

Melbourne Water Biosolids Case Study – Quantitative Risk Assessment

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Biosolids are a dried, nutrient-rich soil-like material that is a by-product of the wastewater treatment process. When solids are separated from wastewater, they go through biological treatment. This reduces pathogens, odours and particles that attract insects and vermin.

Following the biological treatment, the solids are then air-dried and stockpiled on-site for at least three years to ensure they meet the rigorous standards required by Victorian Environment Protection Authority (EPA) to enable their beneficial reuse. These completely processed solids are then described as ‘biosolids’. Across Australia and around the world, biosolids have been used for many years.

Melbourne Water’s biosolids are produced from our two wastewater treatment plants, the Western Treatment Plant (WTP) and Eastern Treatment Plant (ETP), which combined treat approximately 90% of Melbourne’s wastewater. The biosolids properties qualify them for a range of suitable reuse options, including broad acre farmland application.

Melbourne Water successfully reused over 50,000 dry tonnes of biosolids in 2019/20, which is enough to cover the Melbourne Cricket Ground at a thickness of 2.5m.

In Victoria, the EPA regulates the use of biosolids based on the EPA Publication 943: *Guidelines for environmental management: Biosolids land application (EPAV 943)*. These guidelines set clear standards for biosolids land application and require a strict testing regime by water utilities and land holders (farmers).

Being rich in nutrients, micro-nutrients and organic matter, biosolids are a good fertiliser as well as a soil conditioner to enhance the soil and stimulate plant growth. Organic matter such as nitrogen, phosphorous, and micronutrients (such as copper, zinc and iron) slowly release during plant growth and improve the soil’s productivity (McLaughlin et al, 2008). The benefits include improved soil structure, water holding capacity and porosity, in addition to the nutrients.

Soil water-holding capacity is the amount of water that a given soil can hold for crop use. When there is a deficit in the amount of water in the soil, the soil profile needs to be replenished by precipitation or irrigation. Improving soil water holding capacity is especially beneficial during drought periods.



Picture showing biosolids delivered to broad acre farming land in west Victoria prior to land application (source: Loop Organics)

A key component of the EPAV 943 regulation is to provide a framework for achieving safe and sustainable use of biosolids through land application. At Melbourne Water this is achieved by utilising a Quantitative Risk Assessment (QRA). The QRA was developed by Melbourne Water with international peer-review from the Imperial College London. The QRA analyses potential pathways of chemicals/contaminants found within wastewater from the wastewater treatment process through to the end-use of biosolids. It is Melbourne Water catchment and treatment process specific and complements the EPA 943 guidelines.

The QRA utilises a three-stage screening process to determine if a potential 'contaminant' could pose any risks from the applied biosolids.

- Step 1: Primary screening of all potential chemicals and contaminants that may or have the potential to be found in wastewater.
- Step 2: Desktop analysis to determine if the screened and shortlisted potential contaminants in Step 1 are likely to be found in high enough concentration to pose a risk through any of the exposure pathways.
- Step 3: Detailed risk assessment for the list of contaminants narrowed down in Step 2 to determine the potential levels of risk each poses. It explores the exposure of each contaminant along various exposure pathways and its potential impact. Laboratory analysis of each contaminant is used if available and modelled data if not. This data is used to verify

the actual risk posed and then to determine using the precautionary principle what management actions are required for the safe application of biosolids to land.

The QRA is reviewed and revised at five-year intervals to ensure it remains updated with the latest data and information, including emerging contaminants. The QRA provides valuable data to Melbourne Water for biosolids land application. This includes a safe application rate and the frequency of re-application. By adopting the findings from the QRA process and following the strict requirements from the EPAV 943 guideline, the biosolids can be applied safely and beneficially to land.

Reference

McLaughlin, Michael and Bell, Mike and Nash, David and Pritchard, Deborah and Whatmuff, Mark and Warne, Michael and Heemsbergen, Diane and Broos, K and Barry, Glenn and Penney, Nancy. 2008. Benefits of using biosolid nutrients in Australian agriculture - a national perspective., in Diane Wiesner, Australian Water Association (ed), Biosolids Specialty Conference IV, Jun 11 2008. Adelaide, South Australia: Australian Water Association