Emerging contaminants assessment 2020: Summary of Mildura results

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Summary report

Executive summary

In March 2020, Environment Protection Authority Victoria (EPA) undertook targeted sampling of water, sediment and soil at eight locations in Mildura, Victoria.

The results for all emerging contaminants were consistent with concentrations EPA has observed in previous studies, with the exception of metals at Horseshoe Lagoon and in Lake Hawthorn (Sardina et al. 2019; Sharp et al 2020; EPA publication 1870, May 2020). Concentrations of PFAS in surface waters, sediments and soil samples were relatively low. In water, measured concentrations of PFOS did not exceed the ecological 95 per cent species protection guideline value (0.13 µg/L) (PFAS NEMP 2.0). In soil, PFBA was the only PFAS compound detected (0.0045 mg/kg) and from a site with a high intensity agriculture land-use. Currently there are no guidelines for PFBA. In sediment, PFAS concentrations were below the detection limit at all sites.

Of the 106 pesticides analysed, only four were detected in the environment. In water, herbicides atrazine, simazine and diuron were detected across different land-uses, with one simazine concentration exceeding the ecological 99 per cent species protection guideline level at a site with urban industrial land-use. In soil, all pesticides were below the limit of reporting, and, in sediment, only the insecticide bifenthrin was detected at two urban sites (residential and industrial). Currently there are no guidelines for bifenthrin in the environment.

Metals were found across all land-use types in urban and regional Mildura. In water, six metals (As, Cr, Cu, Pb, Ni, Zn) exceeded water quality guidelines, and the highest concentrations were found in the Horseshoe Lagoon (background site). Further water sampling is recommended to gain a better understanding of the natural variation of metal concentrations in water bodies in Mildura. In sediment and soil, metals were frequently detected across all land-use types, but concentrations did not exceed the current guidelines.

This assessment enables EPA to further identify the extent and magnitude of emerging and legacy contaminants in regional Victoria, to inform where there may be priority areas, inform regulatory responses, and identify sectors to work with to prevent and reduce environmental pollution and harm. The results suggest pesticide and PFAS levels in soils are not increased in this region, however additional sampling would be required to confirm this. This document should be read in conjunction with EPA publication 1879: *Emerging contaminants 2019-20: Summary of results*.

Definitions and methodology

Selection of sites

EPA selected sites representing five land-use types: background, low-intensity agriculture (grazing), high-intensity agriculture (cropping, horticulture), urban residential, and urban industrial.

The background site, Horseshoe Lagoon, represented a natural environment with no or minimal anthropogenic impact (e.g. wind-blown dust from agricultural areas). However, it is noted that at the time of sampling, the site was largely impacted by blue-green algae due to drier conditions, and nutrient inputs from large flocks of water birds.

Water and sediment samples were collected at seven sites, and soil samples at eight sites. All sampling sites were within 30 km of Mildura.

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Sampling methodology

The methods for sample collection, handling, transporting, storing and quality assurance and control were consistent with EPA publication IWRG 701 (2009) and PFAS National Environmental Management Plan (NEMP) (2018). Emerging contaminants were determined using USEPA 8270, USEPA 537 and USEPA-821-R-11-007, *Pesticide Analytical Manual* (1999), AS4479, USEPA 3050, 200.7, 6010, 200.8 and 6020 methods at the National Measurement Institute. Out of 33 PFAS-compounds analysed, five most frequently detected were PFHxS, PFOS, PFBS, PFBA and PFOA. Out of 106 pesticides analysed, four detected were atrazine, bifenthrin, diuron and simazine.

Results

PFAS: PFOS, PFHxS, PFBS, PFBA and PFOA

The concentrations of PFAS compounds in water, sediment and soil samples across the five land-use types were found to be relatively low. At the background site, concentrations of PFOS, PFHxS, PFBS, PFBA and PFOA were lower than the limit of reporting (LOR) in water, sediment and soil (Table 1). In water, across other land-uses, maximum concentrations of PFHxS, PFOS, PFBS, PFBA and PFOA were 0.026, 0.011, 0.028, 0.11 and 0.021 μg/L respectively. In soil, PFBA was the only PFAS compound detected at a concentration of 0.0045 mg/kg, and in a high-intensity agriculture site. For PFOS, PFHxS, PFBS and PFOA, all sites had concentrations below LOR (Table 1) in both soil and sediment.

Table 1. Range of concentrations and % samples detected for PFHxS, PFOS, PFBS, PFBA and PFOA[#].

