

Technical report

September 2025

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| Recycled water use in irrigated crops 2023-2025 |



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# Executive Summary

EPA Victoria, in partnership with CSIRO and Department of Energy, Environment and Climate Action (DEECA), undertook a two-stage investigation into the use of recycled water (Class A and C) for crop irrigation and its potential to introduce emerging contaminants into agricultural systems. The study aimed to assess the occurrence, transport, and uptake of a broad suite of chemical and biological contaminants in water, soil, and crop tissues under real-world field conditions.

**2023 Overview**  
The first stage, conducted in 2023, involved sampling at seven farms across Victoria, including five farms using recycled water and two reference farms using alternative irrigation sources. Crops studied included broccoli, lettuce, and pasture. Samples collected included irrigation water, adjacent soils, and plant tissues (roots, shoots, and edible portions). High-resolution mass spectrometry (HRMS) and targeted analytical techniques were used to screen for over 2,900 chemicals (with 666 targeted chemicals), including pharmaceuticals and personal care products (PPCPs), pesticides, endocrine disrupting chemicals (EDCs), phthalates, per- and polyfluoroalkyl substances (PFAS), polycyclic aromatic hydrocarbons (PAHs), and a range of industrial chemicals, such as semi-volatile organic compounds (SVOCs).

There were 60 chemicals detected in water samples, most frequently at sites using recycled water. In water samples across all sites, 27 pesticides were detected along with 5 PAHs, 8 PFAS, 14 PPCPs, 5 phthalates, and 1 SVOCs. In soil samples, 140 chemicals were detected, including 2 EDCs, 28 PAHs, 2 PFAS, 4 PPCPs, 46 pesticides, 9 phthalates and 49 SVOCs. In plant samples, 93 chemicals were detected, which included 1 EDC, 16 PAHs, 7 PFAS, 4 PPCPs, 36 pesticides, 5 phthalates, and 24 SVOCs. Out of 89 plant samples analysed, 87 samples contained at least one of the 93 detected chemicals.

**2024 Study Overview**  
Building on the 2023 findings, the second stage in 2024 focused on two crops—broccoli (Class A water) and pasture (Class C water)—across six farms, including two reference farms. Sample collection was expanded for robustness, with 10 replicate samples of water, soil, and plant tissue per farm, alongside surface water sampling from nearby rivers to evaluate potential off-site transport.

Targeted chemical analysis focused on PPCPs, PFAS, pesticides, and selected industrial chemicals. Physicochemical parameters (pH, EC, nutrients, trace elements) were also measured, and plant health was evaluated using biomass and pigment (chlorophyll, carotenoids) content.

A total of 79 chemicals were detected in water samples across all sites, including 1 EDC, 11 PAHs, 7 PFAS, 33 PPCPs, 12 pesticides, 3 phthalates, and 12 SVOCs. Soil samples were screened for only PFAS. In soil samples, out of 27 PFAS analysed, only PFDA and PFOS were detected. Plant samples were screened for 27 PFAS and 52 PPCPs. Out of 150 plant samples analysed, 93 samples had detections of carbamazepine, DEET, tramadol, tebuconazole, PFBA, PFBS, and PFHxS.

**Key Findings (2023 & 2024)**

* Recycled water consistently contained a greater number and concentration of chemicals than reference water.
* Although emerging contaminants were present in water and in soil, our study found limited evidence that they moved into the edible parts of the plants.
* No impact of recycled water on crop health was observed. Differences in plant pigments and biomass appeared linked to crop maturity, not to irrigation source.
* Some pesticides were found in edible parts of the plants from the reference farms not using recycled water for irrigation, indicating on-farm sources (e.g. direct pesticide application).
* The reference farm irrigation water for broccoli contained PPCPs, suggesting other potential sources (e.g. river water).
* Concentrations of PFAS found in edible crops were generally low and with a low detection rate. As such they are unlikely to present a risk to human health.
* Based on this study, recycled water can be used for crop irrigation, if the quality of the water is regularly monitored, and use managed appropriately.
* Ongoing monitoring and the inclusion of more crop types and locations are recommended to refine risk assessments and management strategies.

# Project Background

Emerging contaminants include, for example, pharmaceuticals and personal care products (PPCPs), phthalates, pesticides, endocrine disrupting chemicals (EDCs) and per- and polyfluoroalkyl substances (PFAS). Using treated wastewater can discharge these contaminants into the environment.

It is important that recycled water scheme proponents and users take reasonable steps to manage the risk posed to human and environmental health from emerging contaminants. However, little is known about the impact to crops and soil from these chemicals in Victoria, nor in Australia more broadly.

The purpose of this project was to measure emerging contaminants in irrigation water, soil and crops in farms that rely on Class A and C water as a resource. Results from the farms were compared to those not using recycled water, as well as local ambient concentrations in nearby rivers.

The results presented here will help us to:

* Investigate baseline concentrations of emerging contaminants in the agroecosystem (soil, plants, water) in Victoria.
* Understand whether emerging contaminants accumulate into edible crops irrigated with recycled water and present an adverse risk to human health.
* Improve state of knowledge and support the recycled water industry in meeting their GED requirements.

## Aims

Here we present results from a field study conducted over 2023-2025 to better understand how recycled water impacts the chemical load of crops. Specifically, the study aimed to:

1. Understand whether recycled water use on farms contains emerging contaminants that may end up in soil or crops used for human (broccoli, lettuce) and animal (ryegrass) consumption
2. Compare farms using recycled water to those using other water sources, to understand the difference in emerging contaminants that may be present in recycled water.
3. To help farmers, regulators and the public understand the potential for emerging contaminants in recycled water to accumulate in crops and pasture.

## Intended audience

This report is intended for a broad audience. It provides valuable insights for water authorities, academics, industry stakeholders, recycled water users and members of the community who want to understand the potential impacts of recycled water on agricultural systems and the environment.

# Methods

## Sampling campaign, 2023

For the 2023 campaign, seven farms were included in the study. For broccoli and ryegrass, two farms using recycled water were compared to one reference farm that did not use recycled water. One farm that uses recycled water for lettuce was also included. Farms were selected primarily based on their recycled water class (A or C) and crop type.

Pasture farms growing ryegrass (*Lolium perenne*) for cattle and sheep grazing were in central-northern Victoria. In this region, flood (border check) irrigation is common due to the low topography and prevalence of sodic soils with poor water retention ([Agriculture Victoria 2023](https://agriculture.vic.gov.au/farm-management/water/irrigation/bordercheck-irrigation-design)). Border check irrigation is a type of irrigation that distributes water via open irrigation channels to irrigation bays that are enclosed by earthen banks.

Market garden farms growing broccoli (*Brassica oleracea* *var. italica*) and iceberg lettuce (*Lactuca sativa var. capitata*) were in south-western Victoria. Recycled water has been used for market garden crop irrigation in this region since 2005 ([Barker et al. 2011](https://www.researchgate.net/profile/Robert-Faggian/publication/256086602_A_history_of_wastewater_irrigation_in_Melbourne_Australia/links/54802dd40cf250f1edbfc341/A-history-of-wastewater-irrigation-in-Melbourne-Australia.pdf)). Fixed sprinkler irrigation is common, and recycled water is shandied with river water to reduce salinity, improving the suitability of recycled water for growing market garden crops. A summary of each farm sampled is provided in Table 1.

Table 1. Summary of the seven farms sampled in Victoria in 2023.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Site ID** | **Crop type** | **Recycled water class** | **Irrigation type** | **Notes** |
| F01 | Ryegrass pasture | Class C | Flood | Recycled water only; cattle and sheep grazing. |
| F02 | Ryegrass pasture | Class C | Flood | Recycled water shandy with dairy runoff; dairy cattle grazing. |
| F03 | Ryegrass pasture | - | Flood | River water only; dairy cattle grazing. |
| F04 | Broccoli | Class A - diluted | Fixed sprinkler | Recycled water shandy with river water. |
| F05 | Broccoli | Class A - diluted | Fixed sprinkler | Recycled water shandy with river water. |
| F06 | Broccoli | - | Fixed sprinkler | River water only |
| F07 | Lettuce | Class A - diluted | Fixed sprinkler | Recycled water shandy with river water. |

In April 2023, the main sampling of crops, soil and water was undertaken. Timing coincided with a period where irrigation water was necessary for crop growth. Water samples (n = 6 per recycled water farm, n = 4 per reference farm) were collected, using a stainless-steel sampling pole for channels and lagoons, or by holding bottles directly under the fixed sprinkler. Irrigation systems were flushed for 5 minutes prior to sampling. Amber glass and HDPE bottles were used. Standard preservatives (H2SO4) were either pre-added or added using a micropipette once the bottle was filled to reduce the sample to pH 3 for analyte preservation.

For crops sampling, at harvest, loose soil was removed from around the crop to ease extraction. Roots were gently shaken to remove bulk soil particles and crop height measured. For each broccoli and lettuce sample, two adjacent plants were collected, one for chemicals analysis and one for AMR analysis. Whole crop samples were stored in large LDPE bags. For ryegrass pasture, all grass plants within a 30 cm x 30 cm area were collected from two adjacent plots and stored in two large LDPE bags.

Soil samples were collected from the soil surrounding the excavated crop. Soil 0 – 10 cm deep was mixed thoroughly using a stainless-steel trowel and sampled to represent the depth that crop roots had most contact with. Samples were stored in amber glass or HDPE jars. All samples were immediately packed on ice in sealed boxes for overnight transport to CSIRO for analysis.

## Sampling campaign, 2024

Following the 2023 campaign, sampling was undertaken again in 2024 to build on findings. The second stage focussed on two crops – broccoli (Class A water) and pasture (Class C water), utilising the same farm locations, as well as sampling the nearby rivers to assess background levels or offsite transport.

A summary of the farms and rivers sampled in 2024 is provided in Table 2.

Table 2. Farms and surface water locations sampled in 2024.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Site ID** | **Crop type** | **Recycled water class** | **Irrigation type** | **Notes** |
| F01 | Ryegrass pasture | Class C | Flood | Recycled water only; cattle and sheep grazing. |
| F02 | Ryegrass pasture | Class C | Flood | Recycled water shandy with dairy runoff; dairy cattle grazing. |
| F03 | Ryegrass pasture | - | Flood | River water only; dairy cattle grazing. |
| F04 | Broccoli | Class A - diluted | Fixed sprinkler | Recycled water shandy with river water. |
| F05 | Broccoli | Class A - diluted | Fixed sprinkler | Recycled water shandy with river water. |
| F06 | Broccoli | - | Fixed sprinkler | River water only |
| Goulburn River | - | - | - | - |
| Werribee River | - | - | - | - |

Sample collection involved the same methods as 2023, with expanded sample sizes. A total of 10 samples each of water, soil and plant tissue were collected per farm, allowed for improved replication and robustness in the data. Only surface water samples were collected from the river locations. Following the same procedures undertaken in 2023, all samples were immediately packed on ice in sealed boxes for overnight transport to CSIRO for analysis.

## High resolution mass spectrometry (HRMS) analysis

High resolution mass spectrometry (HRMS) is a non-target analytical technique that is used to screen the molecular masses of compounds present in a sample, which can then be compared to a pre-existing database to identify the presence of chemicals.

It is a useful initial screening tool, as a means of guiding targeted, quantitative analysis. Because HRMS is not able to measure the exact concentrations of specific chemicals that may be present in a sample, targeted analysis using certified standards is still needed. Initial screens using tools like HRMS analyses can make further chemical analysis more efficient through identifying chemicals that are likely to be present for quantification.

In both sampling years, non-target HRMS was used as an initial screening step. See Appendix B for specific details on how HRMS was conducted in this study.

## Targeted quantitative analysis of emerging contaminants

Targeted quantitative analysis is a highly sensitive means of measuring the concentrations of emerging contaminants that may be present in a sample, which is essential for characterising the risk of chemicals in the environment.

In both 2023 and 2024, broad suites of emerging contaminants were targeted. These included EDCs, PPCPs, polycyclic aromatic hydrocarbons (PAHs), PFAS, phthalates, a range of pesticides including herbicides, insecticides and fungicides, as well as a suite of semi-volatile organic compounds (SVOCs). A range of naturally occurring chemicals (associated with plant and soil processes) was also detected, these results are available in Appendix B.

* In 2023, a total of 666 emerging contaminants were targeted.
* In 2024, a total of 694 emerging contaminants were targeted.

Table 3 outlines the groups of emerging contaminants that were analysed for in each year.

Table 3. Emerging contaminant groups analysed for in each year, by sample type.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Year** | **Sample type** | **Analyte groups** | | | | | | |
| **EDCs** | **PAHs** | **PFAS** | **PPCPs** | **Pesticides** | **Phthalates** | **SVOCs** |
| 2023 | Irrigation water | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Soil | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Plant | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| 2024 | Irrigation water | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| River water | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Soil | No | No | Yes | No | No | No | No |
| Plant | No | No | Yes | Yes | No | No | No |

Further explanation of methods for extraction and analysis are in the detailed CSIRO reports included in Appendix B.

# Results

Results for each sampling year are summarised below, by emerging contaminant group. See Appendix A for overall summary statistics of emerging contaminant groups detected at each site in each sampling year.

### HRMS analysis results

In 2023, the HRMS screen was only conducted on water samples, resulting in six chemicals found that were not detected using the targeted analysis. These were pesticides atrazine deisopropyl and haloxyfop, and PPCPs fexofenadine, gabapentin, ibuprofen, and tolazoline.

In 2024, HRMS analysis found 46 chemicals in pasture irrigation water, and 51 chemicals in broccoli irrigation water. These included 34 PPCPs, 26 pesticides and their metabolites, 12 SVOCs and 5 chemicals of natural origin. Of the emerging contaminants identified in recycled water that were not of a natural origin, 2 chemicals were identified in pasture shoots and 8 chemicals were identified in broccoli florets, with most of these chemicals being pesticides. Principal components analysis (PCA) found that there was a difference in the chemical composition of water between the recycled water sites and reference sites, indicating recycled water is a source of emerging contaminants.

For detailed HRMS analysis results, see CSIRO reports in Appendix B.

### Targeted quantitative analysis results

### *Overview*

This section sets out a summary of results from targeted analysis for both 2023 and 2024. Further information of targeted analysis results is described below and in Appendix A and B.

For both sampling campaigns,

* recycled water consistently contained a greater range of emerging contaminants than reference water.
* a broad range of emerging contaminants were identified at low concentrations in recycled water, however this did not consistently translate to concentrations in soil or plants. Detection rates were typically low for most emerging contaminants in plants.

On-farm or other sources were also likely, particularly for pesticides which were detected in edible parts of plants but were either not detected in recycled water or were identified in plants at farms using other sources of water. Similarly, concentrations of endocrine disruptor chemicals were not identified in

The following sections provide more detailed information, with the full reports in Appendix B.

### *Polycyclic aromatic hydrocarbons*

In 2023, polycyclic aromatic hydrocarbons (PAHs) were detected in water, soil and broccoli samples. Mean PAH concentrations were highest at pasture site F1 (mean ± SD = 0.0047 ± 0.031 µg/L) for water samples, at pasture reference site F3 for soil samples (8.83 ± 16.73 µg/kg), and in the shoots of broccoli plants at site F5 for plant samples (21.32 ± 89.41 µg/kg) (Figure 1). Furthermore, where detected in broccoli plants, mean PAH concentrations were consistently highest in the shoots, followed by the florets, then the roots. Of 89 plant samples analysed, PAHs were detected in 39 samples. The highest PAH concentrations were for C2 alkyl napthalenes (0.36 µg/L) in water, dibenz(a,h)anthracene (120 µg/kg) followed by naphthalene (110 µg/kg) in soil, and naphthalene (760 µg/kg) in the shoots of broccoli plants at site F5.

PAH concentrations in broccoli were similar across all sites in 2023, including the reference site. Additionally, although PAHs were detected in soil in 2023 at all pasture sites, no PAHs were detected in pasture plant samples. Overall, trends of PAHs in irrigation water did not appear to correlate with trends of PAHs in soil and plants.

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Figure 1. Mean concentrations of polycyclic aromatic hydrocarbons (PAHs) detected in irrigation water, soil and plant samples at each site in 2023, including standard error bars. n = 6 replicates per sample type for sites F1, F2, F4, F5, F7, and 4 replicates per sample type for reference sites F3 and F6. For plant samples: red = florets, green = roots, and blue = shoots.

In 2024, PAHs were only analysed in water. In water samples, PAHs were detected at all sites (Figure 2), and mean concentrations were highest at pasture site F2 (mean ± SD = 0.014 ± 0.042 µg/L). PAHs with the highest concentrations were C3- and C1 alkyl fluorenes (0.19 µg/L) followed by C2 alkyl fluorenes (0.17 µg/L).

