SUPPLEMENT

Supplement Item S1
General description of the other or non-prevalent contaminants considered in the paper.

Acesulfame potassium is an artificial sweetener used in food and beverages. Environmental Concern: It is not well removed by wastewater treatment plants and can be detected in surface waters, potentially impacting aquatic ecosystems.

Acetaminophen is a common over-the-counter pain reliever and fever reducer. Environmental Concern: It can enter water bodies through wastewater and negatively affect aquatic organisms.

Atenolol is a medication used to treat high blood pressure. Environmental Concern: It can be detected in water bodies and has been associated with potential impacts on aquatic life.

Carbamazepine is a medication used to treat epilepsy and neuropathic pain. Environmental Concern: It is persistent in the environment and can be found in water bodies, potentially affecting aquatic organisms.

Diclofenac is a nonsteroidal anti-inflammatory drug [NSAID] used to relieve pain and inflammation. Environmental Concern: It has been linked to the decline of vulture populations when consumed by scavenging birds.

Diphenhydramine is an antihistamine commonly found in allergy medications. Environmental Concern: It can enter water bodies through wastewater and may impact aquatic life.

Estrone is a natural hormone found in humans and animals. Environmental Concern: Elevated levels of estrone in water bodies can disrupt the endocrine systems of aquatic organisms.

Fexofenadine is an antihistamine used to treat allergies. Environmental Concern: It can be found in water bodies and may have potential effects on aquatic organisms.

Fluoxetine is an antidepressant medication. Environmental Concern: It can enter water systems through wastewater and may impact aquatic life.

Gabapentin is a medication used to treat epilepsy and nerve pain. Environmental Concern: It can be detected in water bodies and may have unknown environmental impacts.

Gemfibrozil is a medication used to lower cholesterol levels. Environmental Concern: It can be found in water bodies and may have potential effects on aquatic organisms.

Ibuprofen is a widely used NSAID. Environmental Concern: It can enter water systems through wastewater and may have potential effects on aquatic life.

Iomeprol is a contrast agent used in medical imaging. Environmental Concern: It can be released into water bodies during medical procedures and may have adverse effects on aquatic ecosystems.

Metformin is a medication used to treat diabetes. Environmental Concern: It can be detected in water bodies and may have potential effects on aquatic life.

Metoprolol is a medication used to treat high blood pressure and heart conditions. Environmental Concern: It can be found in water bodies and may have potential effects on aquatic organisms.

Naproxen is an NSAID used to relieve pain and inflammation. Environmental Concern: It can enter water systems through wastewater and may have potential effects on aquatic life.

Sucralose is an artificial sweetener used in food and beverages. Environmental Concern: It is not well removed by wastewater treatment plants and can be detected in surface waters, potentially impacting aquatic ecosystems.

Sulfamethoxazole is an antibiotic commonly used in medicine. Environmental Concern: It can be found in water bodies and may contribute to antibiotic resistance in aquatic environments.

Tolyltriazole is a corrosion inhibitor used in various industrial applications. Environmental Concern: It can be released into water bodies and may have adverse effects on aquatic life.

Valsartan is a medication used to treat high blood pressure and heart conditions. Environmental Concern: It can be found in water bodies and may have potential effects on aquatic organisms.

Supplement Item S2. Quality Assurance/Quality Control

A] Field Blanks [0 ng/l after adjustment of detection limits for each compound] information

