australia (Rob Tinholt, pers. comm). While this requires rigorous validation, it does indicate that source control measures can be a more effective and less disruptive pathway to reducing human and environmental exposure to emerging contaminants.

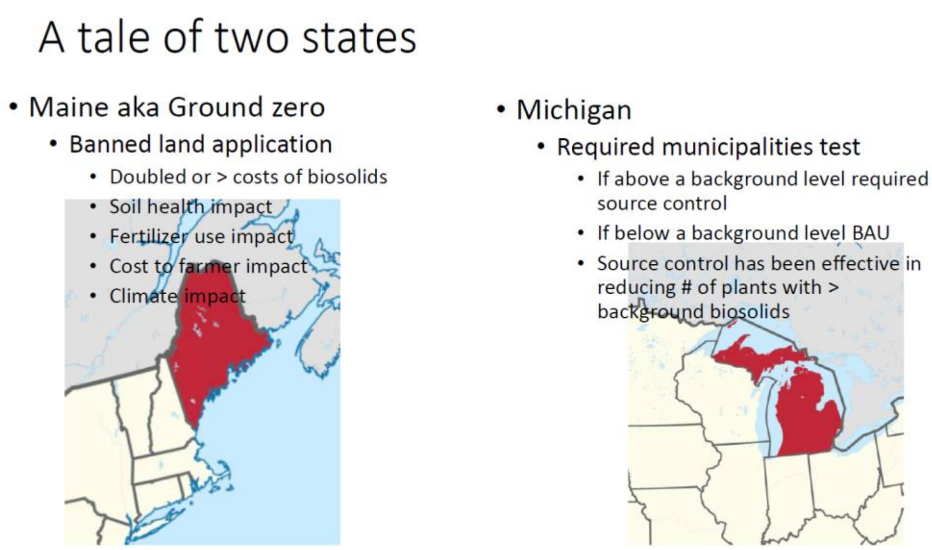

Figure 5: Presentation slides from Dr Sally Brown at the 2023 Biosolids Conference, Sydney (Brown, 2023)

Research in the US indicates that the impact of long-term land application of biosolids on PFAS presence in soils that received annual repetitive land application of Class B biosolids from 1984 to 2019 (35 years) is low (Pepper *et al.*, 2021). PFOS concentration in the biosolids was 14 to 36 µg/kg. PFOA concentration was and <1.2 µg/kg. Site receiving greater than 74 tons/ha recorded soil concentrations at 30cm of 4.1 +/- 1.9µg/kg of PFOS and 0.84 +/- 0.48µg/µg of PFOA. These sites were also irrigated, and both PFOS and PFOA were also present in the irrigation water. For sites with > 74t/ha, the study found 84% attenuation of PFAS analytes at 1m, and 90% attenuation of 2m despite irrigation being applied. The study concluded that even after decades of land application, the concentration and accumulation of PFAS in soils receiving the biosolids was comparatively low, and based on the level of attenuation with depth, the potential for groundwater contamination is relatively small.

In a webinar presentation on 27th January 2023, the author of the above study (Dr Ian Pepper) highlighted the classic mistakes of prior research that has raised concerns about biosolids application to soil:

- Pot studies instead of field studies
- 10x agronomic rate is not the same as 10 years at 1x rate
- Spiked chemicals not the same as chemicals within biosolids

The disconnect between lab/pot studies and the field results obtained by Ian Pepper's work highlights the need to regulation based on validated field studies rather than non-representative and often inappropriately designed lab/pot studies.

Extending the problem with extrapolation of lab/pot and/or theoretical studies to regulation, the approach to calculating the Margins of Safety (MoS) needs serious reconsideration. The approach used effectively uses the maximum scenario of PFAS content in biosolids multiplied well above industry standard application rates (e.g., 50 Dry t/ha), then multiplied by the worst possible grass uptake rates, and worst possible milk absorption rates. The application of extreme margin, on extreme margin, on extreme margin multiplied by extreme application rate results in very low acceptable contaminant levels that do not reflect the realistic patterns of exposure. For example, it, does not reflect the exposure of drinking one glass of milk per day over 50 years, which is more likely to be the average exposure than the extreme, one-off exposure reflected in the proposed margins of safety.

To illustrate this point, a hypothetical example of PFAS exposure though milk consumption is shown below for a 30% percentile case (indicating industry average biosolids application rates of around 10 dry tons/ha) a mean (using the EPS assumed application rate of 50 dry tons/ha, with mean exposure concentration, and a 95th percentile case using an unrepresentative application rate and extreme margins for each exposure pathway step. It can clearly be seen that the extreme, likely one-off exposure concentration rapidly escalates above the likely mean exposure concentration. This rationale underpins the vastly difference in the field validated data of Pepper *et al.* (2021) and lab/pot results and/or theoretically calculated exposure risks.

Table 2: Hypothetical example calculation of PFAS exposure through milk consumption under differing scenarios

Calculation for demonstration only, not real data

	30%ile	mean	95%ile	
PFAS in biosolids	10	25	65	micro-g/kg = milli-g/t
Biosolids application rate	5	10	50	tDS/ha
Application rate PFAS	50	250	3250	milli g/ha
Plant uptake rate	20%	50%	70%	Guesstimate
Milk uptake rate	15%	25%	75%	Guesstimate
Milk solids / ha	1200	1200	1200	kg/ha (NZ data)
Milk concentration	0.001	0.026	1.422	milli-g/kg milk solids

Implications for utilities

Biosolids land application programs run at a significant cost. Any regulatory change that increases operational costs will see those costs borne by the NSW taxpayer in increased service fees and IPART funding. This is in contrast to the polluter pays system outlined in the contaminated land management framework.

Any new regulation should be flexible enough to recognise the various resource benefits that come from biosolids i.e., carbon sequestration, macro and micro-nutrients, metals and beneficial microbial content, balance this with the risks, and be flexible to accommodate the changing demands of biosolid products. It needs to factor in the carbon benefits as identified in the NSW Waste and Sustainable Materials Strategy and NSW Circular Economy Policy. It also must consider that under these strategies and policies, co-digesting or even co-firing with other organic products like food organics or even FOGO may be the best use of resources in a circular economy.

By a disproportionate focus on extreme safety margins for emerging contaminants, the proposed regulatory approach seems to be in contradiction with the overall objectives of the state government circular economy objectives and keeping resources at their highest value. It has the potential to drive utilities towards treating biosolids with thermal technologies such as gasification. While thermal technologies may eliminate some contaminant risks (which is still unknown as there is no accepted methodology for testing gas emissions), a lot of the key benefits of biosolids are lost through thermal treatment. For example, the microbial content including the enzymes and mycorrhizal fungi necessary to make nutrients bioavailable for crop uptake are destroyed in thermal processes. These are key elements missing in Australian soils due to prolonged industrial farming techniques, such as ploughing and over-reliance on the use of synthetic fertilisers (Masters,2019, Massey 2020).

Beneficial use of biosolids in agriculture has operated for 20+ years, over which period concentrations of PFAS chemicals in the global environment have been decreasing as indicated by the downward trend in blood concentration levels (Kim *et al.*, 2019). Over this time, there have been no discernible environmental or health concerns from use of biosolids. In contrast, landowners and numerous scientific reports indicate improvements in soil health. In effect, we have conducted a "global experiment" in relation to PFAS exposure, with average blood concentrations for PFOS+PFHxS and PFOA at a MoS of 1 for unrestricted use roughly 5.2x and 0.2x the proposed limits for biosolids concentrations respectively (Boronow *et al.*, 2019). This combination of anecdotal and quantitative data and observation should serve as a sense-check of the appropriateness of the proposed limits and safely margins for PFAS, galaxolide, triclosan, copper and zinc. At the very least, it should indicate the need for field monitoring to provide the data needed to support solid, realistic and proportionate evidence-based regulation.

We are concerned that the proposed new concentration limits for PFAS and other organic contaminants will drive the industry to unproven technology solutions with uncertain impacts and outputs and unknown community acceptance. Thermal treatment will require significant capital investment, long-term financial payoff and greatly reduced product output volumes (approximately 90% reduction in tonnage). Critical resources that ensure ongoing food security will be permanently lost.