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Figure 2. Mean concentrations of polycyclic aromatic hydrocarbons (PAHs) detected in irrigation and river water samples at each site in 2024, including standard error bars. n = 10 replicates for sites F1-F6 and 2 replicates for Goulburn River.

### *PFAS*

In 2023, PFAS were detected in water, soil, pasture, broccoli and lettuce samples. Mean PFAS concentrations were highest at pasture site F1 for water samples (mean ± SD = 0.0053 ± 0.011 µg/L) and for soil samples (0.41 ± 1.73 µg/kg) (Figure 3).

However, for plant samples, mean PFAS concentrations were highest at site F5, in the shoots of broccoli plants (2.96 ± 16.74 µg/kg) (Figure 3). The highest PFAS concentrations were for PFHxA (0.041 µg/L) and PFOA (0.035 µg/L) in water, PFOA (10.6 µg/kg) and PFOS (8.46 µg/kg) in soil, and PFBS in the shoots of broccoli, lettuce, and pasture samples (154, 64, 41 µg/kg respectively). Of 89 plant samples analysed, PFAS were detected in 37 samples. Detection rates for PFAS other than PFBA were low, ranging between 1.3% and 8.8%.

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Figure 3. Mean concentrations of per- and polyfluoroalkyl substances (PFAS) detected in irrigation water, soil and plant samples at each site in 2023, including standard error bars. n = 6 replicates per sample type for sites F1, F2, F4, F5, F7, and 4 replicates per sample type for reference sites F3 and F6. For plant samples: red = florets, green = roots, and blue = shoots.

In 2024, PFAS were detected in water, soil and plant samples. In water samples, PFAS were detected at all sites except for pasture reference site F3 (Figure 4), and mean concentrations were highest at pasture site F2 (mean ± SD = 0.00086 ± 0.0023 µg/L). In soil samples, PFAS were also detected at all sites except for pasture reference site F3 (Figure 4), and mean concentrations were highest at pasture site F1 (0.28 ± 1.43 µg/kg).

Of 150 plant samples analysed, PFAS were detected in 43 samples. In plant samples, PFAS were detected at all sites except for pasture site F1 (Figure 4), although detection rates were also relatively low. Mean concentrations were highest in the root samples at pasture site F2 (0.25 ± 3.10 µg/kg).

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Figure 4. Mean concentrations of per- and polyfluoroalkyl substances (PFAS) detected in irrigation and river water, soil and plant samples at each site in 2024, including standard error bars. For water samples: n = 10 replicates for sites F1-F6, 2 replicates for Goulburn River, 4 replicates for Werribee River. For soil samples: n = 2 replicates for all sites. For plant samples: n = 10 replicates per sample type; red = florets, green = roots, and blue = shoots.

**Distribution of PFAS at pasture farms**

The 2023 sampling round identified that:

* PFDA (0.008 – 0.014 µg/L), PFHpA (0.008 – 0.014 µg/L), PFHxA (0.017 – 0.041 µg/L), PFNA (0.008 µg/L), and PFUdA (0.009 – 0.013 µg/L) were detected in water, but not in soil or pasture samples.
* PFHxS was detected in water (0.011 – 0.027 µg/L), and in roots (2.5 µg/kg), but not in soil or pasture shoots.
* PFOA was detected in water (0.014 – 0.0035 µg/L), soil (5.62 – 10.6 µg/kg), and roots (15.5 – 21.4 µg/kg), but not pasture shoots.
* PFOS was detected in water (0.013 – 0.026 µg/L), soil (1.76 – 8.46 µg/kg), and roots (4.57 – 5.37 µg/kg), but not pasture shoots.
* PFBA was detected in pasture shoots in one instance (9.6 µg/kg), and PFBS was detected in pasture shoots in one instance (41 µg/kg), but neither were detected in roots.

The 2024 sampling round identified that:

* PFOA (0.0048 – 0.0087 µg/L) and PFNA (0.0012 – 0.0033 µg/L) were detected in water but not detected in soil, root or shoots.
* PFDA was detected in water (0.0014 – 0.0038 µg/L) and in soil (0.56 – 0.57 µg/kg), but not in pasture roots or shoots.
* PFHxS was detected in water (0.0040 – 0.0072 µg/L) and in pasture shoots (5.83 – 10.58 µg/kg) and roots (2.85 – 51.69 µg/kg, detection rate of 4.8%), but not in soil.
* PFOS was detected in water (0.0059 – 0.011 µg/L) and soil (1.18 – 9.28 µg/kg), but not in roots or shoots of pasture.

**Distribution of PFAS at broccoli and lettuce farms**

The 2023 sampling round identified that:

* PFDA (0.009 – 0.01 µg/L), PFHpA (0.006 – 0.019 µg/L), PFHxS (0.012 – 0.02 µg/L), and PFNA (0.008 – 0.009 µg/L) were detected in water, but not in soil, broccoli or lettuce samples.
* PFHxA was detected in water (0.013 – 0.025 µg/L) and in one instance in broccoli shoots (4.37 µg/kg), but not in soil or other plant samples.
* PFOS was detected in water (0.012 – 0.028 µg/L) and soil (1.76 – 4.24 µg/kg), but not in plant samples.
* PFOA was detected in water (0.01 – 0.028 µg/L), soil (3.89 – 5.25 µg/kg) and in one instance in broccoli roots (15.5 µg/kg) but not in shoots or florets.
* PFBA was detected in broccoli florets (3.79 – 6.7 µg/kg) and broccoli shoots (4.94 – 9.94 µg/kg), and in lettuce shoots (6.22 – 8.03 µg/kg) and lettuce roots (3.20 – 3.23 µg/kg), but not in water or soil.
* PFBS was detected only in broccoli shoots (41 – 154 µg/kg) and lettuce shoots (47 – 64 µg/kg), and PFPeA was detected only in broccoli shoots (14.4 – 19.4 µg/kg), and lettuce shoots (12.23 µg/kg).

The 2024 sampling round identified that:

* PFBA was detected in water (0.0079 – 0.0091 µg/L) at multiple sites, and in broccoli florets at one site (2.43 – 4.45 µg/kg).
* PFOA (0.0010 – 0.0030 µg/L) and PFHxS (0.0033 – 0.0047 µg/L) were detected in water, but not in soil or broccoli plants.
* PFOS was detected in water (0.0019 – 0.0060 µg/L) including at the reference site, and in soil (1.45 – 2.64 µg/kg) but not in broccoli plants.
* PFBS was detected in water only at the reference site (0.0017 – 0.0022 µg/L), and in broccoli roots at all sites (0.75 – 3.31 µg/kg).

The number of PFAS identified in plants was low, coupled with generally low concentrations (below FSANZ trigger level for investigation of <1.1 ug/kg or LOD if higher for PFOS+PFHxS and 8.8 ug/kg PFOA).

It is also noted the detection rate is also low (<5% with the exception of PFBA and PFBS, noting the latter mean concentrations were < 1 ug/kg). Overall, it is considered that the risks of PFAS accumulating into food produce from recycled water of the quality used in this study is low.

### *PPCPs*

In 2023, PPCPs were detected in water, soil, pasture, broccoli and lettuce samples. Mean PPCP concentrations were highest at broccoli site F4 for water samples (mean ± SD = 0.0036 ± 0.014 µg/L), at pasture site F2 for soil samples (0.25 ± 4.22 µg/kg), and in the shoots of broccoli plants at site F4 (0.081 ± 1.06 µg/kg) (Figure 5).

PPCPs detected in water, included caffeine, carbamazepine, cotinine, DEET, fluconazole lamotrigine, paraben propyl, telmisartan, triclosan.

In soil, concentrations of carbamazepine, lamotrigine, methyl paraben were detected.

Of 89 plant samples analysed, PPCPs were detected in 13 samples. Specifically, DEET was detected in pasture (shoot, one farm) and lettuce (shoot, one farm), and azithromycin (shoot, one farm), methyl paraben (three farms, root, shoot and floret) and telmisartan (shoot, one farm) in broccoli.

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Figure 5. Mean concentrations of pharmaceuticals and personal care products (PPCPs) detected in irrigation water, soil and plant samples at each site in 2023, including standard error bars. n = 6 replicates per sample type for sites F1, F2, F4, F5, F7, and 4 replicates per sample type for reference sites F3 and F6. For plant samples: red = florets, green = roots, and blue = shoots.

In 2024, PPCPs were only analysed in water and plant samples. In water samples, PPCPs were detected at all sites (Figure 6), and mean concentrations were highest at pasture site F1 (mean ± SD = 0.055 ± 0.22 µg/L). In plant samples, PPCPs were detected at all pasture sites including the reference site, with the highest mean concentration detected in pasture shoots at site F1 (0.040 ± 0.18 µg/kg).

PPCPs detected in water, included lidocaine, metoprolol, propiconazole, paraben propyl, clindamycin, caffeine, 4,5 methyl benzotriazole, benzotriazole, acetaminophen, desmethylcitalopram, diatrizoate, diltiazem, thiabendazole, fluconazole, gabapentin, amidotrizoate, atenolol, methamphetamine, octocrylene, temazepam, thiabendazole, flucanoazole, valsartan, lamotrigine, and venlafaxine. The highest concentrations in water were benzotriazole (2.83 µg/L) followed by lamotrigine (2.7 µg/L).

Of 150 plant samples analysed, PPCPs were detected in 57 plant samples. PPCPs were only detected in pasture plants, with chemicals detected including tramadol, tebuconazole, DEET and carbamazole. The highest concentrations in plants were carbamazepine (3.11 µg/kg) followed by DEET (1.21 µg/kg).

Across both years, the significantly lower number of plants reporting PPCPs compared to concentrations in water, indicates relatively low plant uptake. In addition, where identified in plants, a direct link between recycled water and plant concentrations was not always clear. For example, concentrations of carbamazepine in pasture in 2024 were similar for both reference and recycled water sites, indicating plant uptake may not be solely driven by irrigation. Similarly, concentrations of DEET in water were similar in the pasture reference site and recycled water sites, with corresponding to similar levels seen in root and shoots of pasture.

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Figure 6. Mean concentrations of pharmaceuticals and personal care products (PPCPs) detected in irrigation and river water, and plant samples at each site in 2024, including standard error bars. For water samples: n = 10 replicates for sites F1-F6, 2 replicates for Goulburn River, 4 replicates for Werribee River. For plant samples: n = 10 replicates per sample type; red = florets, green = roots, and blue = shoots.

### *Endocrine Disrupting Chemicals*

In 2023, EDCs were only detected in soil and broccoli samples, but not in water samples.

EDCs were detected in soil at all pasture sites and one broccoli site (Figure 7), and mean concentrations were highest at the pasture reference site F3 (mean ± SD = 0.29 ± 1.15 µg/kg). Progesterone and tert-octyl-phenol were the only two EDCs that were detected in soil, with the highest concentration detected for tert-octyl-phenol (6 µg/kg).

Of 89 plant samples analysed, 7 samples contained EDCs of which tert-octyl-phenol was the only EDC detected. It was also only detected in broccoli sites F4 and F5 (Figure 7). The highest concentration of tert-octyl-phenol detected in broccoli florets was at site F4 at 240 µg/kg.

Given EDCs were not detected in recycled water and there is no correlation between concentrations in soil and in plants, the link between recycled water and EDCs in plant tissue remains unclear. Therefore, the likelihood that EDCs in recycled water pose a significant risk to human health via irrigation of food crops is low.

A graph of a plant and a plant

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Figure 7. Mean concentrations of endocrine disrupting chemicals (EDCs) detected in soil and plant samples at each site in 2023, including standard error bars. n = 6 replicates for sites F1, F2, F4, F5, F7, and 4 replicates for reference sites F3 and F6. For plant samples: red = florets, green = roots, and blue = shoots.

In 2024, given limited EDCs identified in the 2023, samples were only analysed for EDCs in water and not in soil or plants. In the water samples, mean concentrations were highest in the Goulburn River samples (mean ± SD = 0.0047 ± 0.020 µg/L), and at pasture reference site F3 (0.0044 ± 0.018 µg/L) (Figure 8). The only EDC detected was Bisphenol A, with the highest concentration detected at 0.1 µg/L. EDCs were not detected in recycled water at any of the broccoli farm sites (Figure 8).

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Figure 8. Mean concentrations of endocrine disrupting chemicals (EDCs) detected in irrigation and river water samples at each site in 2024, including standard error bars. n = 10 replicates for sites F1-F6 and 2 replicates for Goulburn River.

### *Pesticides*

In 2023, pesticides were detected in water, soil, pasture, broccoli and lettuce samples. Mean pesticide concentrations were highest at pasture site F1 for water samples (mean ± SD = 0.0063 ± 0.11 µg/L), at broccoli site F5 for soil samples (2.92 ± 30.65 µg/kg), and in the shoots of broccoli plants at reference site F6 (41.07 ± 520.62 µg/kg) (Figure 9). The highest pesticide concentrations were for thiabendazole (2.5 µg/L) and sulfometuron methyl (1.9 µg/L) in water, prometryn (1100 µg/kg) and pendimethalin (740 µg/kg) in soil, and imidacloprid in the roots of lettuce plants (19000 µg/kg). Of 89 plant samples analysed, pesticides were detected in 80 samples.

Whilst the concentrations of pesticides in recycled water sites were higher than reference sites for water samples, the corresponding results for soil and plant tissues did not reflect this trend and other sources may be present.

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Figure 9. Mean concentrations of pesticides detected in irrigation water, soil and plant samples at each site in 2023, including standard error bars. n = 6 replicates per sample type for sites F1, F2, F4, F5, F7, and 4 replicates per sample type for reference sites F3 and F6. For plant samples: red = florets, green = roots, and blue = shoots.

In 2024, pesticides were only analysed for in water samples. In water samples, pesticides were detected at all sites (Figure 10), with the highest mean concentration detected at broccoli site F5 (mean ± SD = 0.0023 ± 0.020 µg/L), followed by broccoli site F4 (0.0017 ± 0.015 µg/L). The highest concentrations of pesticides detected were for propyzamide (0.28 µg/L) and simazine (0.18 µg/L).

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Figure 10. Mean concentrations of pesticides detected in irrigation and river water samples at each site in 2024, including standard error bars. n = 10 replicates for sites F1-F6 and 2 replicates for Goulburn River.

### *Phthalates*

In 2023, phthalates were detected in water, soil, pasture, broccoli and lettuce samples. Mean phthalate concentrations were highest at pasture site F2 for both water samples (mean ± SD = 0.022 ± 0.098 µg/L) and soil samples (12.17 ± 25.99 µg/kg), and in the roots of lettuce plants at site F7 (232.47 ± 881.90 µg/kg) (Figure 11). The highest phthalate concentrations were for di-n-pentyl phthalate (DnPP; 0.55 µg/L) and dibutyl phthalate (DBP; 0.2 µg/L) in water, di-(2-ethylbutyl) phthalate (170 µg/kg) and di-ethylhexyl phthalate (DEHP; 71 µg/kg) in soil, and DBP in the roots of lettuce plants (6100 µg/kg) and DEHP in the shoots of broccoli plants (6000 µg/kg). Of 89 plant samples analysed, phthalates were detected in 56 samples.

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Figure 11. Mean concentrations of phthalates detected in irrigation water, soil and plant samples at each site in 2023, including standard error bars. n = 6 replicates per sample type for sites F1, F2, F4, F5, F7, and 4 replicates per sample type for reference sites F3 and F6. For plant samples: red = florets, green = roots, and blue = shoots.

In 2024, phthalates were only analysed for in water samples. Phthalates were detected at all sites in water samples (Figure 12), with the highest mean concentration detected in the Goulburn River sample (mean ± SD = 0.030 ± 0.067 µg/L), followed by pasture site F2 (0.020 ± 0.046 µg/L). The highest concentrations of phthalates detected were for DEHP (0.26 µg/L) and DBP (0.19 µg/L).

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Figure 12. Mean concentrations of phthalates detected in irrigation and river water samples at each site in 2024, including standard error bars. n = 10 replicates for sites F1-F6 and 2 replicates for Goulburn River.

# Conclusions and key findings

This study found that the chemical composition of recycled water used for crop irrigation was distinct from water used on the reference sites (i.e., non-recycled water sources). Consistently, across the different chemical groups, concentrations were higher in irrigation water at recycled water sites compared to reference sites. However, this trend seen in irrigation water was not as apparent in the chemical composition of soil and crops between recycled water and reference sites, indicating that there may be other site-specific sources of chemicals, such as on-farm practices. Additionally, there was limited transfer from water and soil to plant tissues for the chemicals detected.