	median ± MAD (Min - Max) Detection Frequency
Compound	Field Blank Results
2,4-D	0±0(0-0)0
Caffeine	0±0(0-552.99)0.04
4-Nitrophenol	0±0(0-0)0
TBEP	0±0(0-0)0
Fenobucarb	0±0(0-0)0
Atrazine	0±0(0-0)0
Metformin	0±0(0-0)0
Iomeprol	0±0(0-0)0
Acesulfame	0±0(0-0)0
Atenolol	0±0(0-0)0
Acetaminophen	0±0(0-0)0
Gabapentin	0±0(0-0)0
Sucralose	0±0(0-0)0
Metoprolol	0±0(0-0)0
Tolytriazole	0±0(0-0)0
Sulfamethoxazole	0±0(0-0)0
Diphenhydramine	0±0(0-0)0
Fexofenadine	0±0(0-0)0
Carbamezapine	0±0(0-0)0
Fluoxetine	0±0(0-0)0
Naproxen	0±0(0-0)0
Valsartan	0±0(0-0)0
Diclofenac	0±0(0-0)0
Ibuprofen	0±0(0-0)0
Gemfibrozil	0±0(0-0)0
Estrone	0±0(0-0)0

B. Field Replicates

		4NP	Caffeine	TBEP	Fenobucarb	Atrazine	2,4-D
P08	Median	466	4,364	NO DATA	82	44	bdl
Sept	MAD	162	198	NO DATA	5	6	bdl
	MAD/MED	0.35	0.05	NO DATA	0.06	0.13	bdl
Urban	MIN	304	4,166	NO DATA	78	39	bdl
Mae Kha	Max	475	4,393	NO DATA	87	47	13
	Range	171	227	NO DATA	9	9	13
P19	Median	bdl	1,794	bdl	bdl	18	bdl
August	MAD	bdl	1,006	bdl	bdl	2	bdl
	MAD/MED	bdl	0.56	bdl	bdl	0.11	bdl
Peri-urban	MIN	bdl	789	bdl	bdl	16	bdl
S. Well	Max	bdl	2,001	bdl	40	19	bdl
	Range	bdl	1,212	bdl	40	2	bdl
hh	Median	13	bdl	bdl	bdl	bdl	bdl
July	MAD	0	bdl	bdl	bdl	bdl	bdl
	MAD/MED	0	bdl	bdl	bdl	bdl	bdl
Clean	MIN	13	bdl	bdl	bdl	bdl	bdl
Deep well	Max	17	41	bdl	bdl	bdl	bdl
	Range	4	41	bdl	bdl	bdl	bdl

