AUSTRALIAN WATER ASSOCIATION | Australian & New Zealand **Biosolids Partnership**

BIOSOLIDS AND PFAS: RESPONSIBLE MANAGEMENT OF EMERGING CONTAMINANTS

Factsheet

This factsheet has been prepared by the Australian and New Zealand Biosolids Partnership.

The intent of this factsheet is to provide interested parties with information about our understanding and management of per and polyfluoroalkylated substances (PFAS) in biosolids.

The factsheet explains:

- What biosolids are and why they are important
- What PFAS are
- Why we are interested in PFAS in biosolids.
- How PFAS are managed in biosolids and
- ANZBPs position on PFAS in biosolids

What are biosolids?

Biosolids are sourced from treatment plants that receive wastewater from households and industries.

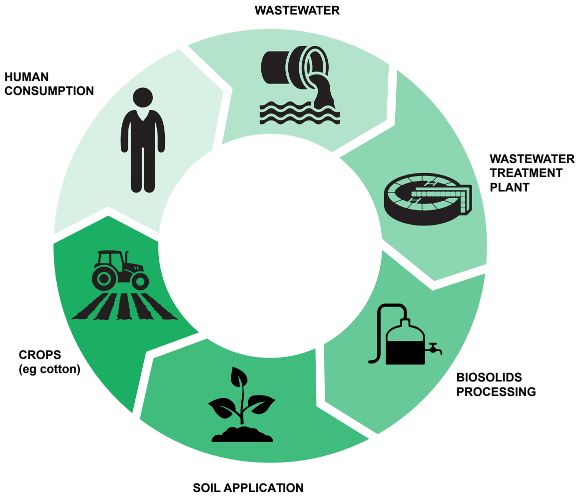

Figure 1 A general figure on biosolids production? Like this but without the gasification step (and potentially also other crop types

Biosolids are a valuable soil conditioner and fertiliser that supports healthy crop and pasture production.

They contain:

- organic carbon - valuable for soil structure and health,
- macro-nutrients nitrogen, phosphorus and sulphur,
- calcium and magnesium; and
- micro-nutrients, such as copper, zinc, iron, molybdenum and manganese.

In striving towards a ‘circular economy’, communities can use biosolids to close the nutrient and carbon loops. Using biosolids as a soil conditioner recycles these nutrients, reducing the use of artificial fertilizers and reliance on petrochemical and mined nutrient sources.

Biosolids use in land application is highly regulated. Prior to use on agricultural land, biosolids go through treatment and risk assessment to ensure they are suitable for use. In 2021, 83% of Australia’s biosolids were beneficially used in agriculture (1).

What are PFAS?

PFAS are a group of manufactured fluorinated compounds widely used in consumer and industrial products because of their resistance to heat, water, and oil.

Most consumers may not be aware they are purchasing products that might contain PFAS(2). Examples of domestic and commercial products include firefighting foams, carpets, textiles, paints, non-stick cookware, aluminium foil, fast food wrappers, stain repellents, personal care products like cosmetics, shampoo, dental floss, sunscreen and some types of pesticides/herbicides.

PFAS move easily in the environment and because they are used in many products, low levels are found widely in the environment, particularly in urban areas (3,4). They have even been identified in remote places such as the Antarctic (5).

The three PFAS analytes of most concern are:

- PFOS (perfluorooctane sulfonate),
- PFOA (perfluorooctanoic acid) and
- PFHxS (perfluorohexanesulfonic acid).

Some PFAS have been found in the blood of the general population. Over the last 20 years there has been a consistent decline in the concentrations of PFOS and PFOA in the blood of people in the general population in Australia and New Zealand. However, other compounds (e.g., PFHxS, PFNA) have remained steady (6).

In 2017 the Commonwealth Department of Health established health-based guideline values (HBGV) for these PFAS(7). These values are used to develop environmental criteria and undertake risk assessments.

HBGV are amounts of PFAS people can be exposed to every day where there is no significant risk of harm to health (Food Standards Australian New Zealand 2017,).

Researchers estimate that the amount of PFAS people in the general population in Australia are exposed to every day, is approximately 5 to 10% of the health-based guideline value (8). This is from all sources including food, water and consumer products.