Some variability in trends were seen between the 2023 and 2024 sampling rounds, with some chemicals being detected in one year but not the other. This could be due to the concentrations of many chemicals being close to the detection limit, differences in the limits of reporting between years, and the inherent variability in chemical concentrations in water, soil and crops across time. Several factors and uncertainties that may have also contributed to the variability of chemical concentrations between years and across sites include, the level of dilution of recycled water with other sources of water before irrigation (shandying), and the on-site application of chemicals.

Overall, our key findings for this study were:

* Recycled water consistently contained a greater number and concentration of contaminants than reference water.
* Although emerging contaminants were present in water and in soil, our study found limited evidence that they moved into the edible parts of the plants.
* No impact of recycled water on crop health was observed. Differences in plant pigments and biomass appeared linked to crop maturity, not to irrigation source.
* Some pesticides were found in edible parts of the plants from the reference farms not using recycled water for irrigation, indicating on-farm sources (e.g. direct pesticide application).
* The reference farm irrigation water for broccoli contained PPCPs, suggesting other potential sources (e.g. river water).
* Concentrations of PFAS found in edible crops were low, with a low detection rate observed for most PFAS. The concentrations reported do not indicate a significant risk of accumulation into food produce from recycled water.
* Based on this study, recycled water can be used for crop irrigation, if the quality of the water is regularly monitored, and use managed appropriately.
* Ongoing monitoring and the inclusion of more crop types and locations are recommended to refine risk assessments and management strategies.

# References

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HEPA. (2025). *PFAS National Environmental Management Plan Version 3.0*. Heads of EPA Australia and New Zealand 2025.

# Appendix A – Data summary tables

Table S1. Summary statistics for groups of emerging contaminants detected in water samples at each site. Min = minimum; SD = standard deviation; Max = Maximum. LOR = Limit of reporting.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Water samples** | | | | | | |
| **Year** | **Analyte group** | **Site** | **Min**  **(µg/L)** | **Mean**  **(µg/L)** | **SD**  **(µg/L)** | **Max**  **(µg/L)** |
| 2023 | EDCs | F1 (pasture) | <LOR | 0 | 0 | <LOR |
|  |  | F2 (pasture) | <LOR | 0 | 0 | <LOR |
|  |  | F3 (pasture reference) | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | <LOR | 0 | 0 | <LOR |
|  |  | F5 (broccoli) | <LOR | 0 | 0 | <LOR |
|  |  | F6 (broccoli reference) | <LOR | 0 | 0 | <LOR |
|  |  | F7 (lettuce) | <LOR | 0 | 0 | <LOR |
|  | PAHs | F1 (pasture) | <LOR | 0.0047 | 0.031 | 0.36 |
|  |  | F2 (pasture) | <LOR | 0.0013 | 0.012 | 0.12 |
|  |  | F3 (pasture reference) | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | <LOR | 0.00061 | 0.0048 | 0.05 |
|  |  | F5 (broccoli) | <LOR | 0.0016 | 0.015 | 0.19 |
|  |  | F6 (broccoli reference) | <LOR | 0 | 0 | <LOR |
|  |  | F7 (lettuce) | <LOR | 0.0015 | 0.013 | 0.13 |
|  | Pesticides | F1 (pasture) | <LOR | 0.0063 | 0.11 | 2.5 |
|  |  | F2 (pasture) | <LOR | 0.0014 | 0.027 | 0.83 |
|  |  | F3 (pasture reference) | <LOR | 0.00030 | 0.0073 | 0.27 |
|  |  | F4 (broccoli) | <LOR | 0.0011 | 0.0093 | 0.19 |
|  |  | F5 (broccoli) | <LOR | 0.0011 | 0.011 | 0.24 |
|  |  | F6 (broccoli reference) | <LOR | 0.00038 | 0.0075 | 0.25 |
|  |  | F7 (lettuce) | <LOR | 0.00087 | 0.010 | 0.28 |
|  | PFAS | F1 (pasture) | <LOR | 0.0053 | 0.011 | 0.037 |
|  |  | F2 (pasture) | <LOR | 0.0032 | 0.0076 | 0.041 |
|  |  | F3 (pasture reference) | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | <LOR | 0.0039 | 0.0076 | 0.028 |
|  |  | F5 (broccoli) | <LOR | 0.0025 | 0.0053 | 0.016 |
|  |  | F6 (broccoli reference) | <LOR | 0.00038 | 0.0021 | 0.014 |
|  |  | F7 (lettuce) | <LOR | 0.0032 | 0.0068 | 0.028 |
|  | Phthalates | F1 (pasture) | <LOR | 0.0056 | 0.030 | 0.2 |
|  |  | F2 (pasture) | <LOR | 0.022 | 0.098 | 0.55 |
|  |  | F3 (pasture reference) | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | <LOR | 0.0039 | 0.018 | 0.1 |
|  |  | F5 (broccoli) | <LOR | 0.0012 | 0.0098 | 0.08 |
|  |  | F6 (broccoli reference) | <LOR | 0 | 0 | <LOR |
|  |  | F7 (lettuce) | <LOR | 0.0014 | 0.0064 | 0.04 |
|  | PPCPs | F1 (pasture) | <LOR | 0.0029 | 0.014 | 0.142 |
|  |  | F2 (pasture) | <LOR | 0.00080 | 0.0044 | 0.044 |
|  |  | F3 (pasture reference) | <LOR | 0.000040 | 0.00047 | 0.006 |
|  |  | F4 (broccoli) | <LOR | 0.0036 | 0.014 | 0.129 |
|  |  | F5 (broccoli) | <LOR | 0.0026 | 0.012 | 0.124 |
|  |  | F6 (broccoli reference) | <LOR | 0.0016 | 0.029 | 0.61 |
|  |  | F7 (lettuce) | <LOR | 0.0025 | 0.012 | 0.118 |
|  | SVOCs | F1 (pasture) | <LOR | 0.000045 | 0.0015 | 0.06 |
|  |  | F2 (pasture) | <LOR | 0.000013 | 0.00051 | 0.02 |
|  |  | F3 (pasture reference) | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | <LOR | 0.000022 | 0.00067 | 0.02 |
|  |  | F5 (broccoli) | <LOR | 0 | 0 | <LOR |
|  |  | F6 (broccoli reference) | <LOR | 0 | 0 | <LOR |
|  |  | F7 (lettuce) | <LOR | 0 | 0 | <LOR |
| 2024 | EDCs | F1 (pasture) | <LOR | 0.0031 | 0.012 | 0.05 |
|  |  | F2 (pasture) | <LOR | 0.0031 | 0.012 | 0.06 |
|  |  | F3 (pasture reference) | <LOR | 0.0044 | 0.018 | 0.07 |
|  |  | F4 (broccoli) | <LOR | 0 | 0 | <LOR |
|  |  | F5 (broccoli) | <LOR | 0 | 0 | <LOR |
|  |  | F6 (broccoli reference) | <LOR | 0 | 0 | <LOR |
|  |  | Goulburn River | <LOR | 0.0047 | 0.020 | 0.1 |
|  |  | Werribee River | - | - | - | - |
|  | PAHs | F1 (pasture) | <LOR | 0.0021 | 0.0098 | 0.06 |
|  |  | F2 (pasture) | <LOR | 0.014 | 0.042 | 0.19 |
|  |  | F3 (pasture reference) | <LOR | 0.0015 | 0.0071 | 0.04 |
|  |  | F4 (broccoli) | <LOR | 0.0044 | 0.014 | 0.09 |
|  |  | F5 (broccoli) | <LOR | 0.0020 | 0.0071 | 0.04 |
|  |  | F6 (broccoli reference) | <LOR | 0.00091 | 0.0038 | 0.02 |
|  |  | Goulburn River | <LOR | 0.0055 | 0.017 | 0.11 |
|  |  | Werribee River | - | - | - | - |
|  | Pesticides | F1 (pasture) | <LOR | 0.00039 | 0.0046 | 0.07 |
|  |  | F2 (pasture) | <LOR | 0.00056 | 0.0075 | 0.13 |
|  |  | F3 (pasture reference) | <LOR | 0.000049 | 0.00070 | 0.01 |
|  |  | F4 (broccoli) | <LOR | 0.0017 | 0.015 | 0.18 |
|  |  | F5 (broccoli) | <LOR | 0.0023 | 0.020 | 0.28 |
|  |  | F6 (broccoli reference) | <LOR | 0.00054 | 0.0043 | 0.08 |
|  |  | Goulburn River | <LOR | 0.000074 | 0.0011 | 0.02 |
|  |  | Werribee River | - | - | - | - |
|  | PFAS | F1 (pasture) | <LOR | 0.00078 | 0.0019 | 0.0075 |
|  |  | F2 (pasture) | <LOR | 0.00086 | 0.0023 | 0.011 |
|  |  | F3 (pasture reference) | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | <LOR | 0.00051 | 0.0015 | 0.0091 |
|  |  | F5 (broccoli) | <LOR | 0.00050 | 0.0015 | 0.0090 |
|  |  | F6 (broccoli reference) | <LOR | 0.00021 | 0.00066 | 0.0033 |
|  |  | Goulburn River | <LOR | 0.00010 | 0.00038 | 0.0020 |
|  |  | Werribee River | <LOR | 0.00056 | 0.0015 | 0.0071 |
|  | Phthalates | F1 (pasture) | <LOR | 0.018 | 0.039 | 0.11 |
|  |  | F2 (pasture) | <LOR | 0.020 | 0.046 | 0.16 |
|  |  | F3 (pasture reference) | <LOR | 0.017 | 0.037 | 0.1 |
|  |  | F4 (broccoli) | <LOR | 0.013 | 0.024 | 0.08 |
|  |  | F5 (broccoli) | <LOR | 0.011 | 0.022 | 0.07 |
|  |  | F6 (broccoli reference) | <LOR | 0.0028 | 0.0085 | 0.03 |
|  |  | Goulburn River | <LOR | 0.030 | 0.067 | 0.26 |
|  |  | Werribee River | - | - | - | - |
|  | PPCPs | F1 (pasture) | <LOR | 0.055 | 0.22 | 2.83 |
|  |  | F2 (pasture) | <LOR | 0.043 | 0.20 | 2.7 |
|  |  | F3 (pasture reference) | <LOR | 0.00070 | 0.0037 | 0.034 |
|  |  | F4 (broccoli) | <LOR | 0.026 | 0.071 | 0.38 |
|  |  | F5 (broccoli) | <LOR | 0.036 | 0.10 | 0.90 |
|  |  | F6 (broccoli reference) | <LOR | 0.0030 | 0.013 | 0.18 |
|  |  | Goulburn River | <LOR | 0.0051 | 0.033 | 0.36 |
|  |  | Werribee River | <LOR | 0.023 | 0.10 | 1.15 |
|  | SVOCs | F1 (pasture) | <LOR | 0.083 | 1.33 | 23 |
|  |  | F2 (pasture) | <LOR | 0.32 | 5.69 | 150 |
|  |  | F3 (pasture reference) | <LOR | 0.11 | 1.80 | 29 |
|  |  | F4 (broccoli) | <LOR | 0.099 | 1.58 | 27 |
|  |  | F5 (broccoli) | <LOR | 0.060 | 0.96 | 16 |
|  |  | F6 (broccoli reference) | <LOR | 0.018 | 0.30 | 6.6 |
|  |  | Goulburn River | <LOR | 0.11 | 1.90 | 40 |
|  |  | Werribee River | - | - | - | - |

Table S2. Summary statistics for groups of emerging contaminants detected in soil samples at each site. Min = minimum; SD = standard deviation; Max = Maximum. LOR = Limit of reporting.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Soil samples** | | | | | | |
| **Year** | **Analyte group** | **Site** | **Min**  **(µg/kg)** | **Mean**  **(µg/kg)** | **SD**  **(µg/kg)** | **Max**  **(µg/kg)** |
| 2023 | EDCs | F1 (pasture) | <LOR | 0.021 | 0.19 | 1.7 |
|  |  | F2 (pasture) | <LOR | 0.087 | 0.52 | 3.1 |
|  |  | F3 (pasture reference) | <LOR | 0.29 | 1.15 | 6 |
|  |  | F4 (broccoli) | <LOR | 0 | 0 | <LOR |
|  |  | F5 (broccoli) | <LOR | 0 | 0 | <LOR |
|  |  | F6 (broccoli reference) | <LOR | 0.0075 | 0.055 | 0.4 |
|  |  | F7 (lettuce) | <LOR | 0 | 0 | <LOR |
|  | PAHs | F1 (pasture) | <LOR | 1.45 | 4.10 | 24 |
|  |  | F2 (pasture) | <LOR | 5.75 | 17.15 | 120 |
|  |  | F3 (pasture reference) | <LOR | 8.83 | 16.73 | 100 |
|  |  | F4 (broccoli) | <LOR | 0.65 | 1.46 | 10 |
|  |  | F5 (broccoli) | <LOR | 1.06 | 2.58 | 17 |
|  |  | F6 (broccoli reference) | <LOR | 1.50 | 2.95 | 16 |
|  |  | F7 (lettuce) | <LOR | 6.31 | 12.41 | 74 |
|  | Pesticides | F1 (pasture) | <LOR | 0.013 | 0.32 | 14 |
|  |  | F2 (pasture) | <LOR | 0.0055 | 0.11 | 4.6 |
|  |  | F3 (pasture reference) | <LOR | 0.52 | 17.25 | 650 |
|  |  | F4 (broccoli) | <LOR | 1.65 | 13.21 | 300 |
|  |  | F5 (broccoli) | <LOR | 2.92 | 30.65 | 1100 |
|  |  | F6 (broccoli reference) | <LOR | 1.49 | 18.65 | 480 |
|  |  | F7 (lettuce) | <LOR | 2.07 | 22.36 | 740 |
|  | PFAS | F1 (pasture) | <LOR | 0.41 | 1.73 | 10.6 |
|  |  | F2 (pasture) | <LOR | 0.13 | 0.69 | 6.53 |
|  |  | F3 (pasture reference) | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | <LOR | 0.024 | 0.32 | 4.24 |
|  |  | F5 (broccoli) | <LOR | 0.21 | 0.82 | 5.25 |
|  |  | F6 (broccoli reference) | <LOR | 0.11 | 0.54 | 3.05 |
|  |  | F7 (lettuce) | <LOR | 0.053 | 0.31 | 2.01 |
|  | Phthalates | F1 (pasture) | <LOR | 0.52 | 1.46 | 7.6 |
|  |  | F2 (pasture) | <LOR | 12.17 | 25.99 | 170 |
|  |  | F3 (pasture reference) | <LOR | 9.12 | 14.62 | 46 |
|  |  | F4 (broccoli) | <LOR | 2.43 | 7.12 | 55 |
|  |  | F5 (broccoli) | <LOR | 2.94 | 8.04 | 50 |
|  |  | F6 (broccoli reference) | <LOR | 1.38 | 4.39 | 21 |
|  |  | F7 (lettuce) | <LOR | 7.81 | 14.86 | 71 |
|  | PPCPs | F1 (pasture) | <LOR | 0.097 | 1.87 | 40 |
|  |  | F2 (pasture) | <LOR | 0.25 | 4.22 | 84 |
|  |  | F3 (pasture reference) | <LOR | 0.048 | 0.90 | 17 |
|  |  | F4 (broccoli) | <LOR | 0.023 | 0.40 | 8.2 |
|  |  | F5 (broccoli) | <LOR | 0.021 | 0.35 | 6.9 |
|  |  | F6 (broccoli reference) | <LOR | 0.033 | 0.48 | 8.2 |
|  |  | F7 (lettuce) | <LOR | 0 | 0 | <LOR |
|  | SVOCs | F1 (pasture) | <LOR | 1.30 | 20.37 | 600 |
|  |  | F2 (pasture) | <LOR | 6.47 | 60.47 | 1100 |
|  |  | F3 (pasture reference) | <LOR | 7.05 | 58.35 | 980 |
|  |  | F4 (broccoli) | <LOR | 2.84 | 28.25 | 650 |
|  |  | F5 (broccoli) | <LOR | 3.24 | 44.47 | 970 |
|  |  | F6 (broccoli reference) | <LOR | 1.29 | 25.75 | 800 |
|  |  | F7 (lettuce) | <LOR | 3.48 | 34.15 | 880 |
| 2024 | PFAS | F1 (pasture) | <LOR | 0.28 | 1.43 | 9.28 |
|  |  | F2 (pasture) | <LOR | 0.062 | 0.28 | 1.64 |
|  |  | F3 (pasture reference) | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | <LOR | 0.075 | 0.39 | 2.10 |
|  |  | F5 (broccoli) | <LOR | 0.058 | 0.30 | 1.65 |
|  |  | F6 (broccoli reference) | <LOR | 0.095 | 0.49 | 2.64 |