Supplement Item S3. Raw Data for main contaminants

Ord	Code	Type	Type	Mom	ID	Rainfall	4-Nitro-phenol	Caffeine	TBEP	Feno-bucar	Atrazine	2,4-D
						(mm)	(ng/l)	(ng/l)	(ng/l)	(ng/l)	(ng/l)	(ng/l)
1	1_44	Rainwater	Pair	1	a	4.2	5613	185	92	29	61	bdl
2	2_34	Rainwater	Pair	2	a	40.4	1537	70	11	bdl	bdl	bdl
3	2_44	Rainwater	Pair	2	b	8	1825	676	38	39	bdl	bdl
4	3_43	Rainwater	Pair	3	a	60.7	6870	157	126	NA	bdl	bdl
5	3_44	Rainwater	Pair	3	b	13.6	6265	bdl	45	28	bdl	bdl
6	4_43	Rainwater	Pair	4	a	60.7	4137	bdl	18	bdl	bdl	bdl
7	4_46	Rainwater	Pair	4	b	75.1	6023	589	62	bdl	bdl	bdl
8	4_44	Rainwater	Pair	4	c	75.3	4546	bdl	bdl	26	16	bdl
9	5_43	Rainwater	Pair	5	a	31.3	956	79	7	bdl	bdl	bdl
10	5_44	Rainwater	Pair	5	b	36.4	5864	518	18	bdl	18	bdl
11	13_43	Rainwater	Pair	6	a	10.5	312	162	143	bdl	95	15
12	13_44	Rainwater	Pair	6	b	8.8	1101	908	168	bdl	61	19
13	8_44	Rainwater	Pair	8	a	1.8	146	60	bdl	186	19	26
14	9_44	Rainwater	Pair	9	a	16.3	142	488	NA	29	bdl	bdl
15	9_48	Rainwater	Pair	9	b	37.7	127	118	NA	299	23	bdl
16	10_52	Rainwater	Pair	10	a	14.2	449	bdl	bdl	NA	bdl	bdl
17	10_44	Rainwater	Pair	10	b	23.6	500	50	50	66	bdl	bdl
18	10_46	Rainwater	Pair	10	c	10	1876	140	88	29	13	bdl
19	10_48	Rainwater	Pair	10	d	8.4	716	427	72	269	22	bdl
20	11_71	Rainwater	Pair	11	a	10.4	1661	148	NA	bdl	34	bdl
21	11_81	Rainwater	Pair	11	b	31.4	1326	40	NA	bdl	bdl	bdl
22	11_83	Rainwater	Pair	11	c	2.6	520	125	NA	bdl	bdl	bdl
23	1_45	Throughfall	Pair	1	a	4.2	4913	843	98	108	59	65
24	2_35	Throughfall	Pair	2	a	40.4	1312	139	14	30	bdl	bdl
25	2_45	Throughfall	Pair	2	b	8	1928	1073	58	87	bdl	29
26	3_46	Throughfall	Pair	3	a	60.7	2463	712	192	49	23	27
27	3_45	Throughfall	Pair	3	b	13.6	7127	136	48	72	bdl	17
28	4_48	Throughfall	Pair	4	a	60.7	2995	77	18	bdl	bdl	bdl
29	4_47	Throughfall	Pair	4	b	75.1	2471	1176	39	30	bdl	bdl
30	4_45	Throughfall	Pair	4	c	75.3	3040	79	bdl	28	17	bdl
31	5_46	Throughfall	Pair	5	a	31.3	120	120	7	bdl	bdl	bdl
32	5_45	Throughfall	Pair	5	b	36.4	1672	592	16	bdl	14	bdl
33	13_46	Throughfall	Pair	6	a	10.5	120	121	131	bdl	81	23
34	13_45	Throughfall	Pair	6	b	8.8	551	131	292	bdl	47	64
35	8_45	Throughfall	Pair	8	a	1.8	61	130	bdl	86	20	74
36	9_45	Throughfall	Pair	9	a	16.3	64	954	NA	41	bdl	bdl
37	9_49	Throughfall	Pair	9	b	37.7	165	359	NA	342	29	bdl
38	10_53	Throughfall	Pair	10	a	14.2	83	45	29	NA	bdl	bdl
39	10_45	Throughfall	Pair	10	b	23.6	303	62	75	137	bdl	bdl
40	10_47	Throughfall	Pair	10	c	10	671	325	68	125	bdl	bdl
41	10_49	Throughfall	Pair	10	d	8.4	136	142	78	128	28	bdl
42	11_72	Throughfall	Pair	11	a	10.4	948	410	NA	bdl	49	bdl
43	11_82	Throughfall	Pair	11	b	31.4	1001	113	NA	bdl	bdl	bdl
44	11_84	Throughfall	Pair	11	c	2.6	436	211	NA	bdl	bdl	bdl
45	6_44	Rainwater	Extra	6	c	11.3	459	92	bdl	bdl	19	bdl
46	7_44	Rainwater	Extra	7	a	24.7	2791	288	491	35	198	26

47	11_44	Dry Dep (RF site)	Pair	25	a	NR	56	246	NA	bdl	bdl	bdl
48	11_45	Dry Dep (TF site)	Pair	25	a	NR	62	213	NA	bdl	bdl	bdl
49	12_44	Dry Dep (RF site)	Pair	26	a	NR	79	120	76	bdl	bdl	bdl
50	12_45	Dry Dep (TF site)	Pair	26	a	NR	115	227	35	bdl	bdl	bdl

Bdl is below detection limit; Dry Dep is dry deposition. Rainfall and throughfall events are paired by month and ID.