Similarly, if all NSW Biosolids products are directed to composting this would have significant impacts. It would increase the cost of the biosolids program as the number of contractors capable of receiving the material is limited (it is not a competitive market). This could put a significant strain on the compost market and the ability to capture approximately 1 million tonnes of extra garden organics necessary to blend with biosolids at the 1 to 5 ratio currently being used. Open windrow composting processes also have a higher carbon footprint that direct land application (Figure 7, McLeod, 2022).

ANZBP recommends the EPA establish greater consistency between terminologies and definitions used across regulatory instruments and supporting documents. For example, the current Resource Recovery Order and Exemption refer to biosolids "generators" and "consumers", while the Biosolids Guidelines refer to biosolids "producers", "re-processors", "appliers" and "end users" or "final users". Greater consistency in terminology across documents may assist in clarifying the roles and responsibilities of all parties involved in beneficially reusing biosolids.

Question 3: What are your views on the current definitions of biosolids?

The ANZBP supports updating the definition of biosolids to ensure that it remains relevant in enabling effective regulation to protect the environment. ANZBP can assist in arranging and facilitating workshops with the EPA, utilities, and the private sector to ensure the new definition encompasses the varying needs of the industry, including:

- Enabling resource recovery to achieve circular economy objectives using a risk-based approach.
- Enabling thermal treatment of biosolids and wastewater sludges to address contaminant risks where required.

ANZBP supports the distinction between sewage sludge and biosolids in the context of defining products suitable for land application. However, section 3.1 of the Issues paper states sewage sludge is the "matter remaining when most of the liquid component of influent to a sewage treatment plant is removed" which does not accurately reflect the nature of all sewage sludges. This description reflects the nature of primary sludge but does not accurately describe the nature of secondary sludge, which is the waste biomass generated during biological treatment process such as trickling filters and activated sludge processes (i.e., biological solids that are generated during the process of treating sewage), or tertiary treatment sludges such as those removed through tertiary filtration or flotation processes, which can include algal sludge. This is an important point in the context of defining biosolids for the purposes of the Energy from Waste Framework, as the current definition of biosolids achieves the desired outcome of exempting thermal treatment of all sewage sludges from the prohibition, not just treated biosolids that would be suitable for land application. The consequence of any change to the biosolids definition on the intended outcomes of the Energy from Waste Regulation must be fully considered.

The definition of biosolids needs to consider the various input and output streams within a sewage treatment plant, and the most effective methods of input and extraction that optimise processing and reuse outcomes, to enable these plants to operate as resource recovery facilities that can achieve true circularity of resources in society. The resources that must be considered include water, carbon, nitrogen, phosphorus, micronutrients (e.g., copper and zinc), electricity, heat and gas.

The definition of biosolids should be technology-agnostic, i.e., it should not be limited to products generated by a specific process such as anaerobic digestion.

The definition of biosolids should consider appropriate risk mitigation measures for products of different quality, such as the barrier options (e.g., direct soil injection and incorporation into the soil within six hours) for managing vector attraction under the current guidelines. Care should be taken not to limit opportunities for biosolids land application by reducing flexibility in the biosolids definition and grading systems.

The definition of biosolids should not limit opportunities for engaging fully within the circular economy for improved social, environmental and economic outcomes, e.g., through co-treatment with other organic waste streams such as food and beverage wastes. Sewage treatment plants are in a unique position to assist in the capture and recycling of food organics from commercial, industrial and domestic sources. The ability to use this food waste to generate renewable energy and return nutrients to farming regions in NSW should not be restricted by a narrow or limited definition of biosolids. For example, the current definition limits biosolid on how it arrives at the treatment plant, rather than what the product is. Wastewater sludge is a complex mixture of organic (and inorganic) materials, including food waste that enters the plant through the sewer network. However, if source separated food organics are collected and transported to a treatment plant by another means and treated with the material which arrived through the network, the resulting digested product is no longer considered biosolids under the current definition. We encourage the EPA to consider how a limited interpretation of the definition of biosolids can impede effective resource recovery of food waste in NSW as part of the circular economy, understanding that this must be balanced against damage that poorly stabilised and highly contaminated organic products can have on the environment.

Question 4: How will the proposed new classification system for biosolids management affect you?

It is not clear how EPA reached the conclusion that 'some licensees were unsure of their sampling and testing responsibilities to classify biosolids in accordance with the Biosolids Guidelines' based on the limited data collected in the survey. If the EPA is concerned about potential for inaccurate grading, perhaps an education program for all biosolids producers and processors would be useful. This could be targeted at those parties who are of greatest concern to the EPA. Standardised online grading tools similar to the EPA load-based licensing calculation tool might also be useful to improve compliance with grading requirements.

The proposed changes to the classification system combine multiple classifications into one class. This does not simplify classification. Rather, it creates the potential for inadvertent errors in determining the appropriate end use. For example, it is not clear whether Class I biosolids could be used for home lawns and gardens unless the stabilisation grade is also referenced, and it is not clear whether Class III biosolids could be used for composting. It would be simpler to have a unique class for each row in Table 2, section 3.2.2 of the Issues Paper.

Table 2, section 3.2.2 of the Issues Paper attempts to compare the existing and proposed classification systems, however these cannot be directly compared because the numeric limits for the current and proposed contaminant gradings do not align. The table implies the proposed C1 grade aligns with the existing Grade A and the proposed C2 grade aligns with the existing Grade C. This is not correct, as the proposed limits for cadmium, copper, mercury, and zinc are not aligned with existing limits. The implications of this misalignment are further discussed in our response to question 5.

Table 2, section 3.2.2. of the Issues Paper does not align with the Table 3 in section 4.2 of the Technical Findings Report. For example, in the Issues Paper Class III is defined as ungraded for both contaminant and stabilisation grade, with end uses 8 and 9 being permissible, whereas the Technical Finding Report shows three different combinations of contaminant and stabilisation grade within Class III, with end uses 8 and 9 being allowed only if contaminant grade C1 or C2 is met. Also, in the Issues Paper Class II is defined as contaminant grade C2 and stabilisation grade S2 but in the Technical Findings report Class II is also defined as contaminant grade C2 and stabilisation grade S1. The inconsistencies between the reports create confusion and will need to be refined if the proposed classification system is adopted by EPA.

Landfill disposal should not be listed as an "end use" as it is disposal rather than beneficial use.

Under Table 2, section 3.2.2, the Issues Paper states "Most NSW biosolids are expected to fall under Class II. We propose that these be considered suitable for applying to agricultural land, provided other requirements for land management are met." This statement seems redundant, as end uses for Class II are identified in the table and include agriculture and other uses.

Table 2, section 3.2.2, of the Issues Paper implies ungraded biosolids can be reprocessed (e.g., composted) but biosolids that fails C2 or S2 cannot be reprocessed. This creates potential for unintended consequences, e.g., composting of ungraded biosolids that would have failed C2 or S2 if it had been graded.

Clear, robust and practical sampling and grading methodologies are central to efficient grading, classification and use of biosolids. The Technical Findings Report states work is underway by a statistician to determine the basis for sampling is intended to be finished once the regulatory approach has been established. We assume the sampling approach will be influenced by the proposed grading and classification requirements. The EPA has advised the proposed metals limits are intended to be absolute maximum concentrations (email from Julie Cattle to Lauren Randall, 20 October 2023). This implies continuous sampling may not be allowed under the new regulatory approach. The implications of potential changes to the sampling approach cannot be identified until a proposed sampling approach has been communicated by the EPA. As highlighted in our response to question 2, ANZBP recommends continuous sampling be retained in the future regulatory approach to ensure efficient grading without the need for very large biosolids storages at significant cost to the community.

The Technical Findings Reports (section 4.2) states 'Stockpiling low quality biosolids or applying them on licenced premises is not good for the environment'. However, temporary stockpiling will be required if the continuous sampling option is removed, and stockpiling of biosolids that can't be applied to land may be necessary in the event landfills do not accept it. Unless the EPA can guarantee landfills will have the capacity and desire to accept biosolids not suitable for land application, utilities may have no other option than to stockpile if they have the space. This issue may be affected by potential changes to pre-classification of biosolids under the waste guidelines (section 4.3, Technical Findings Report). The implications of additional biosolids being classified as not suitable for use must be fully considered as part of the regulatory review, including flow-on effects for landfills.

The inclusion of urban landscaping for Class 2 biosolids is a positive addition for a low-risk market that minimises the environmental impacts of transportation and processing.