Table S3. Summary statistics for groups of emerging contaminants detected in plant samples at each site. Min = minimum; SD = standard deviation; Max = Maximum. LOR = Limit of reporting.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Plant samples** | | | | | | | |
| **Year** | **Analyte group** | **Site** | **Sample type** | **Min**  **(µg/kg)** | **Mean**  **(µg/kg)** | **SD**  **(µg/kg)** | **Max**  **(µg/kg)** |
| 2023 | EDCs | F1 (pasture) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F2 (pasture) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F3 (pasture reference) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | Floret | <LOR | 3 | 26.83 | 240 |
|  |  |  | Root | <LOR | 0.16 | 1.45 | 13 |
|  |  |  | Shoot | <LOR | 0.16 | 1.45 | 13 |
|  |  | F5 (broccoli) | Floret | <LOR | 0 | 0 | <LOR |
|  |  |  | Root | <LOR | 0.68 | 2.98 | 17 |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F6 (broccoli reference) | Floret | <LOR | 0 | 0 | <LOR |
|  |  |  | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F7 (lettuce) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  | PAHs | F1 (pasture) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F2 (pasture) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F3 (pasture reference) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | Floret | <LOR | 6.49 | 33.73 | 240 |
|  |  |  | Root | <LOR | 3.11 | 15.78 | 135 |
|  |  |  | Shoot | <LOR | 19.83 | 83.34 | 580 |
|  |  | F5 (broccoli) | Floret | <LOR | 15.28 | 58.84 | 350 |
|  |  |  | Root | <LOR | 1.60 | 10.81 | 90 |
|  |  |  | Shoot | <LOR | 21.32 | 89.41 | 760 |
|  |  | F6 (broccoli reference) | Floret | <LOR | 13.61 | 59.18 | 330 |
|  |  |  | Root | <LOR | 0.62 | 6.32 | 72 |
|  |  |  | Shoot | <LOR | 16.64 | 87.25 | 680 |
|  |  | F7 (lettuce) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  | Pesticides | F1 (pasture) | Root | <LOR | 0.019 | 0.46 | 21 |
|  |  |  | Shoot | <LOR | 0.020 | 0.64 | 35 |
|  |  | F2 (pasture) | Root | <LOR | 0.040 | 1.41 | 74 |
|  |  |  | Shoot | <LOR | 0.0086 | 0.29 | 13 |
|  |  | F3 (pasture reference) | Root | <LOR | 1.17 | 37.64 | 1600 |
|  |  |  | Shoot | <LOR | 2.93 | 106.29 | 4700 |
|  |  | F4 (broccoli) | Floret | <LOR | 0.010 | 0.46 | 25 |
|  |  |  | Root | <LOR | 1.48 | 38.19 | 1700 |
|  |  |  | Shoot | <LOR | 3.43 | 63.39 | 2300 |
|  |  | F5 (broccoli) | Floret | <LOR | 0.58 | 11.09 | 480 |
|  |  |  | Root | <LOR | 0.93 | 19.23 | 790 |
|  |  |  | Shoot | <LOR | 14.19 | 161.91 | 4700 |
|  |  | F6 (broccoli reference) | Floret | <LOR | 1.33 | 25.68 | 990 |
|  |  |  | Root | <LOR | 0.67 | 13.63 | 395 |
|  |  |  | Shoot | <LOR | 41.07 | 520.62 | 11000 |
|  |  | F7 (lettuce) | Root | <LOR | 33.61 | 642.99 | 19000 |
|  |  |  | Shoot | <LOR | 2.11 | 25.07 | 860 |
|  | PFAS | F1 (pasture) | Root | <LOR | 0.28 | 2.06 | 21.4 |
|  |  |  | Shoot | <LOR | 0.23 | 3.10 | 41 |
|  |  | F2 (pasture) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F3 (pasture reference) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0.077 | 0.86 | 9.6 |
|  |  | F4 (broccoli) | Floret | <LOR | 0.20 | 1.01 | 6.7 |
|  |  |  | Root | <LOR | 0.089 | 1.17 | 15.5 |
|  |  |  | Shoot | <LOR | 0.28 | 1.42 | 9.94 |
|  |  | F5 (broccoli) | Floret | <LOR | 0.173 | 0.95 | 6.61 |
|  |  |  | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 2.96 | 16.74 | 154 |
|  |  | F6 (broccoli reference) | Floret | <LOR | 0 | 0 | <LOR |
|  |  |  | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 1.24 | 7.77 | 66 |
|  |  | F7 (lettuce) | Root | <LOR | 0.037 | 0.34 | 3.23 |
|  |  |  | Shoot | <LOR | 1.23 | 7.46 | 64 |
|  | Phthalates | F1 (pasture) | Root | <LOR | 74.29 | 263.70 | 1300 |
|  |  |  | Shoot | <LOR | 45.19 | 212.79 | 1200 |
|  |  | F2 (pasture) | Root | <LOR | 116.97 | 630.55 | 4800 |
|  |  |  | Shoot | <LOR | 19.24 | 111.86 | 760 |
|  |  | F3 (pasture reference) | Root | <LOR | 21.09 | 109.84 | 620 |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | Floret | <LOR | 83.77 | 437.84 | 2900 |
|  |  |  | Root | <LOR | 4.45 | 16.94 | 100 |
|  |  |  | Shoot | <LOR | 198.44 | 851.42 | 6000 |
|  |  | F5 (broccoli) | Floret | <LOR | 2.38 | 9.34 | 58 |
|  |  |  | Root | <LOR | 3.61 | 12.85 | 70 |
|  |  |  | Shoot | <LOR | 125.47 | 372.54 | 1850 |
|  |  | F6 (broccoli reference) | Floret | <LOR | 6.36 | 28.50 | 180 |
|  |  |  | Root | <LOR | 17.43 | 56.95 | 320 |
|  |  |  | Shoot | <LOR | 100.59 | 312.35 | 1970 |
|  |  | F7 (lettuce) | Root | <LOR | 232.47 | 881.90 | 6100 |
|  |  |  | Shoot | <LOR | 8.83 | 77.49 | 680 |
|  | PPCPs | F1 (pasture) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0.012 | 0.27 | 5.76 |
|  |  | F2 (pasture) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F3 (pasture reference) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F4 (broccoli) | Floret | <LOR | 0.028 | 0.60 | 13 |
|  |  |  | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0.081 | 1.06 | 15.8 |
|  |  | F5 (broccoli) | Floret | <LOR | 0.018 | 0.37 | 7.4 |
|  |  |  | Root | <LOR | 0.044 | 0.89 | 18 |
|  |  |  | Shoot | <LOR | 0.034 | 0.49 | 7.95 |
|  |  | F6 (broccoli reference) | Floret | <LOR | 0.018 | 0.31 | 5.4 |
|  |  |  | Root | <LOR | 0.021 | 0.36 | 6.3 |
|  |  |  | Shoot | <LOR | 0.023 | 0.41 | 7 |
|  |  | F7 (lettuce) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0.030 | 0.46 | 8.03 |
|  | SVOCs | F1 (pasture) | Root | <LOR | 9.19 | 166.78 | 5100 |
|  |  |  | Shoot | <LOR | 8.57 | 177.41 | 6800 |
|  |  | F2 (pasture) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F3 (pasture reference) | Root | <LOR | 0.016 | 0.59 | 21 |
|  |  |  | Shoot | <LOR | 2.51 | 59.51 | 1500 |
|  |  | F4 (broccoli) | Floret | <LOR | 28.65 | 525.26 | 18044 |
|  |  |  | Root | <LOR | 5.62 | 73.37 | 1500 |
|  |  |  | Shoot | <LOR | 24.07 | 193.26 | 3610 |
|  |  | F5 (broccoli) | Floret | <LOR | 42.69 | 478.25 | 12820 |
|  |  |  | Root | <LOR | 10.35 | 107.91 | 2000 |
|  |  |  | Shoot | <LOR | 53.22 | 344.72 | 5320 |
|  |  | F6 (broccoli reference) | Floret | <LOR | 78.96 | 949.31 | 18009 |
|  |  |  | Root | <LOR | 4.06 | 39.52 | 650 |
|  |  |  | Shoot | <LOR | 45.41 | 288.57 | 3700 |
|  |  | F7 (lettuce) | Root | <LOR | 4.43 | 87.61 | 2300 |
|  |  |  | Shoot | <LOR | 4.75 | 82.84 | 2300 |
| 2024 | PFAS | F1 (pasture) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F2 (pasture) | Root | <LOR | 0.25 | 3.10 | 51.69 |
|  |  |  | Shoot | <LOR | 0.036 | 0.61 | 10.58 |
|  |  | F3 (pasture reference) | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0.054 | 0.68 | 10.27 |
|  |  | F4 (broccoli) | Floret | <LOR | 0 | 0 | <LOR |
|  |  |  | Root | <LOR | 0.062 | 0.33 | 2.39 |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F5 (broccoli) | Floret | <LOR | 0.13 | 0.65 | 4.45 |
|  |  |  | Root | <LOR | 0.087 | 0.47 | 3.31 |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F6 (broccoli reference) | Floret | <LOR | 0 | 0 | <LOR |
|  |  |  | Root | <LOR | 0.028 | 0.20 | 1.89 |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  | PPCPs | F1 (pasture) | Root | <LOR | 0.024 | 0.12 | 0.81 |
|  |  |  | Shoot | <LOR | 0.040 | 0.18 | 1.21 |
|  |  | F2 (pasture) | Root | <LOR | 0.033 | 0.17 | 1.73 |
|  |  |  | Shoot | <LOR | 0.039 | 0.24 | 3.11 |
|  |  | F3 (pasture reference) | Root | <LOR | 0.027 | 0.16 | 1.47 |
|  |  |  | Shoot | <LOR | 0.021 | 0.14 | 1.26 |
|  |  | F4 (broccoli) | Floret | <LOR | 0 | 0 | <LOR |
|  |  |  | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F5 (broccoli) | Floret | <LOR | 0 | 0 | <LOR |
|  |  |  | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |
|  |  | F6 (broccoli reference) | Floret | <LOR | 0 | 0 | <LOR |
|  |  |  | Root | <LOR | 0 | 0 | <LOR |
|  |  |  | Shoot | <LOR | 0 | 0 | <LOR |