Supplement Item S4.
Emerging Concern Contaminants reported in the literature

Table [A] 4-Nitrophenol in Rainwater

Locations/study	**Concentration [ng/l]+**
Moscow [n=8; ng/l; Polyakova et al., 2018]	8-11
Melpitz, Germany [Hofmann et al., 2008]	400
Holme Moss, UK [Hofmann et al., 2008]	1,900
Arlington, Texas, USA [n=22; Ganranoo et al., 2010]	<5,000**
Hannover, Germany [Levsen et al, 1990]	5,700**
Vosges Mountains, France [Levsen et al., 1993]	1,100-6,100
Thailand [Rainfall & Throughfall; this study]	60-7,100
Bavaria, Germany [mix; n=8; Schussler and Nitschke, 2001]	~dl-12,000**
FRG, Germany [Rippen et al., 1987]	2,000-16,000**
Holme Moss, UK [Fog water; Hofmann et al., 2008]	2,100-20,000
Mt Ochsenkopf, Germany [fog water; 58-289 nM; Richartz et al., 1990]	8,500-40,200**
Holme Moss, UK [Cloud water; Hofmann et al., 2008]	3,400-71,000**
Lombardia, Italy [2 sites, 5 days; 12-29 mg/L; Belloli et al., 2006]	12,000,000-29,000,000#

----------**Footnotes**----------

+Values rounded to 100s; dl is detection level; bdl is below detection level
*Reported by Harrison et al [2005];
** values bdl not indicated, if any
# unlikely the units of mg/l are correct; no values bdl reported if any

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4-Nitrophenol References

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Table B. Caffeine in water resources

Locations/study	**Standardized [ng/l]**
Tai Lake, China [lake water; 10 sites; Liu et al., 2020]	26
Antarctic Peninsula [glacier drain; González-Alonso et a., 2017]	29
Antarctic Peninsula [streams; n = 6; González-Alonso et a., 2017]	bdl - 323
Singapore [Reservoirs; You et al., 2015]	34–645
Thailand [Rainfall & Throughfall; this study]	bdl-1,176
Madison, WI, USA [Commercial runoff; Burant et al., 2018]	369-1,270
Minneapolis, USA [Urban stormwater; Fairburn et al., 2018]	207 [bdl-1,710]#
Singapore [Tributaries; You et al., 2015]	57–2,980
Australia [stormwater; n=23; 6 catchments; Sidhu et al., 2013**]**	bdl-5,200
Madison, WI, USA [Residential runoff; Burant et al., 2018]	235-5,400
Kleinmond, South Africa [Rainwater in Tanks; 10 events, 2015; Waso 2017]	1,880-9,430
Singapore [Ag runoff; n = 19; Tran et al.., [2019]	113–29,730
Singapore [Urban runoff; n = 51; Tran et al.., 2019]	7–69,459
Kleinmond, South Africa [Rainwater in Tanks; 10 events, 2014-15; Waso et al., 2016]	151-151,000

----------**Footnotes**----------

median [range]

Caffeine References

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Table C. TBEP in Rainwater & Throughfall water [and other]

Locations/study	**Concentration [ng/l]**
Eifel, Germany [remote lakes; Regnery & Puttmann, 2010b]	bdl
Beijing, China [3 mos; n=10; Shi et al., 2016]	2.23-7.58
Bekond,Germany [SWHT; Regnery & Puttmann, 2010a]	36 [bdl-77]#
Northern Sweden [snow in road & airport; Marklund et al., 2005]	2-94
Rome & Martignano, Italy [n=3; Bacaloni et al, 2008]	38-115
Bekond, Germany [precipitation; Regnery & Puttmann, 2010a]	bdl [bdl-205]#
Kleiner Feldberg, Germany [precipitation; Regnery & Puttmann, 2010a]	17 [bdl-242]#
Thailand [Rainfall & Throughfall; this study]	46±27 [bdl-292]
Frankfort/Main, Germany [n=1; Fries and Puttmann, 2001]	393
Brahnbrucke, Germany [n=1; Fries & Puttmann, 2003]	394
Strausberg/Munchberg, Germany [n=2; Fries & Puttmann, 2003]	120-448
Frankfort/Main, Germany [precipitation; Regnery & Puttmann, 2010a]	21 [bdl-505]#
Madison, WI, USA [Residential runoff; Burant et al., 2018]	bdl-1,050
Frankfort/Main, Germany [SWHT; Regnery & Puttmann, 2010a]	77 [bdl-1,616]#
Madison, WI, USA [Commercial runoff; Burant et al., 2018]	757-3,900