We do not see landfill as a viable or responsible long-term disposal pathway for organic material. Under existing guidelines (section 3.3.1) "A grade with low contaminant concentrations may be achieved by blending (diluting) with other acceptable materials or biosolids products". We recommend blending (diluting) or re-processing (e.g., composting) be permitted for biosolids that fail contaminant grade C2 to enable continued beneficial end use of biosolids, especially in the short to medium term, provided MASCCs can be met by managing application rates. We also recommend further investment in research and development to find other suitable treatment technologies or end use options for longer-term beneficial use of biosolids that fail contaminant grade C2.

We suggest EPA consider modifying the proposed classification system to provide greater clarity. For example, the below may be clearer than the proposal in the Issues Paper, noting that without details on potential changes to the stabilisation grading system it is difficult to know whether the proposed end uses are appropriate. The below example assumes end use option 8 is modified to include blending and composting. This example does not consider the implications of proposed changes to metals thresholds for contaminant grading, as these are addressed in our response to question 5.

New classification	Contaminant grading	Stabilisation grading	End use option
Class A	C1	S1	All
Class B	C1	S2	2 to 8
Class C	C2	S1 or S2	3 to 8
Class D	C1 or C2 or failed C2	Ungraded or failed S2	8
Class E	Ungraded	Ungraded	Not suitable for use

<u>Question 5: If the EPA were to introduce the regulatory thresholds for contaminants in Tables 3 and 4, how would this impact your management of biosolids?</u>

A preliminary analysis by the ANZBP estimates that 90% of NSW biosolids that are currently beneficially used for land application would be discarded to landfill. However, the ANZBP estimates that there may not be adequate landfill capacity to accommodate the significant volume of biosolids and consequently effluent discharges would need to carry "solids" which would include significant load of nitrogen, phosphorus and pathogens into their respective receiving environments.

Limited detail is included in the Issues Paper and supporting documents regarding how the proposed contaminant limits will be applied. To assess the actual implications of the proposed changes, further information is required, particularly regarding:

a. The basis for determining the relevant margin of safety and whether this will be different for different contaminants.

b. The statistical basis for the limits (e.g., median, 90%ile or absolute maximum), and whether this affects sampling requirements, noting that if continuous monitoring is not allowed then significant additional biosolids storage will be required.
c. Whether the Contaminant and Nitrogen Limiting Biosolids application Rates (CLBAR and NLBAR) calculation methodologies will remain the same (as per section 4.4 of the existing guidelines).
d. Whether biosolids that is above the proposed emerging contaminant thresholds (MoS 1, 2 or 5) can be applied to land providing the contaminant and stabilisation grades are suitable and the NLBAR is limiting meaning the chemical contaminant Maximum Allowable Soil Contaminant Concentration (MASCC) can be met (as is likely to be the case for some NSW biosolids).
e. Whether "A grade with low contaminant concentrations may be achieved by blending (diluting) with other acceptable materials or biosolids products." as per the existing guidelines (section 3.3.1) will be permissible.
f. Whether emerging contaminant concentrations will impact the contaminant grading and therefore the overall biosolids classification or will be assessed in isolation.
g. Whether other mitigation strategies can be implemented to meet requirements (e.g., with the half-life of galaxolide and triclosan being 3 months, can the products be withheld for a period before application to mitigate perceived detrimental effects?).

It is noted from the NSW EPA's HHERA for Galaxolide that the MoS 1 limit for restricted use land application is well below the mean measure that the EPA collected from the 80 plants sampled in its own testing exercise, with only 9/20 plants having results below the MoS 1 maximum, so the NSW EPA must be well aware that the current proposed limits will have a massive impact on the management and reuse of biosolids in NSW.

From the data provided on the 'NSW Biosolids Guideline review: Identification of Key Exposure Pathways to Assess Risks from PFAS in Biosolids' Appendix A, Table A1- Measured PFAS Concentrations in NSW Biosolids (DPE, 2023) 40% of the plants sampled would be excluded if the MoS 1 limits were implemented, 73% if the MoS 2 limits were implemented and 90% of biosolids excluded if the MoS 5 limits are implemented. Worse still 68% of FOGO would be excluded at MoS 1 limits, 81% at MoS 2 limits and 88% at MoS 3 limits, effectively making FOGO a contaminant source unappealing for use in co-digestion and similar circular economy initiatives where it can add significant benefits.

Impact of using a CLBAR/MASCC limit

If the CLBAR methodology outlined in the PFAS NEMP 3.0 is used for all contaminants applied to each plant individually, volumes of biosolids applied to land would be significantly reduced for some treatment plants compared to current application rates which currently use the NLBAR as the limiting factor.

From initial testing as confirmed by the EPAs results Galaxolide will be the limiting contaminant for most plants individually.

While still adding value to the soil at this lower application rate, it is also important to consider the significant negative carbon and financial impacts due to the additional site assessments, validation, reporting, setup, transport, processing and incorporation (Figure *6*). From the farmer's perspective they will be receiving significantly less product to remediate their soil while having to conduct the same amount of work through ploughing. This will make biosolids a less appealing option. Operational costs will increase significantly in the cost to assess paddocks and prepare Biosolids Application Reports (up to 7 times more land required to manage the same volume of product) or find larger farms to accept the same volume. This may also require more transport as the larger more suitable farms may be further from the location of generation, and more float and work to transport machinery to build bunds and spread the biosolids.

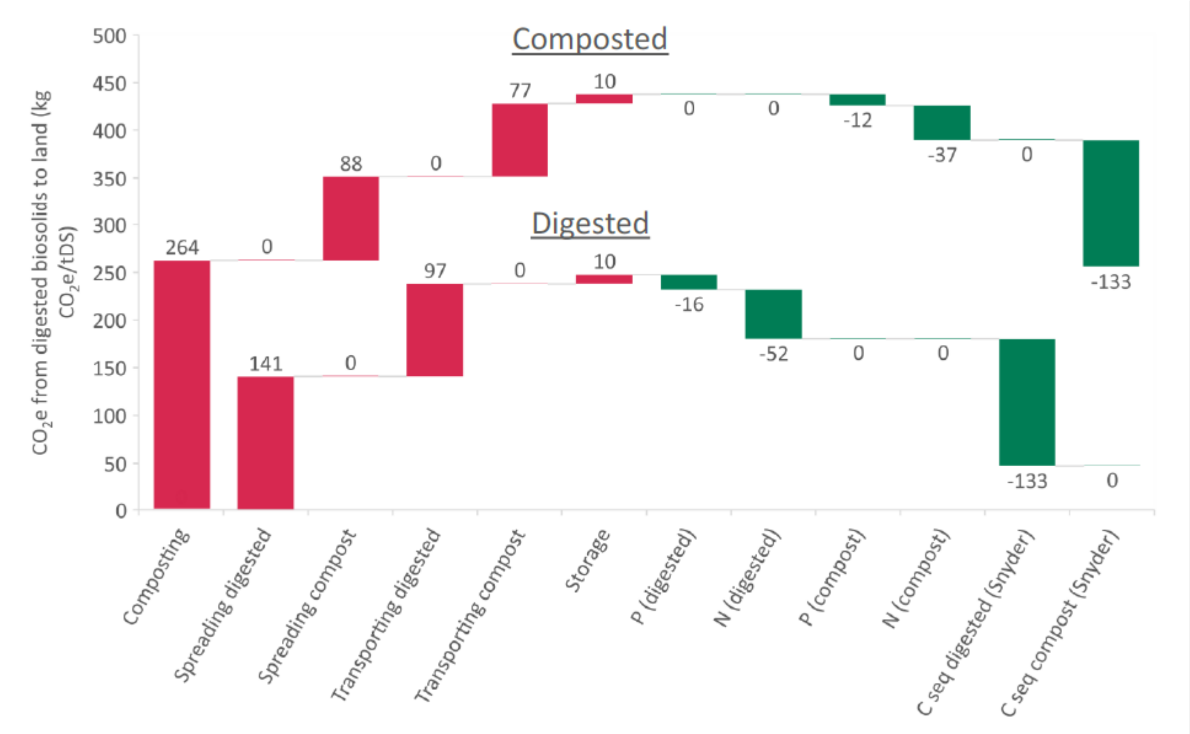

Figure 6: Separated carbon baselines, on a kg CO_2e/dry tonnes basis, estimated for Sydney Water's biosolids products digested and recycled directly to land (total net emission on 47 kk CO_2e/tDS) and products first composted before being recycled to land (total net emission of 257 kg CO_2e/tDS) (Mcleod 2022)

Proposed galaxolide, triclosan and PBDE limits

The ANZBP recommends the HHERAs be further investigated considering theoretical calculations do not match what is being seen in the field regarding soil health, crop performance and worm reproductivity.