Table S4. Summary statistics for individual emerging contaminants detected in water samples for each sampling year and at each type of site (i.e., recycled water irrigated site, reference site, or river water samples). Where a chemical was not detected in any samples at a sampling point, it was excluded from this table. Min = minimum; SD = standard deviation; Max = Maximum. LOR = Limit of reporting.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Water samples** | | | | | | | | | |
| **Year** | **Analyte group** | **Analyte** | **Site type** | **Min**  **(µg/L)** | **Mean**  **(µg/L)** | **SD**  **(µg/L)** | **Max**  **(µg/L)** | **Total sample size** | **Detections sample size** |
| 2023 | PAHs | C2 alkyl napthalenes | Recycled water | <LOR | 0.027 | 0.071 | 0.36 | 33 | 6 |
|  |  | C3 alkyl napthalenes | Recycled water | <LOR | 0.0096 | 0.033 | 0.15 | 33 | 5 |
|  |  | Naphthalene | Recycled water | <LOR | 0.0078 | 0.019 | 0.09 | 33 | 6 |
|  |  | 1-Methyl naphthalene | Recycled water | <LOR | 0.010 | 0.035 | 0.19 | 33 | 5 |
|  |  | 2-Methyl naphthalene | Recycled water | <LOR | 0.0093 | 0.038 | 0.21 | 33 | 3 |
|  | Pesticides | Clopyralid | Reference | 0.054 | 0.057 | 0.0042 | 0.06 | 2 | 2 |
|  |  | Dichloroprop | Reference | 0.008 | 0.0085 | 0.00070 | 0.009 | 2 | 2 |
|  |  | Diuron | Recycled water | 0.01 | 0.030 | 0.019 | 0.09 | 33 | 33 |
|  |  | Epoxiconazole | Recycled water | <LOR | 0.0075 | 0.010 | 0.03 | 33 | 14 |
|  |  | Fipronil | Recycled water | <LOR | 0.0054 | 0.0075 | 0.02 | 33 | 13 |
|  |  | Flutriafol | Recycled water | <LOR | 0.056 | 0.052 | 0.25 | 33 | 32 |
|  |  |  | Reference | <LOR | 0.005 | 0.0067 | 0.02 | 12 | 5 |
|  |  | Imidacloprid | Recycled water | <LOR | 0.018 | 0.016 | 0.04 | 33 | 20 |
|  |  | MCPA | Reference | 0.006 | 0.006 | 0 | 0.006 | 2 | 2 |
|  |  | Mesosulfuron methyl | Recycled water | <LOR | 0.012 | 0.019 | 0.06 | 33 | 10 |
|  |  | Metalaxyl | Recycled water | <LOR | 0.0072 | 0.010 | 0.04 | 33 | 15 |
|  |  | Metolachlor | Recycled water | <LOR | 0.0063 | 0.0082 | 0.03 | 33 | 15 |
|  |  | Metsulfuron methyl | Recycled water | <LOR | 0.010 | 0.019 | 0.06 | 33 | 9 |
|  |  | Propargite | Reference | <LOR | 0.0058 | 0.015 | 0.05 | 12 | 2 |
|  |  | Propiconazole | Recycled water | <LOR | 0.00027 | 0.0022 | 0.018 | 66 | 1 |
|  |  | Propyzamide | Recycled water | <LOR | 0.073 | 0.087 | 0.28 | 33 | 20 |
|  |  |  | Reference | <LOR | 0.0041 | 0.0099 | 0.03 | 12 | 2 |
|  |  | Pyrimethanil | Recycled water | <LOR | 0.0027 | 0.0057 | 0.02 | 33 | 7 |
|  |  | Sebuthylazin | Recycled water | <LOR | 0.0039 | 0.0049 | 0.01 | 33 | 13 |
|  |  | Simazine | Recycled water | <LOR | 0.022 | 0.016 | 0.08 | 33 | 32 |
|  |  | Spirotetramat | Recycled water | <LOR | 0.0036 | 0.0048 | 0.01 | 33 | 12 |
|  |  | Spirotetramat.enol | Recycled water | <LOR | 0.0039 | 0.0049 | 0.01 | 33 | 13 |
|  |  | Sulfentrazone | Recycled water | <LOR | 0.15 | 0.39 | 1.7 | 33 | 5 |
|  |  | Sulfometuron methyl | Recycled water | <LOR | 0.24 | 0.47 | 1.9 | 33 | 20 |
|  |  |  | Reference | <LOR | 0.14 | 0.086 | 0.27 | 12 | 10 |
|  |  | Tebuthiuron | Recycled water | <LOR | 0.049 | 0.049 | 0.17 | 33 | 20 |
|  |  | Terbuthylazine | Recycled water | <LOR | 0.0057 | 0.0083 | 0.03 | 33 | 13 |
|  |  | Thiabendazole | Recycled water | <LOR | 0.41 | 0.82 | 2.5 | 33 | 7 |
|  |  | Trichlopyr | Reference | 0.016 | 0.019 | 0.0049 | 0.023 | 2 | 2 |
|  |  | 2,4 D | Reference | 0.01 | 0.015 | 0.0070 | 0.02 | 2 | 2 |
|  |  | 2,6 D | Reference | 0.02 | 0.02 | 0 | 0.02 | 2 | 2 |
|  | PFAS | PFDA | Recycled water | <LOR | 0.0029 | 0.0046 | 0.014 | 33 | 10 |
|  |  | PFHpA | Recycled water | <LOR | 0.0094 | 0.0038 | 0.019 | 33 | 31 |
|  |  |  | Reference | <LOR | 0.0009 | 0.0028 | 0.009 | 10 | 1 |
|  |  | PFHxA | Recycled water | 0.013 | 0.024 | 0.0081 | 0.041 | 33 | 33 |
|  |  | PFHxS | Recycled water | <LOR | 0.014 | 0.0074 | 0.027 | 33 | 28 |
|  |  |  | Reference | <LOR | 0.0014 | 0.0044 | 0.014 | 10 | 1 |
|  |  | PFNA | Recycled water | <LOR | 0.0012 | 0.0029 | 0.009 | 33 | 5 |
|  |  | PFOA | Recycled water | <LOR | 0.018 | 0.0084 | 0.035 | 33 | 32 |
|  |  |  | Reference | <LOR | 0.0012 | 0.0037 | 0.012 | 10 | 1 |
|  |  | PFOS | Recycled water | <LOR | 0.019 | 0.0053 | 0.028 | 33 | 32 |
|  |  |  | Reference | <LOR | 0.0012 | 0.0037 | 0.012 | 10 | 1 |
|  |  | PFUdA | Recycled water | <LOR | 0.00066 | 0.0027 | 0.013 | 33 | 2 |
|  | Phthalates | DnPP | Recycled water | <LOR | 0.038 | 0.13 | 0.55 | 33 | 3 |
|  |  | DBP | Recycled water | <LOR | 0.011 | 0.036 | 0.2 | 33 | 6 |
|  |  | DCHP | Recycled water | <LOR | 0.0024 | 0.013 | 0.08 | 33 | 1 |
|  |  | DEP | Recycled water | <LOR | 0.0090 | 0.025 | 0.1 | 33 | 4 |
|  |  | DIBP | Recycled water | <LOR | 0.011 | 0.035 | 0.17 | 33 | 4 |
|  | PPCPs | Benzotriazole | Recycled water | <LOR | 0.049 | 0.046 | 0.142 | 33 | 24 |
|  |  |  | Reference | <LOR | 0.0027 | 0.0043 | 0.01 | 10 | 3 |
|  |  | Benzotriazole 4,5methyl | Recycled water | <LOR | 0.0023 | 0.0050 | 0.019 | 33 | 8 |
|  |  | Caffeine | Recycled water | <LOR | 0.0068 | 0.012 | 0.051 | 33 | 11 |
|  |  |  | Reference | <LOR | 0.050 | 0.17 | 0.61 | 12 | 1 |
|  |  | Carbamazepine | Recycled water | <LOR | 0.00097 | 0.0038 | 0.021 | 33 | 3 |
|  |  | DEET | Recycled water | <LOR | 0.0022 | 0.0078 | 0.06 | 66 | 14 |
|  |  | Fluconazole | Recycled water | <LOR | 0.022 | 0.017 | 0.055 | 33 | 28 |
|  |  | Galaxolide | Recycled water | <LOR | 0.0056 | 0.012 | 0.0416 | 33 | 6 |
|  |  | Lamotrigine | Recycled water | <LOR | 0.0084 | 0.021 | 0.107 | 33 | 10 |
|  |  | Metoprolol | Recycled water | <LOR | 0.0017 | 0.0041 | 0.0176 | 33 | 6 |
|  |  | Paraben Propyl | Recycled water | <LOR | 0.0052 | 0.017 | 0.073 | 33 | 4 |
|  |  | Tebuconazole | Recycled water | <LOR | 0.0083 | 0.015 | 0.06 | 66 | 20 |
|  |  | Tebuconazole | Reference | <LOR | 0.0019 | 0.0065 | 0.028 | 22 | 2 |
|  |  | Telmisartan | Recycled water | <LOR | 0.010 | 0.021 | 0.12 | 33 | 18 |
|  |  | Triclosan | Recycled water | <LOR | 0.0026 | 0.0035 | 0.009 | 33 | 13 |
|  |  |  | Reference | <LOR | 0.00091 | 0.0021 | 0.006 | 12 | 2 |
|  | SVOCs | Biphenyl | Recycled water | <LOR | 0.0042 | 0.011 | 0.06 | 33 | 5 |
| 2024 | EDCs | Bisphenol A | Recycled water | <LOR | 0.027 | 0.026 | 0.06 | 9 | 5 |
|  |  |  | Reference | <LOR | 0.017 | 0.035 | 0.07 | 4 | 1 |
|  |  |  | River water samples | 0.05 | 0.075 | 0.035 | 0.1 | 2 | 2 |
|  | PAHs | Acenaphthene | Recycled water | <LOR | 0.0066 | 0.0086 | 0.02 | 9 | 4 |
|  |  |  | Reference | <LOR | 0.0025 | 0.005 | 0.01 | 4 | 1 |
|  |  |  | River water samples | 0.01 | 0.02 | 0.014 | 0.03 | 2 | 2 |
|  |  | Acenaphthylene | Recycled water | <LOR | 0.012 | 0.015 | 0.04 | 9 | 4 |
|  |  |  | Reference | <LOR | 0.01 | 0.0081 | 0.02 | 4 | 3 |
|  |  | C1 alkyl fluorenes | Recycled water | <LOR | 0.052 | 0.076 | 0.19 | 9 | 5 |
|  |  | C2 alkyl fluorenes | Recycled water | <LOR | 0.028 | 0.056 | 0.17 | 9 | 4 |
|  |  | C2 alkyl napthalenes | Recycled water | <LOR | 0.0066 | 0.016 | 0.05 | 9 | 2 |
|  |  |  | River water samples | <LOR | 0.03 | 0.042 | 0.06 | 2 | 1 |
|  |  | C3 alkyl fluorenes | Recycled water | 0.03 | 0.087 | 0.061 | 0.19 | 9 | 9 |
|  |  |  | Reference | 0.01 | 0.022 | 0.012 | 0.04 | 4 | 4 |
|  |  |  | River water samples | 0.02 | 0.065 | 0.063 | 0.11 | 2 | 2 |
|  |  | C3 alkyl napthalenes | Recycled water | <LOR | 0.0011 | 0.0033 | 0.01 | 9 | 1 |
|  |  |  | River water samples | <LOR | 0.015 | 0.021 | 0.03 | 2 | 1 |
|  |  | C3 alkyl phenanthrenes | Recycled water | <LOR | 0.0033 | 0.01 | 0.03 | 9 | 1 |
|  |  | Naphthalene | River water samples | <LOR | 0.01 | 0.014 | 0.02 | 2 | 1 |
|  |  | 1-Methyl naphthalene | Recycled water | <LOR | 0.0061 | 0.0091 | 0.03 | 18 | 7 |
|  |  |  | River water samples | <LOR | 0.01 | 0.02 | 0.04 | 4 | 1 |
|  |  | 2-Methylnaphthalene | Recycled water | <LOR | 0.0027 | 0.0066 | 0.02 | 18 | 3 |
|  |  |  | River water samples | <LOR | 0.01 | 0.02 | 0.04 | 4 | 1 |
|  | Pesticides | Atrazine | Recycled water | <LOR | 0.0022 | 0.0044 | 0.01 | 9 | 2 |
|  |  | Azoxystrobin | Recycled water | <LOR | 0.0088 | 0.010 | 0.03 | 9 | 5 |
|  |  | Boscalid | Recycled water | <LOR | 0.011 | 0.014 | 0.04 | 9 | 4 |
|  |  |  | Reference | <LOR | 0.017 | 0.012 | 0.03 | 4 | 3 |
|  |  | Chlorantraniliprole | Recycled water | <LOR | 0.0055 | 0.0072 | 0.02 | 9 | 4 |
|  |  |  | Reference | <LOR | 0.0025 | 0.005 | 0.01 | 4 | 1 |
|  |  | DCPA | Reference | <LOR | 0.0075 | 0.005 | 0.01 | 4 | 3 |
|  |  | DDD.p.p | Reference | <LOR | 0.005 | 0.01 | 0.02 | 4 | 1 |
|  |  | DDT.p.p | Reference | <LOR | 0.02 | 0.04 | 0.08 | 4 | 1 |
|  |  | Propiconazole | Recycled water | <LOR | 0.26 | 0.24 | 0.89 | 35 | 27 |
|  |  |  | Reference | 0.0022 | 0.0039 | 0.00098 | 0.0072 | 18 | 18 |
|  |  |  | River water samples | <LOR | 0.045 | 0.028 | 0.069 | 6 | 5 |
|  |  | Propyzamide | Recycled water | <LOR | 0.087 | 0.11 | 0.28 | 9 | 4 |
|  |  |  | Reference | <LOR | 0.015 | 0.01 | 0.02 | 4 | 3 |
|  |  | Pyrimethanil | Recycled water | <LOR | 0.0011 | 0.0033 | 0.01 | 9 | 1 |
|  |  | Simazine | Recycled water | <LOR | 0.11 | 0.057 | 0.18 | 9 | 8 |
|  |  |  | Reference | 0.01 | 0.017 | 0.005 | 0.02 | 4 | 4 |
|  |  |  | River water samples | 0.01 | 0.015 | 0.0070 | 0.02 | 2 | 2 |
|  |  | Simetryn | Recycled water | <LOR | 0.0044 | 0.0052 | 0.01 | 9 | 4 |
|  |  | Terbuthylazine | Recycled water | <LOR | 0.0044 | 0.0052 | 0.01 | 9 | 4 |
|  |  | Thiabendazole | Recycled water | <LOR | 0.12 | 0.25 | 0.64 | 9 | 5 |
|  |  |  | River water samples | <LOR | 0.023 | 0.033 | 0.047 | 2 | 1 |
|  | PFAS | PFBA | Recycled water | <LOR | 0.0010 | 0.0028 | 0.0091 | 40 | 5 |
|  |  | PFBS | Reference | <LOR | 0.00099 | 0.0010 | 0.0021 | 20 | 10 |
|  |  |  | River water samples | <LOR | 0.00093 | 0.00085 | 0.0016 | 5 | 3 |
|  |  | PFDA | Recycled water | <LOR | 0.0010 | 0.0011 | 0.0037 | 40 | 19 |
|  |  |  | River water samples | <LOR | 0.00017 | 0.00039 | 0.00089 | 5 | 1 |
|  |  | PFHxS | Recycled water | <LOR | 0.0046 | 0.0015 | 0.0071 | 40 | 38 |
|  |  |  | River water samples | <LOR | 0.0033 | 0.0025 | 0.0053 | 5 | 4 |
|  |  | PFNA | Recycled water | <LOR | 0.00087 | 0.0010 | 0.0032 | 40 | 18 |
|  |  | PFOA | Recycled water | <LOR | 0.0042 | 0.0024 | 0.0086 | 40 | 38 |
|  |  |  | Reference | <LOR | 0.00051 | 0.00058 | 0.0013 | 20 | 9 |
|  |  |  | River water samples | <LOR | 0.0017 | 0.0010 | 0.0026 | 5 | 4 |
|  |  | PFOS | Recycled water | <LOR | 0.0060 | 0.0021 | 0.010 | 40 | 38 |
|  |  |  | Reference | <LOR | 0.0013 | 0.0014 | 0.0033 | 20 | 10 |
|  |  |  | River water samples | <LOR | 0.0040 | 0.0029 | 0.0071 | 5 | 4 |
|  | Phthalates | DEHP | Recycled water | 0.06 | 0.093 | 0.035 | 0.16 | 9 | 9 |
|  |  |  | Reference | 0.03 | 0.047 | 0.035 | 0.1 | 4 | 4 |
|  |  |  | River water samples | 0.08 | 0.17 | 0.12 | 0.26 | 2 | 2 |
|  |  | DBP | Recycled water | 0.04 | 0.082 | 0.036 | 0.14 | 9 | 9 |
|  |  |  | Reference | <LOR | 0.025 | 0.043 | 0.09 | 4 | 2 |
|  |  |  | River water samples | 0.09 | 0.14 | 0.070 | 0.19 | 2 | 2 |
|  |  | DEP | Recycled water | <LOR | 0.0083 | 0.010 | 0.04 | 18 | 9 |
|  |  |  | Reference | <LOR | 0.0012 | 0.0035 | 0.01 | 8 | 1 |
|  |  |  | River water samples | <LOR | 0.022 | 0.033 | 0.07 | 4 | 2 |
|  | PPCPs | Acetaminophen | Recycled water | <LOR | 0.12 | 0.36 | 1.1 | 9 | 1 |
|  |  | Amoxicillin | Recycled water | <LOR | 0.05 | 0.1 | 0.25 | 9 | 2 |
|  |  | Amphetamine | Recycled water | <LOR | 0.013 | 0.021 | 0.054 | 9 | 3 |
|  |  | Atenolol | Recycled water | <LOR | 0.0021 | 0.0075 | 0.037 | 44 | 4 |
|  |  | Benzotriazole | Recycled water | <LOR | 0.57 | 0.55 | 2.83 | 35 | 33 |
|  |  |  | Reference | <LOR | 0.010 | 0.010 | 0.023 | 18 | 10 |
|  |  |  | River water samples | <LOR | 0.14 | 0.11 | 0.35 | 6 | 5 |
|  |  | Benzotriazole 4,5methyl | Recycled water | <LOR | 0.21 | 0.11 | 0.46 | 35 | 33 |
|  |  |  | Reference | <LOR | 0.010 | 0.0098 | 0.021 | 18 | 10 |
|  |  |  | River water samples | <LOR | 0.052 | 0.028 | 0.086 | 6 | 5 |
|  |  | Benzoylecgonine | Recycled water | <LOR | 0.012 | 0.014 | 0.038 | 9 | 6 |
|  |  | Caffeine | Recycled water | <LOR | 0.13 | 0.12 | 0.38 | 44 | 27 |
|  |  |  | Reference | <LOR | 0.017 | 0.018 | 0.052 | 22 | 11 |
|  |  |  | River water samples | <LOR | 0.33 | 0.42 | 1.14 | 8 | 4 |
|  |  | Carbamazepine | Recycled water | 0.01 | 0.25 | 0.25 | 0.85 | 44 | 44 |
|  |  |  | Reference | <LOR | 0.0043 | 0.0048 | 0.010 | 22 | 10 |
|  |  |  | River water samples | <LOR | 0.013 | 0.019 | 0.051 | 8 | 4 |
|  |  | Cetrazine | Recycled water | <LOR | 0.007 | 0.019 | 0.058 | 9 | 2 |
|  |  | Clindamycin | Recycled water | <LOR | 0.011 | 0.016 | 0.04 | 9 | 4 |
|  |  | DEET | Recycled water | 0.018 | 0.12 | 0.068 | 0.25 | 35 | 35 |
|  |  |  | Reference | 0.013 | 0.030 | 0.013 | 0.046 | 18 | 18 |
|  |  |  | River water samples | 0.018 | 0.038 | 0.019 | 0.076 | 6 | 6 |
|  |  | Desmethlycitalopram | Recycled water | <LOR | 0.015 | 0.011 | 0.029 | 9 | 6 |
|  |  | Diatrizoate | Recycled water | <LOR | 0.025 | 0.070 | 0.3 | 44 | 6 |
|  |  |  | Reference | <LOR | 0.0030 | 0.0080 | 0.028 | 22 | 3 |
|  |  |  | River water samples | <LOR | 0.018 | 0.053 | 0.15 | 8 | 1 |
|  |  | Diltiazem | Recycled water | <LOR | 0.00019 | 0.00069 | 0.0036 | 35 | 3 |
|  |  | Doxylamine | Recycled water | <LOR | 0.016 | 0.033 | 0.082 | 9 | 2 |
|  |  | Fluconazole | Recycled water | 0.0028 | 0.043 | 0.026 | 0.10 | 35 | 35 |
|  |  |  | River water samples | <LOR | 0.0070 | 0.0038 | 0.011 | 6 | 5 |
|  |  | Gabapentin | Recycled water | <LOR | 0.066 | 0.17 | 0.8 | 44 | 21 |
|  |  |  | Reference | <LOR | 0.0045 | 0.012 | 0.045 | 22 | 3 |
|  |  |  | River water samples | <LOR | 0.02 | 0.056 | 0.16 | 8 | 1 |
|  |  | Lamotrigine | Recycled water | <LOR | 0.49 | 0.59 | 2.7 | 44 | 40 |
|  |  |  | River water samples | <LOR | 0.12 | 0.10 | 0.33 | 8 | 6 |
|  |  | Lidocaine | Recycled water | 0.0028 | 0.013 | 0.018 | 0.10 | 35 | 35 |
|  |  |  | River water samples | <LOR | 0.017 | 0.013 | 0.027 | 6 | 5 |
|  |  | Methamphetamine | Recycled water | <LOR | 0.0041 | 0.0052 | 0.013 | 9 | 4 |
|  |  | Metoprolol | Recycled water | <LOR | 0.082 | 0.070 | 0.26 | 44 | 35 |
|  |  |  | River water samples | <LOR | 0.0054 | 0.0088 | 0.021 | 8 | 3 |
|  |  | Octocrylene | Recycled water | <LOR | 0.17 | 0.08 | 0.31 | 9 | 8 |
|  |  |  | Reference | <LOR | 0.11 | 0.080 | 0.18 | 4 | 3 |
|  |  | Oxazepam | Recycled water | <LOR | 0.015 | 0.021 | 0.05 | 9 | 4 |
|  |  | Paraben Propyl | Recycled water | <LOR | 0.077 | 0.18 | 0.88 | 35 | 17 |
|  |  |  | Reference | <LOR | 0.028 | 0.0097 | 0.044 | 18 | 17 |
|  |  |  | River water samples | <LOR | 0.00092 | 0.0022 | 0.0055 | 6 | 1 |
|  |  | Phenytoin | Recycled water | <LOR | 0.0081 | 0.010 | 0.026 | 9 | 4 |
|  |  | Tebuconazole | Recycled water | <LOR | 0.062 | 0.056 | 0.16 | 44 | 37 |
|  |  |  | Reference | <LOR | 0.0060 | 0.0049 | 0.014 | 22 | 14 |
|  |  |  | River water samples | <LOR | 0.028 | 0.029 | 0.062 | 8 | 5 |
|  |  | Temazepam | Recycled water | <LOR | 0.051 | 0.047 | 0.13 | 9 | 7 |
|  |  | Tramadol | Recycled water | <LOR | 0.018 | 0.0089 | 0.043 | 44 | 40 |
|  |  |  | River water samples | <LOR | 0.012 | 0.012 | 0.026 | 8 | 5 |
|  |  | Valsartan | Recycled water | <LOR | 0.053 | 0.042 | 0.11 | 9 | 7 |
|  |  | Venlafaxine | Recycled water | <LOR | 0.00013 | 0.00090 | 0.006 | 44 | 1 |
|  | SVOCs | Benzaldehyde | Recycled water | 0.01 | 0.16 | 0.23 | 0.61 | 9 | 9 |
|  |  |  | Reference | <LOR | 0.01 | 0.011 | 0.02 | 4 | 2 |
|  |  |  | River water samples | 0.01 | 0.085 | 0.10 | 0.16 | 2 | 2 |
|  |  | C1 alkyl biphenyls | Recycled water | <LOR | 0.001 | 0.0033 | 0.01 | 9 | 1 |
|  |  |  | River water samples | <LOR | 0.01 | 0.014 | 0.02 | 2 | 1 |
|  |  | C1 alkyl dibenzothiophenes | Recycled water | <LOR | 0.0011 | 0.0033 | 0.01 | 9 | 1 |
|  |  | C2 alkyl biphenyls | Recycled water | <LOR | 0.014 | 0.026 | 0.08 | 9 | 4 |
|  |  | C3 alkyl biphenyls | Recycled water | <LOR | 0.0088 | 0.026 | 0.08 | 9 | 1 |
|  |  | Mestranol | Recycled water | <LOR | 2.55 | 10.84 | 46 | 18 | 1 |
|  |  | Phenol | Recycled water | <LOR | 0.22 | 0.66 | 2 | 9 | 3 |
|  |  |  | Reference | <LOR | 0.0025 | 0.005 | 0.01 | 4 | 1 |
|  |  | 2,4.Di.tert.butyl.phenol | Recycled water | 15 | 19.11 | 4.53 | 27 | 9 | 9 |
|  |  |  | Reference | 2.5 | 10.7 | 12.31 | 29 | 4 | 4 |
|  |  |  | River water samples | 17 | 28.5 | 16.26 | 40 | 2 | 2 |
|  |  | 2,6.Dichlorophenol | Recycled water | <LOR | 0.0011 | 0.0032 | 0.01 | 18 | 2 |
|  |  | 3.Ethyl.phenol | Recycled water | <LOR | 16.68 | 49.99 | 150 | 9 | 5 |
|  |  |  | Reference | <LOR | 0.01 | 0.02 | 0.04 | 4 | 1 |
|  |  |  | River water samples | 0.01 | 0.015 | 0.0070 | 0.02 | 2 | 2 |
|  |  | 7,9.Di.tert.butyl.1.oxaspiro  .4.5.deca.6.9.diene.2.8.dione | Recycled water | <LOR | 0.091 | 0.11 | 0.29 | 9 | 4 |
|  |  |  | Reference | <LOR | 0.042 | 0.034 | 0.07 | 4 | 3 |