----------**Footnotes**----------

median [range]
SWHT: Stormwater holding tank

TBEP References

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Table D. Fenobucarb in Rainwater & Throughfall water

Locations/study	**Concentrtaion [ng/l]**
Kitakyushu, Japan [urban; 2 periods; Haraguchi et al., 1995]	10-14
Yokohama, Japan [13 events; Sakai, 2006]	bdl-140
Thailand [this study]	bdl-342
Kanto Plain, Japan [2 months; Nohara et al., 1997]	nr-580
Mekong Delta, Vietnam [rain or other drinking water; Chau et al,. 2015]	≤ 2,320
Utsunomiya Japan [5 sites; 4 seasons; Suzuki et al., 2003]	bdl-8,280 ng/l+

---------- **footnotes** ----------

+High values in low rainfall events; mean is about 1,000 ng/l
nr is not reported
Sakai [2006] 12/13 events had bdl

Fenoibucarb References

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E. Atrazine in Rainwater & Throughfall water

Locations/study	Standardized [ng/l]
Imathia, Greece [Albanis et al. 1998]	bdl-7
Vavihill, Sweden [rural site; 4 years; 31-60% DF; Kreuger et al., 2006]	*bdl-30*
Roskilde & Oure, Denmark [Asman et al., 2004]	bdl-15 ng/l
Bear Lake, Colorado, USA [n=9; Mast et al., 2007]	bdl-60
Thailand [Rainfall and Throughfall; this study]	bdl-95
Northern Germany [2 locations; Bester et al., 1994]	bdl-120
Vosges, France [2 sites; Trautner et al., 1992]	9-137
Paris, France [n=5; Chevreuil & Garmouma, 1993].	bdl-140
Lake Michigan, USA [monthly; Miller et al., 2000]	0.09-160
Arizona [roof rainwater; 18% detection; Villagómez-Márquez et al., 2022]	4.55 [0.98, 167.00]*
NW Croatia [2 seasons; Drevenkar et al., 2004]	bdl-180
Limberg, The Netherlands [Van Maanen et al., 2001]	bdl->200
Northern German [urban, remote, ag; Siebers et al., 1994]	bdl-430
Switzerland [4 locations; Buser, 1990]	bdl-600
Alsace, France [rural; n=39; Scheyer et al. 2005]	bdl-844
Gruze [Zurich], Switzerland [industrial; n=41; Bucheli et al, 1998]	33[bdl-903]
Great Lakes Region, USA [several sites; Hall et al., 1993]	bdl-1000
USA [81 sites; 99% of the samples; Goolsby et al., 1997]	bdl-1000 [10,900&]
Georgia, USA (Potter et al., 2017)	1-1030
Alsace, France [urban; n=39; Scheyer et al. 2005]	bdl-1,030
Flanders, Belgium [5 years; Quaghebeur et al., 2004]	bdl-1,300
Ohio & Indiana, USA [n=79; Richards et al., 1987]	bdl-1,500
Walnut Creek, Iowa, USA [n=302; Hatfield et al., 1996]	bdl-1,700 [154,000++]
Vallombrosa area, Italy [2 forest sites; Trevisan et al., 1993]	bdl-1,990
Maryland, USA [n=68; Wu et al., 1981]	3-2,190
Germany [4 sites ag + natural; Dankwardt et al., 1994]	bdl-4,180
Argentina [5 locations; n = 112; Alongso et al., 2018]	100-26,900
Iowa, USA [2 sites; n=325; Nations & Hallberg, 1992]	bdl-7,000 [40,000+]

----------Footnotes ----------

Many sites reported in van Dijk are bdl

*median [ranged of detected values]; detection frequency = 10%

+ outliers were 24,000 and 40,000 at each of the two sites.