The galaxolide and triclosan thresholds are derived based on risks to reproductivity of worms in the soil. Due to a lack of available local research, European and Canadian research was used with a scaling factor applied based on the difference of carbon content of soils. Australian soils are very different to European and Canadian soils. They have a much higher sand and clay content. Soils are being remediated by biosolids due to prolonged industrial farming techniques, such as ploughing and over-reliance on the use of synthetic fertilisers (Masters, 2019; Massey 2020). Anecdotally there is little to no worm populations seen in the soils pre and during application of biosolids. Of note significant worm populations are seen 6-12 months after application due to positive impacts on the soil structure, pH, nutrient contents and microbial contents of the soil. This was highlighted at Oxenthorpe near Molong where owner Stephen Liesk has seen his soils transformed and the return of worms. Watercare in New Zealand has also worked with contractors who use worm populations directly in biosolids to treat the biosolids with great success in terms of stabilisation and improved water holding capacity. It is likely that triclosan and galaxolide, which are present in a wide variety of domestic products, have been present in biosolids for a significant time. The anecdotal evidence suggests further research within the Australian context is needed to assess the ratio of biosolids that can be blended with soils while mitigating the risks to worm reproductivity. The ANZBP would support collaborating with the EPA and researchers to achieve this.

The screening criteria numbers used to calculate the risk quotient are designed to mitigate risks under all conditions and may be overly conservative in some contexts. In halving the screening criteria number to scale to the local soil organic content, has the EPA assumed the same number of worms are in a volume of Australian soils as were in the same volume of European and Canadian soils? If so, this may not be accurate. Anecdotal evidence suggests there are little to no worms in the Australian soils being remediated by biosolids, probably because there is little in the soil to sustain them due to prolonged industrial farming techniques. The soil structure needs to be rebuilt before a worm population can be regrown. ANZBP suggests the ecological screening criterion numbers should be reviewed following collection of field supported evidence from NSW soils.

The thresholds for PDBE (Br1-Br10) are based on US EPA drinking water levels. This assumes all contaminants pass through the soil, leach into groundwater and then pass into drinking water without any dilution which may mitigate risk under all conditions but may be overly conservative in some contexts. It may be appropriate to include dilution factors to account for the amount that moves through each stage in the cycle, from soil to groundwater to drinking water.

Revised copper and zinc limits

The new copper and zinc for contaminant Grade C2 are lower than thresholds for existing Grade C, which is likely to result in large volumes of biosolids products being downgraded to Class 3 biosolids and requiring reprocessing or landfill disposal. The ANZBP does not consider disposal to landfill a viable long-term option Landfill disposal of organic materials is inconsistent with EPAs goals and objectives and other state government and EPA policies, including the Waste and Sustainable Materials Strategy 2041, Circular Economy Policy, and the Waste Avoidance and Resource Recovery Act 2001. It is not clear whether physical landfill capacity exists in NSW to take the volume of biosolids that may be classified as not suitable for use. Further, biosolids producers cannot guarantee landfills will accept biosolids. Poorly stabilised biosolids will require further treatment to ensure it is spadable and low odour, to enable landfills to accept it. Additionally, leachate from the landfills is often released to the sewerage system under trade waste agreements. Ceasing leachate trade waste agreements or requiring landfills to construct costly pre-treatment processes to manage contaminants risks at sewage treatment plants would create flow-on effects for councils and ultimately ratepayers.

Reprocessing the biosolids to compost will have a financial impact on utilities and their customers. There will also be a significant detrimental environmental impact due to the carbon emissions impact of composting versus direct land application (Figure 7).

Agronomists are typically involved in biosolids land application programs and are very familiar with managing copper and zinc risks in different soil conditions. It may be possible to develop a suitable pathway for end use of biosolids with elevated copper and zinc concentrations where the factors discussed in section 5.6.4 and 5.6.5 of the Technical Findings Report are considered and a lower cost, better environmental outcome solution than landfill can be achieved.

There may be an opportunity to investigate whether drinking water quality impacts on leaching of copper and zinc from household plumbing into the sewerage system. If causal factors can be identified there may be opportunities to adjust drinking water quality parameters (e.g., pH) to reduce the concentrations of these in biosolids, and thereby reduce the likelihood of biosolids being classified as not suitable for use.

It is unknown if the metal concentrations are addressed by thermal treatment with concentrations being increased but potentially immobilised. Thermal treatment may become a viable option due to the significant volume reduction of product when compared to the cost of further processing or landfilling. This will be at the permanent loss of the microbial content of the biosolids which plays a critical part in the remediation of depleted farming soils in NSW.

The ANZBP welcomes further discussion with the EPA on the revised limits for metals. The baseline soils that the National Biosolids Research Program used to assess microbial populations are not clear (e.g., soils impacted by prolonged industrial farming techniques that had little to no microbial population due to monoculture cropping and extensive synthetic fertiliser use (such as the soils that are typically remediated through Australian biosolids programs), or untouched natural Australian soils?). The negative impacts raised in the technical paper do not meet the anecdotal crop responses our farmers on our programs see in the field with the application of biosolids with higher copper and zinc levels over the following 5 years and beyond. The methodology also does not seem to consider the adaptability of microbial populations to their surrounding conditions (as mentioned in one of the reference papers), and in particular the microbial population that comes with the biosolids. Copper/zinc/cadmium and other metals are not being applied to an existing microbial population in isolation (as per the 12-year study that was referenced), but with a large repopulating microbial population that is conditioned to the presence of the metals to a soil whose microbial population has been depleted/destroyed by ongoing poor farming practise of monoculture cropping and synthetic fertiliser use.

Risk quotients

Risk Quotient numbering is calculated as exposure concentration / human health screening criteria or predicted daily intake / TDI – background. This is assuming you are eating biosolids directly! This is then divided by 5 to determine if regulation is required at a MoS 5 level. This is extremely conservative. The Risk Quotient numbering should have a significant dilution factor relative to plant uptake and dilution based on non-biosolids market availability. The ANZBP does not agree on the methodology used for calculating the risk quotient.

Using the highest risk pathway of the farmer directly consuming only their own produce is not a realistic baseline. Simply educating farmers on the contaminant risks of biosolids significantly reduces or eliminates this pathway and then a more realistic risk pathway that is applicable to the general population can be applied that enables the full benefits of biosolids to continue to be realised.

Thermal solution challenges

If thermal treatment continues to remain a desired pathway for processing biosolids there are several impacts that must be considered.

Constructing a pyrolysis/gasification plant requires significant capital investment. We have estimated the cost of building a plant capable of processing 30,000 wet tonnes of biosolids per annum to be in the vicinity of $120-$300 million. Larger utilities may be able to construct centralised hubs depending on the needs and balance of capital and operating costs. It must be considered that for smaller utilities this level of capital challenging. The logistics and negative financial and environmental impacts of smaller utilities transporting their biosolids to processing facilities should also be considered.

The impacts and receptivity to constructing a thermal treatment option are also unknown. Discussions of the construction of incinerators in Sydney remain strong political fuel at election times, and there is a high risk of community backlash against the construction of thermal treatment facilities near suburban areas (of which many plants are now encroached by suburban dwellings).

There are also conflicting impacts of contaminant and stability gradings. Implementing technologies to mitigate stability risks and some contaminant risks may lead to concentrating other contaminants, and destruction of the most valuable part of the biosolids for land remediation, the microbial content (Masters, 2019; Zeldovich 2021; Nelson, 2023; Lowenfels and Lewis, 2010; Massey 2020). This also heavily relies on the definition of the new product to determine the viability of the treatment process. For example, does biochar still need to meet biosolids guidelines for reuse, or is it a new product that can be utilised in other markets where concentrated heavy metals are not an environmental risk (such as brick or concrete manufacture)? Following the pathway for individual resource recovery orders and exemptions is a long and expensive process and requires the production of an end product and comprehensive testing and analysis before the application process can commence. This carries a significant amount of capital investment risk in the assumption that a satisfactory beneficial reuse will be able to be found.