Table S5. Summary statistics for individual emerging contaminants detected in soil samples for each sampling year and at each type of site (i.e., recycled water irrigated site or reference site). Where a chemical was not detected in any samples at a sampling point, it was excluded from this table. Min = minimum; SD = standard deviation; Max = Maximum. LOR = Limit of reporting.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Soil samples** | | | | | | | | | |
| **Year** | **Analyte group** | **Analyte** | **Site type** | **Min**  **(µg/kg)** | **Mean**  **(µg/kg)** | **SD**  **(µg/kg)** | **Max**  **(µg/kg)** | **Total sample size** | **Detections sample size** |
| 2023 | EDCs | Progesterone | Recycled water | <LOR | 0.045 | 0.27 | 1.7 | 37 | 1 |
|  |  |  | Reference | <LOR | 0.10 | 0.36 | 1.2 | 11 | 1 |
|  |  | tert-octyl phenol | Recycled water | <LOR | 0.16 | 0.71 | 3.1 | 37 | 2 |
|  |  |  | Reference | <LOR | 1.58 | 2.38 | 6 | 11 | 5 |
|  | PAHs | Acenaphthene | Recycled water | <LOR | 0.17 | 0.54 | 2.2 | 33 | 4 |
|  |  | Acenaphthylene | Recycled water | <LOR | 0.024 | 0.083 | 0.4 | 33 | 3 |
|  |  | Anthracene | Recycled water | <LOR | 0.52 | 0.81 | 2.5 | 33 | 12 |
|  |  |  | Reference | <LOR | 0.38 | 0.90 | 2.7 | 9 | 2 |
|  |  | Benz(a)anthracene | Recycled water | <LOR | 3.43 | 8.83 | 49 | 33 | 19 |
|  |  |  | Reference | <LOR | 4.85 | 5.70 | 14 | 9 | 6 |
|  |  | Benzo(a)pyrene | Recycled water | <LOR | 4.25 | 11.57 | 65 | 33 | 21 |
|  |  |  | Reference | <LOR | 6.6 | 7.74 | 21 | 9 | 6 |
|  |  | Benzo(b,J)fluoranthene | Recycled water | <LOR | 3.85 | 10.57 | 59 | 33 | 22 |
|  |  |  | Reference | <LOR | 6.2 | 6.74 | 16 | 9 | 6 |
|  |  | Benzo(c)phenanthrene | Recycled water | <LOR | 0.060 | 0.24 | 1.1 | 33 | 2 |
|  |  |  | Reference | <LOR | 0.044 | 0.13 | 0.4 | 9 | 1 |
|  |  | Benzo(e)pyrene | Recycled water | <LOR | 2.76 | 7.24 | 40 | 33 | 21 |
|  |  |  | Reference | <LOR | 4.03 | 4.34 | 12 | 9 | 6 |
|  |  | Benzo(ghi)perylene | Recycled water | <LOR | 4.55 | 10.26 | 40 | 33 | 20 |
|  |  |  | Reference | <LOR | 16.72 | 19.50 | 50 | 9 | 7 |
|  |  | Benzo(k)fluoranthene | Recycled water | <LOR | 0.95 | 4.05 | 23 | 33 | 8 |
|  |  |  | Reference | <LOR | 0.26 | 0.8 | 2.4 | 9 | 1 |
|  |  | C1 alkyl phenanthrenes | Recycled water | <LOR | 0.78 | 2.90 | 16 | 33 | 4 |
|  |  |  | Reference | <LOR | 0.68 | 1.39 | 3.7 | 9 | 2 |
|  |  | C2 alkyl napthalenes | Recycled water | <LOR | 9.04 | 10.09 | 31 | 33 | 26 |
|  |  |  | Reference | <LOR | 9.66 | 9.94 | 25 | 9 | 8 |
|  |  | C2 alkyl phenanthrenes | Reference | <LOR | 0.2 | 0.6 | 1.8 | 9 | 1 |
|  |  |  | Reference | <LOR | 0.13 | 0.4 | 1.2 | 9 | 1 |
|  |  | Chrysene | Recycled water | <LOR | 4.97 | 12.98 | 74 | 33 | 28 |
|  |  |  | Reference | <LOR | 7.85 | 6.41 | 19 | 9 | 8 |
|  |  | Dibenz(ah)anthracene | Recycled water | <LOR | 3.63 | 20.88 | 120 | 33 | 1 |
|  |  |  | Reference | <LOR | 28.11 | 40.39 | 100 | 9 | 4 |
|  |  | Dibenzo(a.e)pyrene | Recycled water | <LOR | 0.5 | 2.8 | 18 | 66 | 2 |
|  |  |  | Reference | <LOR | 0.23 | 0.73 | 2.9 | 18 | 2 |
|  |  | Dibenzo(a.i)pyrene | Reference | <LOR | 0.61 | 1.25 | 3.4 | 9 | 2 |
|  |  | Fluoranthene | Recycled water | <LOR | 6.40 | 11.67 | 66 | 33 | 29 |
|  |  |  | Reference | <LOR | 13.86 | 11.55 | 33 | 9 | 8 |
|  |  | Fluorene | Recycled water | <LOR | 0.75 | 1.52 | 6 | 33 | 10 |
|  |  |  | Reference | <LOR | 0.033 | 0.1 | 0.3 | 9 | 1 |
|  |  | Indeno(1.2.3.c.d)pyrene | Recycled water | <LOR | 2.54 | 6.23 | 35 | 33 | 19 |
|  |  |  | Reference | <LOR | 5.75 | 5.28 | 14 | 9 | 7 |
|  |  | Naphthalene | Recycled water | <LOR | 20.05 | 29.47 | 110 | 33 | 31 |
|  |  |  | Reference | <LOR | 33.68 | 31.75 | 75 | 9 | 8 |
|  |  | Perylene | Recycled water | <LOR | 0.5 | 2.09 | 12 | 33 | 6 |
|  |  |  | Reference | <LOR | 0.36 | 0.59 | 1.6 | 9 | 3 |
|  |  | Phenanthrene | Recycled water | <LOR | 2.60 | 3.87 | 19 | 33 | 26 |
|  |  |  | Reference | <LOR | 6.55 | 5.77 | 16 | 9 | 7 |
|  |  | Pyrene | Recycled water | <LOR | 12.63 | 15.44 | 74 | 33 | 30 |
|  |  |  | Reference | <LOR | 18.3 | 11.05 | 36 | 9 | 8 |
|  |  | 1-Methyl naphthalene | Recycled water | <LOR | 3.9 | 4.29 | 12 | 33 | 24 |
|  |  |  | Reference | <LOR | 5.7 | 6.18 | 16 | 9 | 5 |
|  |  | 2-Methyl naphthalene | Recycled water | <LOR | 9.76 | 9.97 | 30 | 33 | 26 |
|  |  |  | Reference | <LOR | 12.56 | 12.47 | 32 | 9 | 7 |
|  |  | 5-Nitroacenaphthene | Recycled water | <LOR | 0.42 | 2.43 | 14 | 33 | 1 |
|  | Pesticides | Azoxystrobin | Recycled water | <LOR | 51.21 | 62.64 | 200 | 33 | 27 |
|  |  |  | Reference | <LOR | 12.08 | 34.10 | 103 | 9 | 4 |
|  |  | Boscalid | Recycled water | <LOR | 56.39 | 50.0 | 130 | 33 | 20 |
|  |  |  | Reference | <LOR | 7.3 | 21.62 | 65 | 9 | 3 |
|  |  | Carbaryl | Recycled water | <LOR | 0.018 | 0.10 | 0.6 | 33 | 1 |
|  |  |  | Reference | <LOR | 0.055 | 0.16 | 0.5 | 9 | 1 |
|  |  | Chlorantraniliprole | Recycled water | <LOR | 9.41 | 8.30 | 23 | 33 | 21 |
|  |  |  | Reference | <LOR | 1.94 | 5.64 | 17 | 9 | 2 |
|  |  | Chlorpyriphos | Recycled water | <LOR | 0.49 | 1.11 | 5.6 | 33 | 11 |
|  |  |  | Reference | <LOR | 0.6 | 1.04 | 2.5 | 9 | 3 |
|  |  | Cyazofamid | Recycled water | <LOR | 3.88 | 10.24 | 51 | 33 | 12 |
|  |  |  | Reference | <LOR | 1.7 | 4.97 | 15 | 9 | 2 |
|  |  | Cyprodinil | Recycled water | <LOR | 18.77 | 37.97 | 200 | 33 | 20 |
|  |  |  | Reference | <LOR | 0.48 | 1.46 | 4.4 | 9 | 1 |
|  |  | DDD.p.p | Recycled water | <LOR | 0.86 | 1.77 | 5.9 | 33 | 7 |
|  |  | DDE.p.p | Recycled water | <LOR | 24.24 | 49.93 | 150 | 33 | 11 |
|  |  | DDT.p.p | Recycled water | <LOR | 0.039 | 0.12 | 0.5 | 33 | 3 |
|  |  | Deltamethrin | Recycled water | <LOR | 0.27 | 0.94 | 4.6 | 33 | 3 |
|  |  | Diflufenican | Recycled water | <LOR | 0.93 | 3.14 | 14 | 33 | 7 |
|  |  | Epoxiconazole | Reference | <LOR | 0.077 | 0.23 | 0.7 | 9 | 1 |
|  |  | Ethofumesate | Recycled water | <LOR | 0.086 | 0.25 | 1.2 | 33 | 4 |
|  |  |  | Reference | <LOR | 146.33 | 266.78 | 650 | 9 | 5 |
|  |  | Fipronil | Recycled water | <LOR | 0.51 | 0.92 | 4.1 | 33 | 13 |
|  |  |  | Reference | <LOR | 10.33 | 21.16 | 57 | 9 | 2 |
|  |  | Floupicolide | Recycled water | <LOR | 70.06 | 90.42 | 300 | 33 | 20 |
|  |  |  | Reference | <LOR | 112.22 | 184.37 | 480 | 9 | 3 |
|  |  | Flubendiamide | Recycled water | <LOR | 39.66 | 37.46 | 120 | 33 | 20 |
|  |  |  | Reference | <LOR | 7 | 21 | 63 | 9 | 1 |
|  |  | Fludioxonil | Recycled water | <LOR | 53.6 | 58.72 | 270 | 33 | 20 |
|  |  |  | Reference | <LOR | 4.77 | 14.33 | 43 | 9 | 1 |
|  |  | Flutriafol | Recycled water | <LOR | 0.28 | 0.36 | 1.3 | 33 | 15 |
|  |  |  | Reference | <LOR | 0.36 | 0.30 | 1 | 9 | 7 |
|  |  | Imidacloprid | Recycled water | <LOR | 54.86 | 74.19 | 270 | 33 | 26 |
|  |  |  | Reference | <LOR | 22.43 | 43.40 | 116 | 9 | 3 |
|  |  | Indoxacarb | Recycled water | <LOR | 26.33 | 28.55 | 92 | 33 | 20 |
|  |  |  | Reference | <LOR | 5 | 15 | 45 | 9 | 1 |
|  |  | Metalaxyl | Recycled water | <LOR | 0.20 | 0.44 | 1.6 | 33 | 7 |
|  |  |  | Reference | <LOR | 0.76 | 1.6 | 4.5 | 9 | 2 |
|  |  | Methomyl | Recycled water | <LOR | 0.03 | 0.10 | 0.4 | 33 | 3 |
|  |  | Metolachlor | Recycled water | <LOR | 7.46 | 11.98 | 60 | 33 | 20 |
|  |  |  | Reference | <LOR | 4.76 | 7.43 | 18 | 9 | 3 |
|  |  | Novaluron | Recycled water | <LOR | 6.9 | 7.1 | 24 | 33 | 20 |
|  |  |  | Reference | <LOR | 1.22 | 3.66 | 11 | 9 | 1 |
|  |  | Oxadixyl | Recycled water | <LOR | 0.18 | 0.3 | 1.2 | 33 | 8 |
|  |  | Pendimethalin | Recycled water | <LOR | 129.393 | 184.80 | 740 | 33 | 20 |
|  |  |  | Reference | <LOR | 57.77 | 88.70 | 200 | 9 | 3 |
|  |  | Pentachlorophenol | Recycled water | <LOR | 0.33 | 1.47 | 8.3 | 33 | 3 |
|  |  | Prochloraz | Recycled water | <LOR | 4.19 | 4.49 | 13 | 33 | 20 |
|  |  |  | Reference | <LOR | 0.64 | 1.93 | 5.8 | 9 | 1 |
|  |  | Procymidone | Recycled water | <LOR | 0.12 | 0.27 | 1 | 33 | 6 |
|  |  | Prometryn | Recycled water | <LOR | 96.24 | 233.75 | 1100 | 33 | 13 |
|  |  |  | Reference | <LOR | 34.44 | 103.33 | 310 | 9 | 1 |
|  |  | Propamocarb | Reference | <LOR | 0.033 | 0.1 | 0.3 | 9 | 1 |
|  |  | Propiconazole | Recycled water | <LOR | 0.23 | 0.44 | 1.9 | 66 | 19 |
|  |  |  | Reference | <LOR | 0.077 | 0.22 | 0.8 | 18 | 2 |
|  |  | Propyzamide | Recycled water | <LOR | 2.34 | 3.00 | 14 | 33 | 20 |
|  |  |  | Reference | <LOR | 0.6 | 1.96 | 5.9 | 9 | 1 |
|  |  | Pymetrozine | Recycled water | <LOR | 0.024 | 0.10 | 0.5 | 33 | 2 |
|  |  |  | Reference | <LOR | 0.066 | 0.2 | 0.6 | 9 | 1 |
|  |  | Pyraclostrobin | Recycled water | <LOR | 17.44 | 23.84 | 82 | 33 | 20 |
|  |  |  | Reference | <LOR | 51.44 | 93.38 | 220 | 9 | 3 |
|  |  | Spinosad A | Recycled water | <LOR | 0.018 | 0.072 | 0.3 | 33 | 2 |