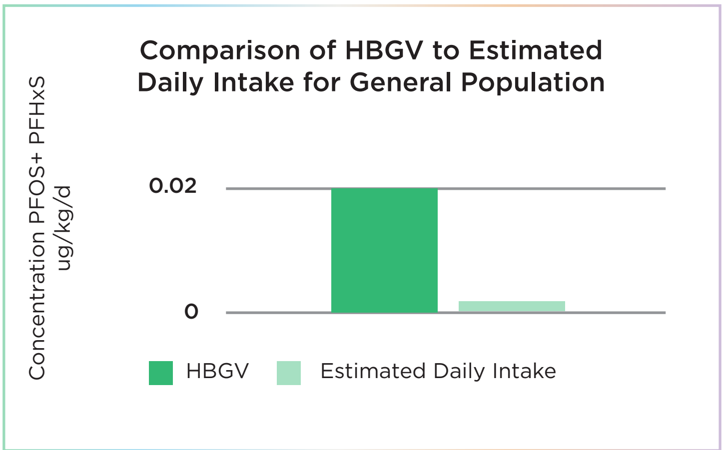

Figure 2: Amount of daily exposure to PFOS+PFHxS for general population compared to HBGV

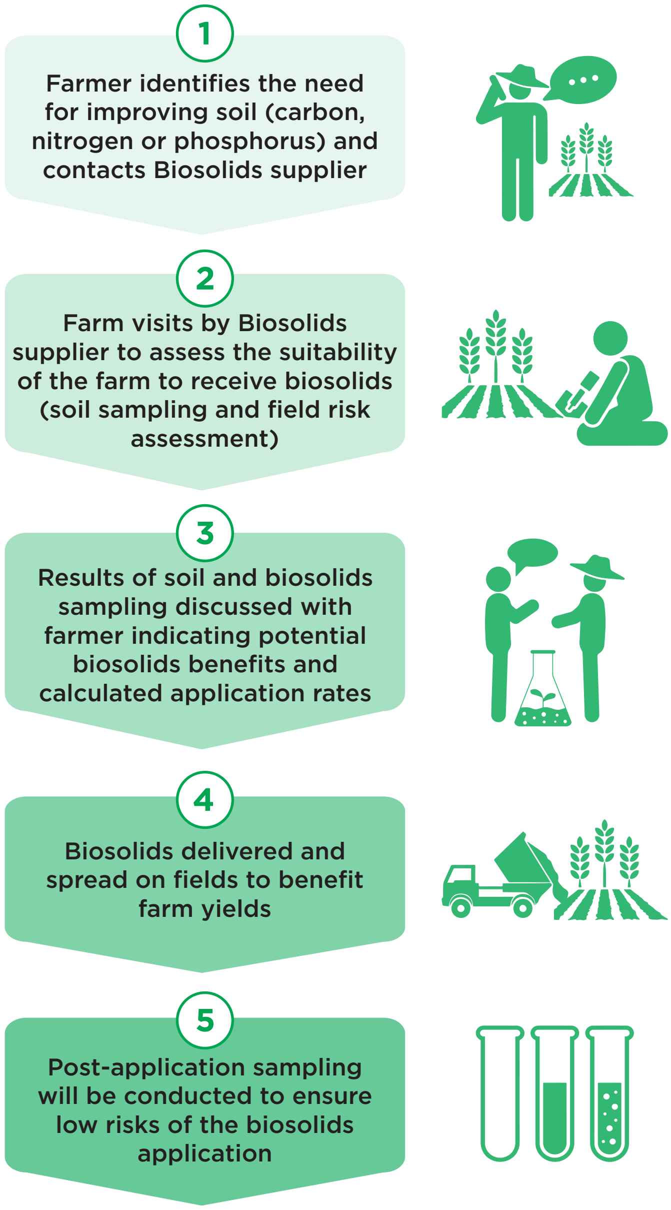

Figure 3: Steps of the Process for the safe application of biosolids

What is the issue with PFAS and Biosolids?

The main reason there is interest in PFAS levels in biosolids is because when they are land applied, they can move from soil into plants that may become food for humans and livestock.

Stringent regulations protect the environment by setting the maximum concentration that is considered 'safe' for each specific application.

The concentration of PFAS that ends up in soils is lower than the concentration in biosolids. This is because it is incorporated into soils using an application rate that will ensure the final levels in soil will meet levels considered to be safe.