PFAS	Water (*n* = 7)		Sediment (*n* = 7)		Soil (*n* = 8[##])	
	Range (μg/L)	Detected (%)	Range (mg/kg)	Detected (%)	Range (mg/kg)	Detected (%)
PFHxS	<0.0002[†] – 0.026	71	<0.001	0	<0.001	0
PFOS	<0.0003[†] – 0.011	57	<0.002	0	<0.002	0
PFBS	<0.0005[†]– 0.028	57	<0.001	0	<0.001	0
PFBA	<0.0005[†] – 0.11	57	<0.002	0	<0.002 – 0.0045	13
PFOA	<0.0005[†] – 0.021	29	<0.001	0	<0.001	0

[#]The minimum concentration is the LOR for each PFAS. Number of sites (*n*) per land-use type: background (1), low-intensity (1), high-intensity agriculture (1), mixed land-use (2), urban residential (1) and urban industrial (1).

[##]An additional sample was collected from a low-intensity agricultural site.

[†]For three sites (background, low- and high-intensity agriculture) LOR was raised to a standard level from ultra-trace due to analytical interferences.

Pesticides

Concentrations of pesticides in surface waters varied (Table 2). Two herbicides were detected: the urea diuron at two sites (0.21 μg/L and 0.28 μg/L; low- and high-intensity agriculture), and the triazine simazine at one urban industrial site (0.34 μg/L). Bifenthrin was the only insecticide detected in water (14 per cent) at concentrations ranging from <0.005 to 0.019 μg/L. All fungicides were below the LOR (Table 2).

In sediment, only the synthetic pyrethroid bifenthrin was detected at two urban sites (residential and industrial) (Table 2).

In soil, all pesticide concentrations were below the LOR, including the legacy insecticides (e.g. DDT and dieldrin), organophosphates (e.g. chlorpyrifos) and carbamates (e.g. pirimicarb) (Table 2).

Table 2. Range and % of samples' detected concentrations for key pesticides in water, sediment and soils[#].

		Water (*n* = 7)		**Sediment** (*n* = 7)		**Soil** (*n* = 8)	
Compound	**Mode of action**	**Range (μg/L)**	**Detected (%)**	**Range (μg/kg)**	**Detected (%)**	**Range (μg/kg)**	**Detected (%)**
Organochlorines	Insecticide	<0.005	0	<1	0	<1	0
Organophosphates		<0.01	0	<1	0	<1	0
Synthetic pyrethroid (bifenthrin)		<0.005 – 0.019	14	<1 – 5.3	29	<1	0
Synthetic pyrethroids (others)		<0.005	0	<1	0	<1	0
Triazines (atrazine)	Herbicide	<0.01 – 0.092	14	<10	0	<10	0
Triazines (simazine)		<0.01 – 0.34	14	<10	0	<10	0
Triazines (others)		<0.01	0	<10	0	<10	0
Urea (Diuron)		<0.01 – 0.28	29	<10	0	<10	0
Fungicides	Fungicide	<0.01	0	<10	0	<10	0
Miscellaneous	Misc	<0.01	0	<10	0	<10	0

#The minimum concentration is the LOR for each pesticide. Number of sites (n) per land-use type:
background (1), low-agriculture (1 – 2), high-agriculture (1), mixed land-use (2), urban residential (1) and urban industrial (1).

Metals

Metals (11 out of 13) were found across different land-use types in urban and regional Mildura. In water, six metals (As, Cr, Cu, Pb, Ni, Zn) exceeded current environmental water quality guidelines. Horseshoe Lagoon had elevated concentration of arsenic (11 μg/L), total chromium (18 μg/L), copper (13 μg/L), lead (10 μg/L), nickel (15 μg/L) and zinc (37 μg/L). This was most likely due to a combination of factors, such as naturally elevated levels of organic material, low pH, high turbidity and a recent algal bloom. Two urban wetlands (Dunning and Etiwanda) had slightly elevated concentrations of total arsenic (3.1 μg/L), exceeding the 99 per cent ecological species protection level (0.8 μg/L). In addition, Etiwanda wetland, which is an urban industrial site, had elevated concentration of chromium (2 μg/L), exceeding the 95 per cent ecological species protection level (1 μg/L), and zinc (11 μg/L), exceeding the 95 per cent protection level (8 μg/L). Overall, chromium concentrations were elevated (1.1 – 1.3 μg/L) along the Murray River, across different land-use types (including background), exceeding the 90 per cent protection level (1.8 μg/L). It is recommended that further water sampling is conducted to gain a better understanding of the natural variation of metal concentrations in these waterbodies.

In sediment and soil samples, 11 of the 13 metals were detected at all sites (As, Be, Bo, Cd, Cr, Co, Cu, Pb, Mn, Ni, Zn). In sediment, metal concentrations were below guidelines, except for nickel in the background site Horseshoe Lagoon (25 mg/kg). In soil, all detected concentrations of metals were below ecological and human health guidelines.

Limitations of the study

- The small number of samples restricts interpretation to specific location.
- Further spatial and temporal replication would provide a greater understanding of and confidence in the variation of concentrations of contaminants in the environment.
- Environmental samples (water, sediment, soil) should be combined with biota (fish, macroinvertebrate) samples to gain a better understanding of the ecosystem level impacts of emerging contaminants.