|  |  | Spinosad D | Recycled water | <LOR | 0.087 | 0.1 | 0.6 | 33 | 7 |
|  |  |  | Reference | <LOR | 0.41 | 0.73 | 1.8 | 9 | 3 |
|  |  | Spirotetramat | Recycled water | <LOR | 0.030 | 0.12 | 0.6 | 33 | 2 |
|  |  | Spirotetramat.enol | Recycled water | <LOR | 0.1 | 0.21 | 0.8 | 33 | 7 |
|  |  | Tebuthiuron | Recycled water | <LOR | 0.23 | 0.3 | 1.1 | 33 | 13 |
|  |  |  | Reference | <LOR | 0.033 | 0.1 | 0.3 | 9 | 1 |
|  |  | Thiabendazole | Recycled water | <LOR | 0.0090 | 0.052 | 0.3 | 33 | 1 |
|  |  | Triadimenol | Reference | <LOR | 0.022 | 0.094 | 0.4 | 18 | 1 |
|  |  | Trifloxystrobin | Recycled water | <LOR | 0.22 | 0.33 | 1.1 | 33 | 12 |
|  |  |  | Reference | <LOR | 0.066 | 0.2 | 0.6 | 9 | 1 |
|  |  | Triflumuron | Reference | <LOR | 0.077 | 0.1 | 0.4 | 9 | 2 |
|  |  | Trifluralin | Recycled water | <LOR | 0.17 | 0.32 | 0.8 | 33 | 8 |
|  | PFAS | PFOA | Recycled water | <LOR | 1.42 | 2.76 | 10.6 | 33 | 8 |
|  |  | PFOS | Recycled water | <LOR | 2.70 | 2.57 | 8.46 | 33 | 25 |
|  |  |  | Reference | <LOR | 1.21 | 1.45 | 3.05 | 9 | 4 |
|  | Phthalates | BBP | Reference | <LOR | 0.12 | 0.36 | 1.1 | 9 | 1 |
|  |  | BEBP | Recycled water | <LOR | 5.15 | 29.59 | 170 | 33 | 1 |
|  |  | DMEP | Recycled water | <LOR | 0.66 | 3.82 | 22 | 33 | 1 |
|  |  | DEHP | Recycled water | <LOR | 21.78 | 22.92 | 71 | 33 | 26 |
|  |  |  | Reference | <LOR | 28.711 | 16.97 | 46 | 9 | 8 |
|  |  | DnOP | Recycled water | <LOR | 7.18 | 12.17 | 38 | 33 | 13 |
|  |  |  | Reference | <LOR | 15.88 | 15.31 | 33 | 9 | 5 |
|  |  | DBP | Recycled water | <LOR | 14.58 | 14.44 | 50 | 33 | 27 |
|  |  |  | Reference | <LOR | 10.31 | 12.46 | 40 | 9 | 8 |
|  |  | DEP | Recycled water | <LOR | 0.61 | 1.31 | 5.4 | 33 | 9 |
|  |  |  | Reference | <LOR | 0.54 | 0.95 | 2.4 | 9 | 3 |
|  |  | DIBP | Recycled water | <LOR | 4.97 | 6.8 | 26 | 33 | 23 |
|  |  |  | Reference | <LOR | 6.75 | 8.1 | 20 | 9 | 7 |
|  |  | DMP | Recycled water | <LOR | 0.34 | 0.95 | 4.4 | 33 | 5 |
|  |  |  | Reference | <LOR | 0.1 | 0.3 | 0.9 | 9 | 1 |
|  | PPCPs | Carbamazepine | Recycled water | <LOR | 0.21 | 0.6 | 2.3 | 37 | 4 |
|  |  |  | Reference | <LOR | 0.1 | 0.48 | 1.6 | 11 | 1 |
|  |  | Ketoprofen | Recycled water | <LOR | 2.27 | 13.80 | 84 | 37 | 1 |
|  |  | Lamotrigine | Recycled water | <LOR | 0.11 | 0.52 | 3 | 37 | 2 |
|  |  | Paraben methyl | Recycled water | 6.9 | 17.27 | 15.46 | 40 | 4 | 4 |
|  |  |  | Reference | 8.2 | 12.6 | 6.22 | 17 | 2 | 2 |
|  | SVOCs | a.Naphthylamine | Recycled water | <LOR | 0.11 | 0.66 | 3.8 | 33 | 1 |
|  |  | a.Terpineol | Recycled water | <LOR | 2.62 | 9.85 | 45 | 33 | 4 |
|  |  | Acetophenone | Recycled water | <LOR | 3.21 | 5.84 | 20 | 33 | 10 |
|  |  |  | Reference | <LOR | 9.88 | 9.79 | 23 | 9 | 5 |
|  |  | Benzothiazole | Recycled water | 97 | 418.63 | 289.30 | 1100 | 33 | 33 |
|  |  |  | Reference | <LOR | 493.88 | 378.30 | 980 | 9 | 8 |
|  |  | Biphenyl | Recycled water | <LOR | 2.72 | 4.04 | 14 | 33 | 12 |
|  |  |  | Reference | <LOR | 2.88 | 2.84 | 7 | 9 | 5 |
|  |  | Bis.2.chloroethoxy.methane | Reference | <LOR | 0.17 | 0.53 | 1.6 | 9 | 1 |
|  |  | Bis.2.chloroethyl.ether | Reference | <LOR | 0.15 | 0.32 | 0.9 | 9 | 2 |
|  |  | Bis.ethylhexyl.sebacate | Recycled water | <LOR | 83.63 | 123.44 | 420 | 33 | 20 |
|  |  |  | Reference | <LOR | 181.05 | 174.17 | 400 | 9 | 7 |
|  |  | Bumetrizole | Recycled water | <LOR | 3.84 | 9.11 | 38 | 33 | 12 |
|  |  |  | Reference | <LOR | 0.88 | 2.66 | 8 | 9 | 1 |
|  |  | Butylhydroxyanisole (BHA) | Recycled water | <LOR | 5.60 | 26.62 | 150 | 33 | 2 |
|  |  | Butylhydroxytoluene (BHT) | Recycled water | <LOR | 0.015 | 0.061 | 0.3 | 33 | 2 |
|  |  |  | Reference | <LOR | 0.044 | 0.13 | 0.4 | 9 | 1 |
|  |  | C1 alkyl biphenyls | Recycled water | <LOR | 0.27 | 1.58 | 9.1 | 33 | 1 |
|  |  |  | Reference | <LOR | 0.24 | 0.73 | 2.2 | 9 | 1 |
|  |  | C2 alkyl biphenyls | Reference | <LOR | 0.23 | 0.7 | 2.1 | 9 | 1 |
|  |  | C3 alkyl naphthalenes | Recycled water | <LOR | 2.86 | 6.84 | 38 | 33 | 20 |
|  |  |  | Reference | <LOR | 2.1 | 1.66 | 4 | 9 | 8 |
|  |  | Carbazole | Recycled water | <LOR | 0.042 | 0.24 | 1.4 | 33 | 1 |
|  |  |  | Reference | <LOR | 0.16 | 0.33 | 0.9 | 9 | 2 |
|  |  | Cumene | Recycled water | <LOR | 0.47 | 0.66 | 1.8 | 33 | 12 |
|  |  |  | Reference | <LOR | 0.13 | 0.26 | 0.7 | 9 | 2 |
|  |  | Decamethyl-  cyclopentasiloxane | Recycled water | <LOR | 1.66 | 5.83 | 28 | 33 | 4 |
|  |  | Dibenzofuran | Recycled water | <LOR | 0.55 | 1.50 | 6.7 | 33 | 9 |
|  |  |  | Reference | <LOR | 0.14 | 0.30 | 0.8 | 9 | 2 |
|  |  | Dioctyl.adipate (DOA) | Recycled water | <LOR | 51.75 | 57.75 | 180 | 33 | 21 |
|  |  |  | Reference | <LOR | 45.66 | 40.23 | 100 | 9 | 7 |
|  |  | Diphenyl.amine | Recycled water | <LOR | 0.17 | 1.02 | 5.9 | 33 | 1 |
|  |  | E.Caprolactam | Recycled water | <LOR | 153.54 | 232.11 | 710 | 33 | 22 |
|  |  |  | Reference | <LOR | 215.77 | 263.99 | 700 | 9 | 6 |
|  |  | Isophorone | Recycled water | <LOR | 1.24 | 4.47 | 25 | 33 | 7 |
|  |  |  | Reference | <LOR | 1.1 | 2.20 | 5.6 | 9 | 2 |
|  |  | m.p.Cresol | Recycled water | <LOR | 2.3 | 3.82 | 14 | 33 | 24 |
|  |  |  | Reference | <LOR | 4.94 | 5.61 | 14 | 9 | 7 |
|  |  | Methyl.caprolactam | Recycled water | <LOR | 0.12 | 0.73 | 4.2 | 33 | 1 |
|  |  |  | Reference | <LOR | 0.36 | 1.1 | 3.3 | 9 | 1 |
|  |  | N.Nitrosodi.N.butylamine | Recycled water | <LOR | 5.54 | 13.38 | 65 | 33 | 9 |
|  |  |  | Reference | <LOR | 7.55 | 15.12 | 38 | 9 | 2 |
|  |  | Octamethyltetrasiloxane | Recycled water | <LOR | 0.03 | 0.13 | 0.7 | 33 | 3 |
|  |  | Phenol | Recycled water | <LOR | 3.18 | 3.68 | 14 | 33 | 30 |
|  |  |  | Reference | <LOR | 6.75 | 6.38 | 15 | 9 | 7 |
|  |  | Stearamide | Recycled water | <LOR | 22.81 | 21.55 | 70 | 33 | 32 |
|  |  |  | Reference | <LOR | 29.06 | 27.04 | 71 | 9 | 8 |
|  |  | Styrene | Recycled water | <LOR | 26.27 | 31.20 | 140 | 33 | 30 |
|  |  |  | Reference | <LOR | 44.77 | 40.71 | 110 | 9 | 8 |
|  |  | tert.Butyl.Benzene | Recycled water | <LOR | 0.027 | 0.11 | 0.6 | 33 | 2 |
|  |  | Tetramethyl.phenol.isomers | Recycled water | <LOR | 0.28 | 1.61 | 9.3 | 33 | 1 |
|  |  |  | Reference | <LOR | 3.11 | 9.33 | 28 | 9 | 1 |
|  |  | Tris.2.4.di.tert.  butylphenyl.phosphate | Recycled water | <LOR | 24.45 | 70.99 | 400 | 33 | 13 |
|  |  |  | Reference | <LOR | 25.77 | 35.52 | 110 | 9 | 5 |
|  |  | Tris.2.4.dimethylphenyl.  phosphate | Recycled water | <LOR | 29.15 | 152.9 | 880 | 33 | 5 |
|  |  |  | Reference | <LOR | 54.444 | 109.44 | 280 | 9 | 2 |
|  |  | 1.2.4.Trimethyl.benzene | Recycled water | <LOR | 0.99 | 1.54 | 4.6 | 33 | 12 |
|  |  |  | Reference | <LOR | 0.33 | 0.69 | 1.9 | 9 | 2 |
|  |  | 1.2.Dichlorobenzene | Recycled water | <LOR | 0.56 | 0.75 | 2.4 | 33 | 20 |
|  |  |  | Reference | <LOR | 0.93 | 1.21 | 3 | 9 | 7 |
|  |  | 1.3.Di.tert.butylbenzene | Recycled water | <LOR | 0.28 | 0.80 | 3 | 33 | 5 |
|  |  | 1.3.Dichlorobenzene | Recycled water | <LOR | 0.94 | 2.48 | 10 | 33 | 6 |
|  |  |  | Reference | <LOR | 0.73 | 1.45 | 3.5 | 9 | 2 |
|  |  | 1.4.Dichlorobenzene | Recycled water | <LOR | 0.96 | 1.33 | 6 | 33 | 21 |
|  |  |  | Reference | <LOR | 0.25 | 0.42 | 1.2 | 9 | 3 |
|  |  | 1.4.Dinitrobenzene | Reference | <LOR | 2.16 | 3.75 | 10 | 9 | 3 |
|  |  | 1H.Benzotriazole | Recycled water | <LOR | 0.090 | 0.40 | 2.2 | 33 | 2 |
|  |  |  | Reference | <LOR | 2.88 | 6.16 | 19 | 9 | 4 |
|  |  | 2.4.6.Trichlorophenol | Recycled water | <LOR | 6.37 | 13.53 | 60 | 33 | 16 |
|  |  |  | Reference | <LOR | 0.81 | 2.21 | 6.7 | 9 | 2 |
|  |  | 2.4.Di.tert.butyl.phenol | Recycled water | <LOR | 0.19 | 0.46 | 2 | 33 | 6 |
|  |  |  | Reference | <LOR | 1.08 | 2.97 | 9 | 9 | 2 |
|  |  | 2.4.Dichlorophenol | Recycled water | <LOR | 0.50 | 1.56 | 8.1 | 33 | 9 |
|  |  |  | Reference | <LOR | 0.033 | 0.1 | 0.3 | 9 | 1 |
|  |  | 2.4.Dimethyl.phenol | Recycled water | <LOR | 0.29 | 1.14 | 6.2 | 33 | 3 |
|  |  | 2.Chlorophenol | Recycled water | <LOR | 0.24 | 1.00 | 5 | 33 | 2 |
|  |  | 2.Cresol | Recycled water | <LOR | 3.41 | 12.71 | 65 | 33 | 10 |
|  |  |  | Reference | <LOR | 1.01 | 2.33 | 7.1 | 9 | 3 |
|  |  | 2.tert.Butyl.phenol | Recycled water | <LOR | 0.36 | 2.08 | 12 | 33 | 1 |
|  |  |  | Reference | <LOR | 3.88 | 11.66 | 35 | 9 | 1 |
|  |  | 2.Toluidine | Recycled water | <LOR | 0.030 | 0.12 | 0.6 | 33 | 2 |
|  |  | 2.Toluidine | Reference | <LOR | 0.088 | 0.17 | 0.4 | 9 | 2 |
|  |  | 4.Chloro.3.cresol | Recycled water | <LOR | 0.42 | 1.37 | 7.1 | 33 | 4 |
|  |  |  | Reference | <LOR | 0.12 | 0.36 | 1.1 | 9 | 1 |
| 2024 | PFAS | PFDA | Recycled water | <LOR | 0.14 | 0.26 | 0.57 | 8 | 2 |
|  |  | PFOS | Recycled water | 1.18 | 3.03 | 2.7 | 9.27 | 8 | 8 |
|  |  |  | Reference | <LOR | 1.28 | 1.47 | 2.64 | 4 | 2 |