Most utilities have very limited data for triclosan, galaxolide and PBDE concentrations in biosolids (<20 samples from each WWTW). Due to the small sample size and large variation in measured concentrations, and lack of clarity regarding how the limits will be applied, it is difficult to establish whether utilities will need to invest in technology to remove contaminants from biosolids to enable continued beneficial reuse.

Implications for investment

In the absence of clarity regarding potential regulatory changes, water utilities have two broad investment options for biosolids treatment upgrades:

1. Continue to invest in infrastructure to meet existing requirements in the short term and consider further upgrades in future to address regulatory changes as part of an adaptive approach, once more certainty is available regarding future regulatory requirements. This approach would not provide contaminant treatment in the short term.
2. Invest in infrastructure to provide contaminant treatment in the short term (10-15 years) as part of a precautionary approach, in anticipation of potential future regulatory changes. This approach is expected to reduce CEC concentrations but is likely to increase metals concentrations. Thermal treatment involves significantly higher delivery risk. Delivery risks include:
    - Capacity and maturity of the market to deliver multiple significant thermal treatment infrastructure projects across NSW simultaneously. This can potentially be mitigated by staging upgrades across NSW and adopting a procurement approach that encourages market capacity building.
    - Uncertainty regarding process performance, product quality and energy efficiency. This can potentially be mitigated by pilot/demonstration trials and designing a plant that can be easily adapted to incorporate additional feedstocks in future if plant performance, product quality or energy efficiency are lower than expected following commissioning.
    - Uncertainty regarding application of the Energy from Waste Framework for pilot/demonstration trials. This can be mitigated through further consultation with EPA regarding the Energy from Waste Policy Statement (EfW Policy) and Energy from Waste prohibition (EfW prohibition).
    - Uncertainty regarding product market. There is no established market in Australia for biosolids derived biochar, a product from thermal treatment of biosolids. Significant time and effort are required to develop biochar markets, including research and development, and collaboration with other industries.

Many utilities across NSW and Australia are currently assessing their options for future biosolids management. Given the significant additional expenditure likely to result from the changes discussed in the Issues Paper, ANZBP recommends the use of a Regulatory Impact Statement or equivalent assessment to evaluate the potential costs, risks and benefits of the new biosolids regulatory approach.

ANZBP notes there is insufficient data available in the literature on the reduction of triclosan, galaxolide, PBDE and chlordane in biosolids to establish whether available treatment technologies can assist in meeting the proposed limits for these contaminants. It is assumed thermal treatment technologies such as pyrolysis/gasification will be able to reduce the concentration of these CECs, based on evidence these technologies can reduce PFAS concentrations and an assumption that similar conditions would be required to reduce other CEC concentrations. However, the removal efficacy of these CECs is not well studied or documented.

There is also insufficient data in the literature to assess the impact of thermal treatment processes on metal concentrations. Most metals are not expected to be removed through thermal treatment, meaning concentrations in the biochar will be higher than in the biosolids, due to the reduction in volume through pyrolysis and gasification. However, thermal treatment may immobilise the metals, reducing leachability compared to biosolids. This uncertainty has the potential to limit land application of biochar, unless further specific guidance is provided for biochar separate to the Biosolids Regulatory Framework.

Potential alternative regulatory approaches

Potential alternatives to adopting fixed biosolids concentration limits that are designed to mitigate risks under all circumstances, and therefore may be overly conservative in some contexts, should be considered by the EPA in consultation with industry. Potential alternative approaches include:

- An outcomes-based regulatory approach that includes the desired outcomes (e.g., MASCCs to protect environmental and human health) and provides fit-for-purpose methods to ensure these outcomes are achieved (e.g., methods for calculating maximum biosolids application rates considering the specific characteristics of the reuse application including receiving soil properties).
- A 'cumulative pollutant loading rate (kg/hectare)' approach similar to the US EPA.
- Adopting a hybrid approach that includes fixed biosolids concentration limits for higher-risk end uses where public access is unrestricted, e.g., home lawns and gardens, public contact sites (parks), urban landscaping (council land) and adopts an outcomes-based for lower-risk end uses where public access is restricted, e.g., agriculture, forestry, soil and site rehabilitation and surface land disposal.

Question 6: Do you have any views on whether the EPA should target its regulatory approach upstream of STPs to minimise the inputs of known and emerging chemicals into sewerage systems? If so, how?

The ANZBP supports the development of a clear and consistent national approach to managing PFAS and other chemicals of emerging concern (CECs) in biosolids across Australia, for the protection of public health and the environment. These chemicals present a significant risk to the long-term viability of biosolids beneficial use. Biosolids is a critical resource for Australia but could become a significant waste burden due to PFAS and other CECs. Technologies for removal or destruction of PFAS and other CECs from biosolids are emerging but these remain costly and more complex than traditional biosolids treatment processes. Preliminary findings from sewage catchment monitoring suggest that residential sources are a significant portion of the load of PFAS and other CECs into sewage treatment plants.

The most cost-effective way to manage PFAS and other CECs in biosolids is through source control, including import and manufacture bans on such chemicals and all products containing them. In fact, source control is the only effective way to ensure PFAS and other CECs are permanently removed from our ecosystems. ANZBP recognises and strongly advocates that a systems approach to management, including source control, is required, rather than relying on 'end of pipe' limits in isolation. Greater control over the importing and use of these chemicals is needed to remove the burden on communities having to pay for high cost of 'end of pipe' treatment and management. For example:

- PFOS has been banned for use in New Zealand since 2011 and New Zealand biosolids has substantially lower concentrations in their biosolids (refer **Appendix 2**). This supports the notion that source control is correlated to improved outcomes for biosolids.

- In the United States, in April 2007, the legislature of the State of Washington passed a bill banning the use of Polybrominated Diphenyl Ethers (PBDEs). The State of Maine Department of Environmental Protection found that all PBDEs should be banned. In May 2007, the legislature of the state of Maine passed a bill phasing out the use of Decabromodiphenyl Ether (DecaBDE).
- The European Union decided to ban the use of two classes of flame retardants, in particular, PBDEs and polybrominated biphenyls (PBBs) in electric and electronic devices. This ban was formalised in the RoHS Directive, and an upper limit of 1 g/kg for the sum of PBBs and PBDEs was set.

We strongly support the NSW EPA having a greater role in source control and regulation that applies to the Australian industry and commercial customers, particularly for the contaminants that are currently or planned to be regulated. It is difficult for water authorities to impose limits if they are not supported by higher level legislation or initiatives. This should include, as a minimum, acceptance standards or waste codes rather than relying on 'end of pipe' limits in isolation. Wastewater treatment plants are receptors and conduits for a wide array of contaminants that originate from upstream sources including domestic, industrial, commercial, as well as stormwater and ground water infiltration. Apart from trade waste acceptance standards, water utilities have minimal control over what is discharged into the sewer network. Trade waste acceptance standards apply to industrial customers, but not commercial customers, who are by far in the majority. As seen in Michigan, effective source control has had a far greater impact in rapidly reducing the output of chemicals of concern such as PFAS to the environment when compared to bans on land application of biosolids (Michigan department of Environment, Great lakes and Energy, 2020)

Changes need to be made at a Commonwealth level by legislating product import and manufacturing bans. If these chemicals are truly harmful, then why are they being used everyday products and considered acceptable for direct human contact and consumption with contaminant levels that far exceed the proposed biosolids regulatory limits (Figure 7)?

In addition to trade waste (industrial and commercial), effective source control also needs to consider domestic sources. Triclosan is used in a wide range domestic products such as fluoride toothpaste, mouthwashes, facial cleansers, aftershave, deodorants and body sprays, lotions and creams, cosmetics, detergents and dishwashing liquids. Galaxolide is a commonly used fragrance ingredient found in household products such as surface cleaners, laundry products, air fresheners, cosmetics and perfumes. Water utilities have no control over the use and release of these products into the sewer network. Due to the number of everyday products these chemicals are found in, education campaigns in isolation will have minimal effect (Water Utilities' only avenue to tackle domestic wastewater). Many of these contaminants make up a small portion of the overall components that make up products and as such do not appear on product labelling. Similarly, galaxolide, being a fragrance, is not required to be labelled on products, so customers are unable to make an informed decision to avoid such products. Full product disclosure labelling for all components with education will allow consumers to make informed purchasing decisions.