Biosolids concentrations in perspective

While biosolids have been used in food and textile agriculture in Australia for many decades, a recent FSANZ study found PFAS in food in Australia to be low (9). Of the 30 PFAS analysed, only PFOS was identified in a very small number of foods which included chicken eggs, liver, fish fillets, cooked prawns, canned tuna. The levels identified were low and below levels that would be considered a risk both here in Australia and in the EU. While PFAS have been identified in milk from a small number of farms in Maine, US (10), a recent study showed that the presence of PFAS in milk from dairy farms that use biosolids was very low or non-detect. The authors concluded that the risk of PFAS in dairy in Maine, US is very low (11).

The evidence that PFAS levels in the general food supply is a good outcome and it is important we continue to keep this status low through responsible use of biosolids.

An ANZBP survey of members in 2017 found the median PFOS concentration in biosolids to be 3ppb and PFOA 2ppb (maximum 386ppb and 50ppb respectively (12). The maximum concentrations were from one water utility which identified the source to be primarily from one key trade waste input which led to them being disconnected from sewer. A recent Australian study found a median PFOS concentration across 19 STP's to be 4.7ppb (max 90ppb) and PFOA median less than the limit of quantification (max 25ppb) (13).

The comparison of PFAS, PFOS and PFOA in biosolids and domestic sources presented in Table 1 demonstrates that the concentrations in most household products are significantly higher than in biosolids.

Table 1: Comparison of PFAS in biosolids and domestic sources

Source	Domestic Product/Environment		
	PFAS (ppb)	PFOS (ppb)	PFOA (ppb)
Sunscreen (16)	180,500		
Paper	34 – 2,200		
Detergents	1.1 – 547		
Household dust [17]	30 – 7,637	170 – 8,100	120 – 2,900
Food packaging	0 – 700		
	Biosolids		
ANZBP survey [18]		3 – 386	2-50
Coggan [19] (median)		4.7	<25

How are PFAS in biosolids managed to protect the environment?

According to the ANZBP's 2021 Biosolids Production and End-Use Survey (14), the majority of biosolids produced in Australia and NZ are monitored for PFAS and other emerging contaminants in accordance with local and/or national regulations and guidelines to manage the concentration of these chemicals in agricultural reuse programs.

In Australia, the individual State's environmental regulators ensure the safe application of biosolids to land and are introducing regulations for PFAS with updated versions of their regulations and guidelines. These regulations and guidelines are informed by guidance from the National Chemicals Working Group (a group made up of the heads of the state's regulators), which has released and revised versions of the National Environmental Management Plan (NEMP) (15) for PFAS.

What else can be done? Greater source control is key.

PFAS are not used in the treatment of wastewater. However, because biosolids are sourced from household and industry wastewater they may contain low concentrations of a range of chemicals we use in our everyday lives, including PFAS.

Source control programmes to detect and limit inputs of PFAS to the wastewater system indicate the majority of PFAS may come from domestic sources, such as from flushing toilets as PFAS leaves our bodies, showering (personal care products) and washing machines (washing PFAS-based textiles). This makes control at wastewater treatment plants challenging.

The benefits from biosolids land application are numerous. ANZBP strongly recommends greater source control through stricter regulation of importation and manufacturing of products containing PFAS. This will limit both primary human exposure to PFAS and the amount ultimately entering the wastewater system, especially through domestic wastewater, which is more difficult to control at a utility level than trade waste sources.

ANZBP's position on PFAS and biosolids

The ANZBP supports the water industry to sustainably use biosolids and welcomes the development and introduction of appropriate science-backed regulations to reduce the likelihood of land application of biosolids causing risks to the environment.

The water industry is dedicated to the protection of the environment and human health and is concerned that over regulation at the end of the production chain without source input control will see the loss of biosolids as a valuable circular economy resource. Biosolids land application returns valuable resources like carbon and essential plant nutrients to the environment to rebuild soil structure. Compounds like 'forever chemicals' PFAS, are threatening biosolids' vital role in building a circular economy.

A 45-year review of biosolids land application research (20) indicates significant benefits to biosolids re-use in agriculture. These likely far outweigh the risks given the low concentrations of PFAS in biosolids, the high level of monitoring and accountability of biosolids, and the background levels of PFAS in the environment.

Notwithstanding, ANZBP is committed to both ongoing research and appropriate legislation to better manage the sources of these chemicals in domestic and industrial products.

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More information? Contact ANZBP

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