Table S6. Summary statistics for individual emerging contaminants detected in plant samples for each sampling year and at each type of site (i.e., recycled water irrigated site or reference site). Where a chemical was not detected in any samples at a sampling point, it was excluded from this table. Min = minimum; SD = standard deviation; Max = Maximum. LOR = Limit of reporting.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Plant samples** | | | | | | | | | |
| **Year** | **Analyte group** | **Analyte** | **Site type** | **Min**  **(µg/kg)** | **Mean**  **(µg/kg)** | **SD**  **(µg/kg)** | **Max**  **(µg/kg)** | **Total sample size** | **Detections sample size** |
| 2023 | EDCs | tert-octyl phenol | Recycled water | <LOR | 3.45 | 25.27 | 240 | 91 | 7 |
|  | PAHs | Acenaphthene | Recycled water | <LOR | 10.16 | 21.49 | 78 | 79 | 17 |
|  |  |  | Reference | <LOR | 5.136 | 16.68 | 61 | 22 | 2 |
|  |  | Acenaphthylene | Recycled water | <LOR | 1.32 | 7.20 | 51 | 79 | 3 |
|  |  | Benz(a)anthracene | Recycled water | <LOR | 0.93 | 8.32 | 74 | 79 | 1 |
|  |  | Benzo(a)pyrene | Recycled water | <LOR | 0.17 | 1.57 | 14 | 79 | 1 |
|  |  | Benzo(b,J)fluoranthene | Recycled water | <LOR | 0.63 | 5.62 | 50 | 79 | 1 |
|  |  | Benzo(e)pyrene | Recycled water | <LOR | 0.50 | 4.50 | 40 | 79 | 1 |
|  |  | Benzo(k)fluoranthene | Recycled water | <LOR | 0.98 | 8.77 | 78 | 79 | 1 |
|  |  |  | Reference | <LOR | 3.27 | 15.35 | 72 | 22 | 1 |
|  |  | C2 alkyl napthalenes | Recycled water | <LOR | 0.65 | 5.85 | 52 | 79 | 1 |
|  |  | Chrysene | Recycled water | <LOR | 1.70 | 15.18 | 135 | 79 | 1 |
|  |  | Fluoranthene | Recycled water | <LOR | 0.21 | 1.45 | 12 | 79 | 2 |
|  |  | Fluorene | Recycled water | <LOR | 40.37 | 116.79 | 580 | 79 | 10 |
|  |  |  | Reference | <LOR | 23.63 | 76.75 | 280 | 22 | 2 |
|  |  | Naphthalene | Recycled water | <LOR | 100.82 | 169.25 | 760 | 79 | 31 |
|  |  |  | Reference | <LOR | 142.27 | 208.64 | 680 | 22 | 9 |
|  |  | Phenanthrene | Recycled water | <LOR | 15.93 | 30.51 | 120 | 79 | 21 |
|  |  |  | Reference | <LOR | 10.95 | 24.48 | 75 | 22 | 4 |
|  |  | Pyrene | Recycled water | <LOR | 0.10 | 0.90 | 8 | 79 | 1 |
|  |  | 1-Methyl naphthalene | Recycled water | <LOR | 3.24 | 13.43 | 77 | 79 | 7 |
|  |  | 2-Methyl naphthalene | Recycled water | <LOR | 3.97 | 11.88 | 64 | 79 | 11 |
|  | Pesticides | Acetamiprid | Recycled water | <LOR | 0.13 | 0.85 | 5.6 | 79 | 2 |
|  |  | Azoxystrobin | Recycled water | <LOR | 152.64 | 548.30 | 3200 | 79 | 14 |
|  |  | Boscalid | Recycled water | <LOR | 50.38 | 164.88 | 870 | 79 | 25 |
|  |  | Buprofezin | Recycled water | <LOR | 0.044 | 0.39 | 3.5 | 79 | 1 |
|  |  | Chlorantraniliprole | Recycled water | <LOR | 0.98 | 2.42 | 9.2 | 79 | 12 |
|  |  | Chlorpyriphos | Recycled water | <LOR | 3.46 | 17.43 | 140 | 79 | 11 |
|  |  | Cyazofamid | Recycled water | <LOR | 113.07 | 513.48 | 4100 | 79 | 10 |
|  |  | Cyprodinil | Recycled water | <LOR | 15.89 | 46.80 | 210 | 79 | 14 |
|  |  | DCPA | Recycled water | <LOR | 16.95 | 63.56 | 400 | 79 | 16 |
|  |  |  | Reference | <LOR | 2.18 | 5.01 | 18 | 22 | 4 |
|  |  | DDE.p.p | Recycled water | <LOR | 24.92 | 55.60 | 340 | 79 | 33 |
|  |  |  | Reference | <LOR | 2.04 | 4.59 | 14 | 22 | 4 |
|  |  | Diflufenican | Recycled water | <LOR | 0.2 | 1.48 | 12 | 79 | 3 |
|  |  | Dimethoate | Recycled water | <LOR | 0.48 | 3.94 | 35 | 79 | 2 |
|  |  | Epoxiconazole | Reference | <LOR | 0.26 | 1.25 | 5.9 | 22 | 1 |
|  |  | Ethiofencarb sulfoxide | Recycled water | <LOR | 2.88 | 12.27 | 77 | 79 | 5 |
|  |  | Ethofumesate | Recycled water | <LOR | 2.94 | 9.14 | 74 | 79 | 22 |
|  |  |  | Reference | <LOR | 476.04 | 1144.53 | 4700 | 22 | 10 |
|  |  | Fipronil | Recycled water | <LOR | 14.77 | 37.16 | 180 | 79 | 16 |
|  |  |  | Reference | <LOR | 22.36 | 50.17 | 170 | 22 | 4 |
|  |  | Floupicolide | Recycled water | <LOR | 112.27 | 280.29 | 1300 | 79 | 38 |
|  |  |  | Reference | <LOR | 1514.27 | 3434.74 | 11000 | 22 | 12 |
|  |  | Flubendiamide | Recycled water | <LOR | 68.27 | 193.45 | 1300 | 79 | 23 |
|  |  | Fludioxonil | Recycled water | <LOR | 21.037 | 59.43 | 400 | 79 | 21 |
|  |  | Imidacloprid | Recycled water | <LOR | 1369.94 | 4107.96 | 19000 | 79 | 28 |
|  |  |  | Reference | <LOR | 14.81 | 38.35 | 120 | 22 | 3 |
|  |  | Indoxacarb | Recycled water | <LOR | 119.52 | 329.97 | 2100 | 79 | 30 |
|  |  | Metalaxyl | Recycled water | <LOR | 5.82 | 15.37 | 86 | 79 | 14 |
|  |  |  | Reference | <LOR | 79.54 | 184.60 | 660 | 22 | 4 |
|  |  | Methomyl | Recycled water | <LOR | 1.30 | 6.10 | 39 | 79 | 6 |
|  |  | Metolachlor | Recycled water | <LOR | 1.40 | 5.09 | 31 | 79 | 7 |
|  |  | Novaluron | Recycled water | <LOR | 56.32 | 197.37 | 1500 | 79 | 21 |
|  |  | Pendimethalin | Recycled water | <LOR | 7.489 | 27.33 | 180 | 79 | 12 |
|  |  | Pentachlorophenol | Recycled water | <LOR | 3.49 | 10.59 | 50 | 79 | 9 |
|  |  |  | Reference | <LOR | 1.45 | 6.82 | 32 | 22 | 1 |
|  |  | Permethrin 1R-cis | Reference | <LOR | 325 | 718.7 | 2600 | 22 | 5 |
|  |  | Permethrin 1R-trans | Reference | <LOR | 188.63 | 416.83 | 1500 | 22 | 5 |
|  |  | Prometryn | Recycled water | <LOR | 16.47 | 60.82 | 380 | 79 | 13 |
|  |  |  | Reference | <LOR | 0.13 | 0.63 | 3 | 22 | 1 |
|  |  | Propamocarb | Recycled water | <LOR | 246.10 | 767.80 | 4700 | 79 | 14 |
|  |  |  | Reference | <LOR | 1274.18 | 2855.38 | 9000 | 22 | 8 |
|  |  | Propyzamide | Recycled water | <LOR | 2.32 | 7.96 | 37 | 79 | 7 |
|  |  | Pyraclostrobin | Recycled water | <LOR | 5.53 | 17.1 | 100 | 79 | 14 |
|  |  |  | Reference | <LOR | 583.72 | 1171.75 | 4000 | 22 | 12 |
|  |  | Spirotetramat | Recycled water | <LOR | 0.75 | 4.34 | 36 | 79 | 4 |
|  |  | Spirotetramat.enol | Recycled water | <LOR | 19.55 | 69.37 | 460 | 79 | 14 |
|  |  | Spirotetramat.enol.glucoside | Recycled water | <LOR | 0.56 | 2.27 | 16 | 79 | 6 |
|  | PFAS | PFBA | Recycled water | <LOR | 2.48 | 3.20 | 9.94 | 79 | 32 |
|  |  |  | Reference | <LOR | 1.20 | 2.72 | 9.6 | 22 | 4 |
|  |  | PFBS | Recycled water | <LOR | 7 | 25.12 | 154 | 79 | 7 |
|  |  |  | Reference | <LOR | 4.86 | 16.20 | 66 | 22 | 2 |
|  |  | PFHxA | Recycled water | <LOR | 0.055 | 0.49 | 4.37 | 79 | 1 |
|  |  | PFHxS | Recycled water | <LOR | 0.031 | 0.28 | 2.5 | 79 | 1 |
|  |  | PFOA | Recycled water | <LOR | 0.66 | 3.40 | 21.4 | 79 | 3 |
|  |  | PFOS | Recycled water | <LOR | 0.12 | 0.7 | 5.37 | 79 | 2 |
|  |  | PFPeA | Recycled water | <LOR | 0.78 | 3.47 | 19.4 | 79 | 4 |
|  | Phthalates | DEHP | Recycled water | <LOR | 350.18 | 951.48 | 6000 | 79 | 24 |
|  |  |  | Reference | <LOR | 148.86 | 421.34 | 1970 | 22 | 8 |
|  |  | DnOP | Recycled water | <LOR | 1.26 | 11.25 | 100 | 79 | 1 |
|  |  | DBP | Recycled water | <LOR | 380.34 | 924.81 | 6100 | 79 | 30 |
|  |  |  | Reference | <LOR | 140.90 | 199.35 | 620 | 22 | 12 |
|  |  | DEP | Recycled water | <LOR | 62.11 | 166.51 | 800 | 79 | 19 |
|  |  |  | Reference | <LOR | 11.36 | 27.55 | 95 | 22 | 4 |
|  |  | DMP | Recycled water | <LOR | 60.75 | 540.04 | 4800 | 79 | 1 |
|  |  |  | Reference | <LOR | 0.36 | 1.70 | 8 | 22 | 1 |
|  | PPCPs | Azithromycin | Recycled water | <LOR | 0.087 | 0.83 | 7.95 | 91 | 1 |
|  |  | DEET | Recycled water | <LOR | 0.12 | 0.9 | 8.033 | 158 | 3 |
|  |  | Paraben methyl | Recycled water | <LOR | 4.26 | 6.11 | 18 | 12 | 5 |
|  |  |  | Reference | <LOR | 3.74 | 3.4 | 7 | 5 | 3 |
|  |  | Telmisartan | Recycled water | <LOR | 0.38 | 2.42 | 15.8 | 79 | 2 |
|  | SVOCs | Acetophenone | Recycled water | <LOR | 177.21 | 455.01 | 2130 | 79 | 17 |
|  |  |  | Reference | <LOR | 225.5 | 491.83 | 1401 | 22 | 5 |
|  |  | Benzaldehyde | Recycled water | <LOR | 36.32 | 176.64 | 1300 | 79 | 5 |
|  |  | Benzothiazole | Recycled water | <LOR | 40.68 | 98.70 | 710 | 79 | 19 |
|  |  |  | Reference | <LOR | 90.36 | 114.13 | 430 | 22 | 11 |
|  |  | Biphenyl | Recycled water | <LOR | 202.17 | 394.35 | 1800 | 79 | 21 |
|  |  |  | Reference | <LOR | 292.72 | 418.44 | 1160 | 22 | 8 |
|  |  | Dibenzofuran | Recycled water | <LOR | 0.077 | 0.68 | 6.1 | 79 | 1 |
|  |  | Dioctyl.adipate (DOA) | Recycled water | <LOR | 612.15 | 2317.76 | 12820 | 79 | 11 |
|  |  |  | Reference | <LOR | 2983.13 | 5812.46 | 18009 | 22 | 8 |
|  |  | E.Caprolactam | Recycled water | <LOR | 149.36 | 675.93 | 5100 | 79 | 5 |
|  |  |  | Reference | <LOR | 25 | 117.26 | 550 | 22 | 1 |
|  |  | Irganox 1076 | Reference | <LOR | 168.63 | 547.18 | 1980 | 22 | 2 |
|  |  | Isophorone | Recycled water | <LOR | 535.69 | 1065.77 | 5320 | 79 | 22 |
|  |  |  | Reference | <LOR | 544.45 | 991.57 | 3190 | 22 | 7 |
|  |  | m.p.Cresol | Recycled water | <LOR | 189.10 | 274.21 | 1280 | 79 | 47 |
|  |  |  | Reference | <LOR | 127 | 189.92 | 690 | 22 | 11 |
|  |  | Phenol | Recycled water | <LOR | 316.20 | 590.28 | 2900 | 79 | 34 |
|  |  |  | Reference | <LOR | 187.72 | 306.48 | 1090 | 22 | 8 |
|  |  | Stearamide | Recycled water | <LOR | 116.59 | 231.40 | 1100 | 79 | 26 |
|  |  |  | Reference | <LOR | 146.22 | 228.65 | 660 | 22 | 11 |
|  |  | Styrene | Recycled water | <LOR | 105.27 | 201.42 | 640 | 79 | 22 |
|  |  |  | Reference | <LOR | 140.86 | 215.62 | 670 | 22 | 12 |
|  |  | Tris.2.4.di.tert.  butylphenyl.phosphate | Recycled water | <LOR | 224.05 | 571.59 | 2300 | 79 | 12 |
|  |  |  | Reference | <LOR | 139.54 | 440.52 | 1500 | 22 | 4 |
|  |  | Tris.2.4.dimethylphenyl.  phosphate | Recycled water | <LOR | 2.15 | 18.02 | 160 | 79 | 2 |
|  |  | 1.2.Dichlorobenzene | Recycled water | <LOR | 1.45 | 5.42 | 30 | 79 | 6 |
|  |  |  | Reference | <LOR | 2.86 | 6.2 | 18 | 22 | 4 |
|  |  | 1.3.Di.tert.butylbenzene | Recycled water | <LOR | 0.55 | 4.95 | 44 | 79 | 1 |
|  |  |  | Reference | <LOR | 2.09 | 9.8 | 46 | 22 | 1 |
|  |  | 1.4.Dichlorobenzene | Recycled water | <LOR | 3.16 | 9.24 | 44 | 79 | 9 |
|  |  |  | Reference | <LOR | 2.22 | 7.40 | 30 | 22 | 2 |
|  |  | 1.4.Dinitrobenzene | Recycled water | <LOR | 0.45 | 4.05 | 36 | 79 | 1 |
|  |  |  | Reference | <LOR | 2.5 | 8.10 | 29 | 22 | 2 |
|  |  | 2.4.Di.tert.butyl.phenol | Recycled water | <LOR | 359.92 | 2034.68 | 18044 | 79 | 19 |
|  |  |  | Reference | <LOR | 72.72 | 167.42 | 550 | 22 | 4 |
|  |  | 2.4.Dichlorophenol | Recycled water | <LOR | 150 | 797.03 | 6800 | 79 | 7 |
|  |  | 2.6.Di.tert.butyl.phenol | Reference | <LOR | 20 | 93.80 | 440 | 22 | 1 |
|  |  | 2.Chlorophenol | Recycled water | <LOR | 5.93 | 21.61 | 150 | 79 | 9 |
|  |  |  | Reference | <LOR | 7.72 | 24.50 | 109 | 22 | 3 |
|  |  | 2.Cresol | Recycled water | <LOR | 756.45 | 1201.39 | 4210 | 79 | 28 |
|  |  |  | Reference | <LOR | 920 | 1291.45 | 3700 | 22 | 8 |
| 2024 | PFAS | PFBA | Recycled water | <LOR | 0.32 | 1.019 | 4.45 | 104 | 10 |
|  |  | PFBS | Recycled water | <LOR | 0.38 | 0.85 | 3.30 | 104 | 20 |
|  |  |  | Reference | <LOR | 0.14 | 0.42 | 1.89 | 52 | 6 |
|  |  | PFHxS | Recycled water | <LOR | 0.80 | 5.30 | 51.69 | 104 | 5 |
|  |  |  | Reference | <LOR | 0.30 | 1.62 | 10.26 | 52 | 2 |
|  | PPCPs | Carbamazepine | Recycled water | <LOR | 0.41 | 0.59 | 3.11 | 104 | 42 |
|  |  |  | Reference | <LOR | 0.24 | 0.50 | 1.47 | 52 | 10 |
|  |  | DEET | Recycled water | <LOR | 0.15 | 0.32 | 1.20 | 104 | 21 |
|  |  |  | Reference | <LOR | 0.17 | 0.32 | 1.04 | 52 | 12 |
|  |  | Tebuconazole | Recycled water | <LOR | 0.0067 | 0.068 | 0.70 | 104 | 1 |
|  |  |  | Reference | <LOR | 0.10 | 0.24 | 0.72 | 52 | 8 |
|  |  | Tramadol | Recycled water | <LOR | 0.16 | 0.29 | 0.89 | 104 | 25 |

# Appendix B – CSIRO reports

Accessibility

Contact us if you need this information in an accessible format such as large print or audio.   
Please telephone 1300 372 842 or email [contact@epa.vic.gov.au](mailto:contact@epa.vic.gov.au)

Interpreter assistance



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