We encourage the EPA to review the current regulatory frameworks and legislation to ensure that the power to regulate and evaluate contaminants from commercial and industrial users is vested in the most appropriate authorities, such as the EPA.

One such avenue may be via Part 2 of the POEO, which enables the EPA to set Protection of the Environment policies that further the objectives of the EPA and manage the cumulative impact on the environment of existing and future activities. These policies also provide a means to adopt Australia-wide environment protection measures set by the National Environment Protection Council. Improving control of long term, persistent substances that affect wastewater quality and reduce safe recovery of resources in line with new national standards – is well within scope of a Protection of the Environment Policy.

Greater control on the use of the contaminants proposed for regulation is needed to remove the burden on water utilities, and in turn communities, having to pay for treatment and management at the end of the process, and put the responsibility back to the producer as the polluter.

Question 7: What suggestions do you have on how the NSW EPA could regulate and manage future unknown and emerging chemical risks?

Source control is the most effective form of regulation. While we understand it is more challenging for unknown and emerging chemicals, source control will have the greatest effect at the lowest cost for the community. The EPA has a list of eleven chemicals they are proposing as the next tranche of contaminants to be considered for regulation. These chemicals, as well as the currently regulated chemicals, would be a good place to start.

The focus should be to stop the contaminants entering the wastewater network in the first place, and then work downstream to users (product labelling and education) and then finally receivers. Enforced product labelling that contains all ingredients used in the manufacture of a product regardless of percentage of the product makeup is critical. This will need to go hand in hand with education and media campaigns, as most of the population will not be aware of these contaminants, let alone know that they are unsafe. Consumers can then make an informed decision regarding the products they buy. This coupled with import bans will provide the most effective management of emerging chemical risks and see the most rapid decline in their use and subsequent presence in our waste products and in turn our natural environments/landscapes.

While the Commonwealth government is moving in the right direction with the Industrial Chemicals Environmental Management Standard (IChEMS), the process is slow. For example, PFOS was listed in the Stockholm Convention in 2009 yet implementation of scheduling PFOS in IChEMS is proposed for mid-2025. In addition to this, the list of chemicals for scheduling is limited, especially considering the number of new chemicals produced every day. Hence the problem needs to be tackled from different angles. Greater involvement of the EPA in upstream source control is required. This needs to include the EPA working closely with industry in terms of regulation, education and development of acceptable methodologies to derive trade waste acceptance standards. There is also the need to work with manufacturers to eliminate these contaminants in every day domestic products.

It is also important to ensure that the management of biosolids considers the relative risk of exposure from all sources to the end use markets. For example, focussing solely on biosolids for plastics management is unlikely to make a material change in risk to the environment or humans as the sources are so widespread and variable. For PFAS the exposure pathway from domestic products is much higher than that of biosolids, let alone through products grown in biosolids (Figure 7).

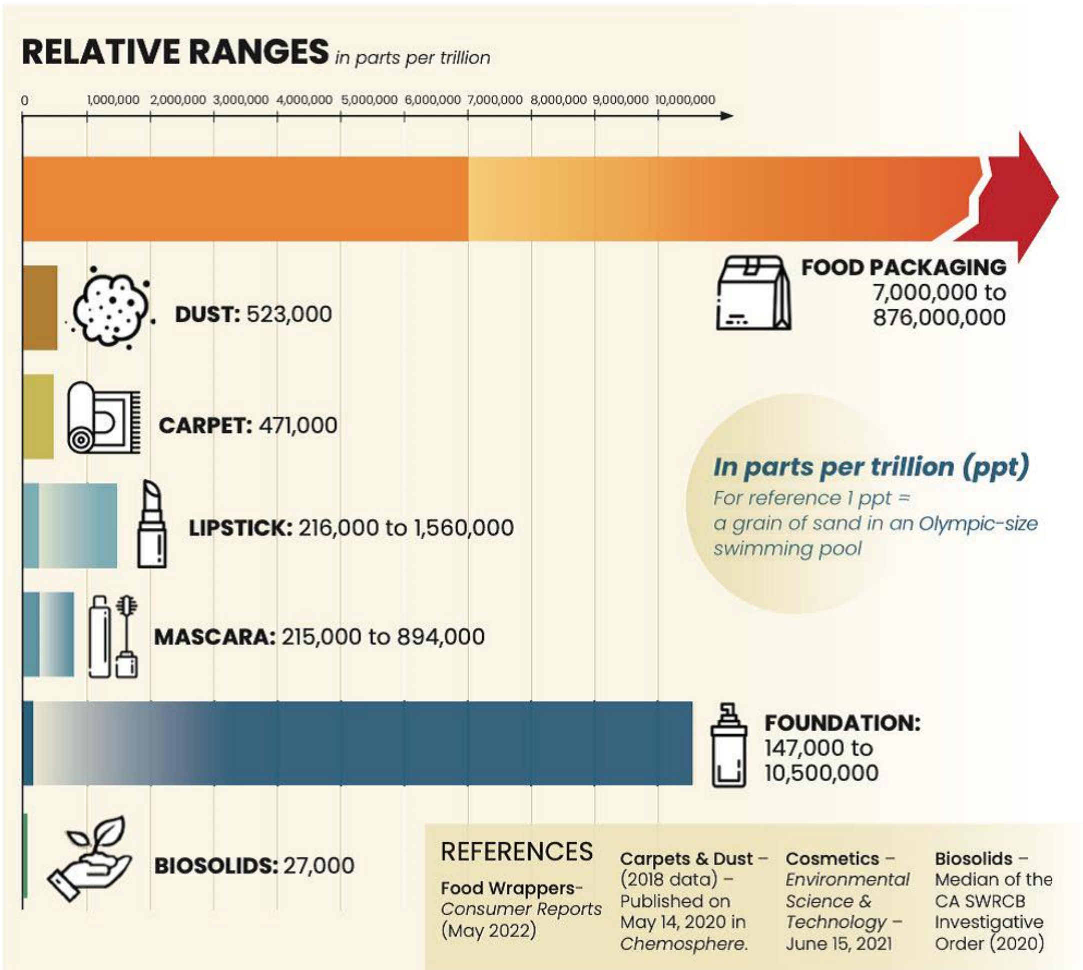

Figure 7: Relative ranges (ppt) of PFAS in consumer products compared to biosolids (Brown 2023)

We encourage our regulator to consider biosolids as a resource rather than a waste and protect them as such. Understanding the true value of biosolids is critical to ensuring we protect its key elements. While the benefits of nutrients contained in biosolids are well understood, little is known about the importance of the microbial structure for soil remediation. Repopulating the soil with the active microbes and enzymes which in turn make the nutrients in the biosolids bioavailable to plant life, is the critical process in biosolids land application, making biosolids by far the most effective fertiliser in increasing crop yields and regenerating soil function for many years after application (Zeldovich 2021, Nelson 2023, Lowenfels and Lewis 2010, and Massey 2020). Biosolids have an important role in the future of global food security and need to be sustained in their true form.

Focusing on thermal processing to mitigate contaminant risks at the end of the pipe destroys the microbial content and removes the bioavailable nutrients. The existing soil microbial content is then required to process and convert the inert nutrients applied, which for most soils is non-existent. Biochar is a product that is not well understood and may have limited soil remediation characteristics, possibly being better used as a base material for use in other products (such as construction products or filter media). A thorough understanding of the mass balance of thermal processing is still uncertain, including contaminants in the gas phases. To mitigate exhaust gas risks, thermal processes need to incorporate a high temperature oxidiser which adds to the capital and operating costs. Further, thermal processes need to gain public acceptance, which may be challenging in NSW.

A national and international literature search revealed that no country has implemented regulatory measures for triclosan and galaxolide. While there is no 'regulation' in place, there have been national bans in other countries i.e., stopping the product at the source. For example, in 2016 the United States Food and Drug Administration (FDA) banned the incorporation of triclosan and 18 other antimicrobial chemicals from household soap products, and in 2017 prevented companies from using triclosan in over-the-counter health care antiseptic products without premarket review. The European Union (EU) banned triclosan as an antimicrobial in food packaging in 2010. Both the US and EU have implemented source control as opposed to end-of-pipe regulation. We would like to see the same logic applied to contaminants of emerging concern proposed for regulation in NSW.

As mentioned above (question 6), source control is a key element in managing contaminant risks and should be considered for any current or emerging contaminants of concern.