++154,000 ng/l reported one day when broadcasting applied on field adjacent to the site on overcast day

& 1% of the samples had values between 1000 and 10900 ng/l

Atrazine References

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Table F. 2.4-D in rainwater

Locations/study	**Standardized [ng/l]**
Vallombrosa area, Italy [2 forest sites; Trevisan et al., 1993]	bdl
Finland [11/22 detected; Hirvi and Rekolainen, 1995]	bdl-8
Gruze [Zurich], Switzerland [industrial; May; Bucheli et al, 1998]	16 [bdl-23]
Vavihill, Sweden [rural site; 4 years; 17-67% DF; Kreuger et al., 2006]	*bdl-31*
Thailand [Rainfall & Throughfall; this study]	3 [bdl-74]
Arizona [roof rainwater; 18% detection; Villagómez-Márquez et al., 2022]	3.98 [1.01, 282]**
Manitoba, Canada [Ag catchment; 4 years; Rawn et al., 1999]	bdl-400
Strasburg, Germany [urban; 15 samples; Scheyer et al., 2007]	bdl-527
Alberta [remote; 2 years; Hill et al., 2002]	bdl-3,800
Alberta [urban; 2 years; Hill et al., 2002]	bdl-9,800
Germany [summarized by Dubus et al., 2000]	bdl-420,000
Natal, South Africa [4 sites; many high values; Sandmann et al, 1991]	20 [430,000]*

----------**Footnotes**----------

*11 values; 6 > 20,000 ng/l

** median [range for detected]; detection frequency = 18%

2.4-D References

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Table G. Other EPCs in water resources

Locations/study	**Concentrations [ng/l]**
----------Acetaminophen	
Antarctic Peninsula [glacier drain; González-Alonso et a., 2017]	bdl
Antarctic Peninsula [streams; n = 6; González-Alonso et a., 2017]	bdl - 38
Kleinmond, South Africa [Rainwater in Tanks; 10 events 2014-15; Waso et al., 2016]	bdl-1,030
Svihov reservoir, Czech Republic [Hnevkovice Profile; Datel & Hrabankova, 2020]	bdl-1,800
Thailand [Rainfall and Throughfall; this study; n =5]	bdl-2,054
Kleinmond, South Africa [Rainwater in Tanks; 10 events 2015; Waso, 2017]	7,420-9,430
Latin America [WWTP effluent; review; Pena-Guzman, 2019]	17-29,200
Latin America [WWTP affluent; review; Pena-Guzman, 2019]	60-66,000
----------Fexofenadine	
Thailand [Rainfall and Throughfall; this study; n = 3]	bdl-2,054
Latin America [WWTP affluent; review; Pena-Guzman, 2019]	640–147,870
----------Diphenhydramine	
Latin America [WWTP affluent; review; Pena-Guzman, 2019]	1-49
Latin America [WWTP effluent; review; Pena-Guzman, 2019]	1-99
Thailand [Rainfall and Throughfall; this study; n = 2]	bdl-208
----------Gabapentin	
Svihov reservoir, Czech Republic [drinking water; Datel & Hrabankova, 2020]	*bdl-18*
Svihov reservoir, Czech Republic [raw water; Datel & Hrabankova, 2020]	*bdl-157*
Svihov reservoir, Czech Republic [Miletin Profile; Datel & Hrabankova, 2020]	*171 [bdl-280]*
Svihov reservoir, Czech Republic [Kacerov Profile; Datel & Hrabankova, 2020]	*29 [bdl-315]*
Thailand [Rainfall and Throughfall; this study; n = 1]	bdl-2,059
Svihov reservoir, Czech Republic [Dolni Kralovice Profile; Datel & Hrabankova, 2020]	*1,045 [bdl-3,120]*
Svihov reservoir, Czech Republic [Hnevkovice Profile; Datel & Hrabankova, 2020]	*1,900 [bdl-33,000]*

G. Other EPC References

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