Further, State and Federal governments and regulators could develop and maintain a public register of products know to contain PFAS and other contaminants. Legislation could be introduced requiring product labels to clearly state they contain PFAS or other contaminants so that consumers can make informed product choices. This could be complemented with a public awareness campaign including advertising in various media formats.

We support the EPA following a risk-based approach to regulation, but it needs to be flexible, consider realistic exposure pathways, and look holistically at what is gained and lost.

There may be opportunities for the EPA to work collaboratively with utilities to trace contaminant sources when elevated contaminant concentrations are identified in particular catchments, through implementation of additional monitoring and investigations.

Question 8: What is your view on implementing a HACCP approach for pathogen management and why?

The ANZBP supports the development of a HACCP based framework for pathogen management and stabilisation in the new regulations/guidelines. The proposed framework should follow the existing risk management frameworks such as the 12 element "Frameworks" documented in the Australian Guidelines for Water Recycling and Australian Drinking Water Guidelines, or the Hazard Analysis and Critical Control Points (HACCP) and ISO 22000 systems widely used in the agricultural sector. These approaches define treatment and control processes, and critical limits for those processes, that can be readily monitored, audited and regulated.

At a minimum to be able to implement a HACCP style framework, specifically for pathogen, log removal values (LRV) attributable to the most common treatment processes should be determined and default values and operating conditions defined. A process for undertaking validation for less common treatment processes should also be developed to allow LRV values to be determined for these. The validation process developed for the WaterVal program could be used as a suitable model (https://members.waterra.com.au/WaterVal).

This approach is well established and understood in the water industry. It provides an outcomes-based framework which ensures end point quality during production rather than relying on end-point monitoring which is retrospective and requires a batch and hold process until the final product quality can be determined. When implemented properly the framework is adaptive with the level of treatment required linked to the end use of the biosolids product.

Specifically, pathogens are expensive to test for and are frequently present in very low numbers which will not allow for positive detections in the volume size testable, while still presenting a public health risk.

Risk based approach to implementing pathogen control is reasonable provided the framework retains the flexibility of the risk assessment to accommodate the circumstances for each STP (location, treatment process, catchment specific contaminants). Imposing a 'one size fits all' list of prescriptive limits will severely impact some STPs, particularly regional facilities with limited resources / control over inputs.

Question 9: What are your views on the proposed recommendations to manage odour and stability? What other methods do you suggest?

ANZBP notes that dewatering is not a stabilisation process. It is designed to remove excess water to create a product that can be more easily handled and transported, at lower cost.

Odour and handling properties are two of the biggest risks to biosolids end use markets. The ANZBP agrees that a best practice manual may help, particularly in understanding challenging topics such as types of offensive odours.

The ANZBP supports a HACCP method for managing odour and stability. This would allow flexibility and the ability to tailor practises to the needs of the soils being regenerated, as well as the farmers and their communities.

Techniques such as drop and spread applications, where biosolids is delivered, spread and incorporated immediately, could be used as a risk mitigation strategy to beneficially reuse less stabilised biosolids (which also have higher nutrient and microbial values to remediate the soil). The ANZBP understands that the barrier options for vector attraction reduction (e.g., direct soil injection and incorporation into the soil within six hours) are commonly used by some utilities in NSW under the current guidelines. We acknowledge this approach does not mitigate odour risks during transport and storage of biosolids. It is also not clear whether this approach provides any pathogen benefit. Clarification is sought from the EPA regarding any proposed changes to this existing practice under the new regulatory framework. Removal of these options for vector attraction reduction may have significant capital and operating cost implications for some utilities who would need to invest in further stabilisation processes at the STPs.

Using a HACCP approach would also be valuable where land application is close to other dwellings. As mentioned above, application could be managed so that 'drop and spread' operations only occur on certain days, while isolated applications could be bunded and stored for longer periods without concern. Minimising and managing the potential for impact through good application practise will be far more successful and achievable than trying to quantify and classify odour.

Scientifically characterising odour through measuring gaseous omissions has had limited success as results can be inconsistent and do not directly correlate with perceived odours. Addressing the issue of 'offensive' odours is challenging as odour is subjective, and complaints around odour are often clouded by other background issues (e.g., neighbours are unable to get on the biosolids program but would like to, or ongoing disputes between neighbouring farmers).

While stability was a limiting factor in the past, the current focus on contaminants is going to be the limiting factor effecting biosolids land application. Few products will be able to meet a C2 grading or better, which will mean that the stability grading will be irrelevant.

Notable gains in stability have been achieved following plant upgrades, however this has sometimes concentrated the contaminants and the product remains at a similar, or worse, grading. For example, the installation of a thermal hydrolysis plant can result in the biosolids being odourless (or lightly earthy at worst) but can concentrate contaminants rendering the product unsuitable for use in land application and requiring composting. Future capital investment decisions will be made based on volume reductions and financial outcomes rather than stability improvements.

ANZBP disagrees with the statement that thermal drying removes pathogens but does not yield a fully stabilised product. Thermally dried, pelletised biosolids are very attractive to consumers. If kept dry, they are very beneficial to the agricultural industry from the perspectives of odour control, ease of transport, application using readily available equipment and comparative ease of storage. Further thermal treatment such as gasification/pyrolysis has also demonstrated successful deactivation of pathogens irreversibly, and significantly reduces or eliminates typical odours encountered in biosolids.

Implementation of minimum sludge retention times needs to be considered in an operational context not just from odour perspective. Treatment plant operators should have flexibility to operate their plants to optimise all aspects of treatment, not just one process unit. ANZBP recommends an outcomes-based approach rather than a process prescriptive approach to managing odour and stability.

The ANZBP acknowledges that odour can vary across the biosolids process chain, including at the STP during treatment and dewatering, then during transport, storage and spreading activities and the variation is complex to understand and predict. However, assessing stability after dewatering, transport and storage does not help to mitigate odour risks during transport, or during storage either at the STP (e.g., for grading) or at the reuse site.

Question 10: Is there a need to change land management practices to ensure that the land application of biosolids is protective of the environment and non-polluting? How?

The environmental benefits of biosolids programs have been seen in NSW for over 30 years as farmers have been able to regenerate their soils to sustain stock and crop yields far beyond what could be achieved pre application. Anecdotally farmers have found that a single application of biosolids continues to show benefits 5 years after application and beyond. The restoration of essential nutrients and microbial populations can leave an ongoing legacy of positive impacts for Australian soils and their ability to produce our food.

We suggest the question be reframed to be 'How can we change land management practises to maximise the benefits of land application of biosolids, while protecting human health and the environment?' Metals, considered contaminants, are of benefit to depleted soils, and microbial communities found in biosolids rapidly restore soils to productivity.

Management practices in the current guidelines are very prescriptive. If the new regulations adopt a HACCP approach, similar to the approach of the AGWR, it will enable a more flexible approach to address site specific needs. The ANZBP is willing to work with the EPA and other industry stakeholders in developing such an approach to land management practices.

Concern has been raised by the EPA about the potential for contaminants to accumulate in the soil with reapplication of biosolids. Application frequency should be taken into consideration as part of a flexible risk based regulatory framework.

We would like to see a place-based approach that focuses on the core drivers towards achieving circular economy objectives. Regulation needs focus on the most impactful way to achieve true environmental protection i.e., product bans and source control at manufacture and import.

Question 11: Do you have any comments about which controls should be made mandatory vs optional and in what circumstances? Why?

A HACCP approach to controls would be appropriate, as site-based decisions could be made based on the specific risks of the application. Options for different types of bunding (silt fence versus earth) based on intended storage periods, application methodologies (campaign spreading versus drop and spread), and buffering methodologies to choose from to apply to each application would be far more beneficial than blanket requirements that can make application to a site prohibitive where the site is otherwise suitable.

Land application contractors have lost longstanding participant farmers from the biosolids program due to the stringent requirements that need to be met for the land application of biosolids. Significant losses of effective paddock area due to buffer zones has been a strong source of frustration for farmers as these do not need to be met for any other form of fertiliser (including chicken manure which has far greater pathogen risks). There is a real risk that operation of and participation in biosolids programs is becoming too difficult to meet regulatory requirements is leading to contractors and farmers losing interest in being involved and focusing on industries with a greater payback for less energy expended such as FOGO.

Question 12: What regulatory or other approaches would you like to see the EPA consider to address microplastic and other contaminants in domestic and trade waste inputs to sewerage systems?

We would like to see the EPA have a more active role in source control for microplastics or any contaminant being considered for regulation that cannot be completely removed during the wastewater treatment process.

Domestic customers make up approximately 70% of wastewater released to the sewer network. We have no control on what our domestic customers release to the sewer network, apart from education campaigns.

While utilities have trade waste acceptance standards for industrial trade waste customers, they do not include all contaminants or contaminants of emerging concern. Utilities also have commercial trade waste customers who are not regulated directly against these standards. Instead, they are required to utilise approved pre-treatment products deemed suitable for their trade waste process. There is a need for the EPA to work closely with industry in terms of regulation, education and development of acceptable methodologies to derive trade waste acceptance standards.

The NSW EPA has successfully taken action in the past to control contaminants entering the sewer. One recent example was the voluntary phase out of microbeads in personal care products and cleaning products in 2016 (Microbeads (nsw.gov.au)). A follow-up study led by the EPA in collaboration with CSIRO and Sydney Water in 2018 found that 'Spherical microbeads from personal care products were infrequently detected in wastewater' (CSIRO 2020). We are pleased to see that the EPA has continued with microplastic source control under the *Plastic Reduction and Circular Economy Act 2021* by banning the supply of rinse-off personal care products containing microbeads from 1 November 2022.

While EPA's focus so far has been on microbeads, we would like to see it extend to other microplastics, including microfibres which are generally the most abundant microplastic in wastewater influent. We would like to see the EPA to support research into microplastic removal at the source. A successful example overseas which is promoted by the Swedish Environmental Protection Authority is a washing machine filter: "PlanetCare is the most efficient microfiber-catching solution on the market" (Planetcare 2023). PlanetCare go beyond just stopping the microplastics being released to wastewater treatment plants, and in turn the environment, but also have a closed-loop service where they collect the used cartridges for free to recycle microfibers and refurbish cartridges for future use.

We encourage the EPA to be proactively involved in research around microplastic sources, preventing microplastics entering the sewer network.

The ANZBP is aware of the challenges around inconsistent microplastic sampling and analysis methods, high laboratory cost for analysis and contamination. We have contributed to microplastics research projects with reputable well-known experts/organisations (CSIRO and Griffith University). A key objective of each of the studies was to develop a robust and high through-put method for microplastic analysis. The microplastic numbers from both studies were about an order of magnitude different, highlighting the challenges in developing a consistent agreed sampling and analysis method for microplastics. Neither study was able to develop a repeatable robust high through-put method for microplastic analysis. Hence microplastic analysis is still very labour intensive and time consuming. Therefore, the cost for analysis is very high. Contamination was also an issue for both studies. Until there is an affordable, standard, accepted and robust sampling and analysis method microplastics are not suitable for regulation.

In addition, and more importantly, there is still uncertainty about the actual impact or harm caused by microplastics. ANZBP strongly supports a risk-based approach for the new regulatory approach to biosolids. The risk to either human health or the environment needs to be clearly understood before regulation is imposed.

One of the conclusions of the CSIRO study on microplastics in biosolids was '*The concentration of microplastics in biosolids from WWTPs, although very high, are unlikely to adversely impact terrestrial organisms based on existing evidence related to terrestrial effects assessments. The amount of microplastics, however, may increase over time in soils through ongoing biosolids application and microplastic accumulation. The potential impacts need to be balanced against the many benefits of biosolids reuse for soil improvement (e.g., carbon emission reductions, reduced use of synthetic fertilisers)'* (CSIRO 'Microplastics in wastewater: summary paper'. Page 4). Where biosolids are rarely reapplied to the same paddock, based on the findings from the CSIRO study, the risk is low. The findings of robust scientific studies are critical to understand if there is a risk to the environment, and in turn, if regulation is required.

If serious about reduction in microplastics then EPA needs to restrict use / ban these and restrict wastes containing these into the sewer.

ANZBP suggests EPA could provide a measurement standard or methodology to support better characterisation of microplastics in biosolids.

Plastic is used for a variety of uses in agriculture, with one study estimating that over 120,000 tonnes of plastic was used in 2020/21FY (https://www.dcceew.gov.au/sites/default/files/documents/apff-national-report-2020-21.pdf). Whilst it is hoped the majority of the plastic could be recovered (and recycled) there is evidence that some of it also leads to microplastic pollution on farms (e.g., Khalid, N., Aqeel, M., Noman, A., & Fatima Rizvi, Z. (2023). Impact of plastic mulching as a major source of microplastics in agroecosystems. *Journal of Hazardous Materials*, *445*. https://doi.org/10.1016/j.jhazmat.2022.130455).

Question 13: What elements would you like to see in a new regulatory approach (e.g., education, grants, partnerships, behaviour change, product stewardship), and why?

The ANZBP would like to see the EPA take a more active role in engaging with stakeholders in this area. It is expected that this new regulatory environment will have significant impacts to how wastewater solids are treated in NSW. It is probable that significant infrastructure will be required to reduce or eliminate contaminants of emerging concern from biosolids. This will be required for a considerable number of treatment plants beyond those currently controlled by State owned Corporations and includes smaller plants run by local government authorities. The EPA should consider opportunities to provide a financial assistance program such as grants to small and medium wastewater providers. This program may be similar to how the Waste and Recycling Infrastructure Fund has been administered through the Environmental Trust.

As the EPA is aware, wastewater treatment is an end of pipe solution. Heavy industrial pollution is controlled through ongoing industrial trade waste agreements, however some of the new contaminants proposed for regulation for the first time are not industrial derived or are not solely industrial in origin. As discussed in Question 12 there are limited restrictions that a wastewater provider is able to impose on domestic customers.

Increased product stewardship is an option that should be considered. We urge the EPA to consider how this might be achieved at a national level.

We encourage the EPA to work with all stakeholders in designing an education campaign. This program will need to focus initially on current end-users and how these changes may impact them and what opportunities are being made available to them to assist in this transition. Further programs will need to help reduce these pollutions at source and the plans to reduce the availability of these chemicals over time such as through product stewardship programs. We urge the EPA to be cautious on how these education programs may impact the reputation of the biosolids products, especially for the end user.

An element of clear exposure pathways for ecological and human health risks considered in the regulatory approach (to ensure regulations are fit for purpose for the appropriate end use outlet). An additional supporting element would be high level impact assessments of the regulatory approach to determine the impact to wastewater authorities, industrial and residential customers, as well as farmers to minimise potential unintended consequences.

Many of the support elements listed above would be useful to an upstream or source control regulatory approach.

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Appendix 2 – New Zealand Biosolids PFAS Concentration Data (2022)

PFOA (µg/kg)		PFHxS + PFOS (µg/kg)	
Site A	**Site B**	**Site A**	**Site B**
11	6.4	4	3
23	13	10	5
15	3.6	7	3
13	2.1	25	<2
15	2.8	10	3

Appendix 3: Example of action to control PFAS in trade waste

A medium sized water utility in Australia proactively monitors their trade waste customers in key industries, including laundries, textile manufacturers and metal finishers. The utility observed one of their customers to have higher than typical concentrations of PFAS compounds (by Total Oxidizable Precursor (TOP) assay) and discussed this with the customer. The customer investigated and found that two of the products they used in their process (a surfactant and a waterproofing agent) contained PFAS. The customer explained that the waterproofing agent is used in the manufacture of the fabrics and either leaves the premises bound to their fabric products or is recycled internally (not released to sewer). The surfactant ("Hostapal LF-AU") lists Perfluoroalkyl acrylate/polyurethane as an ingredient. The customer was able to find an alternate PFAS-free surfactant to use in their process and responsibly disposed of the remaining Hostapal LF-AU.

Hostapal LF-AU is still available for purchase and use in Australia, despite PFAS-free alternatives being available in the market. It will not be impacted by the proposed phase-out action as it was in use in Australia prior to 2025 and it contains other PFAS (other than PFOS, PFOA and PFHxS). It is disappointing that efforts to highlight Hostapal LF-AU as a specific source of PFAS in wastewater have not resulted in a national ban on its use in Australia.

Unfortunately, identifying specific trade waste PFAS sources is cost-prohibitive for larger water utilities that can have upwards of 30,000 trade waste customers. This means many trade waste customers are unlikely to know if they are using problematic products.