

SUPPORTING MATERIAL

Using PUF disk passive samplers to simultaneously measure air concentrations of persistent organic pollutants (POPs) across the Tuscany Region, Italy

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Text

S1: For OCPs, PAH and PCBs GC separation as performed on a capillary column ZB-5ms (30m · 0,25 mm internal · 0,25 μm) from the Phenomenex. The oven temperature program was as follows: start at 50 °C (hold 2 minute), 50-120 °C at 30 °C min^{-1} , 120-280 °C at 6 °C min^{-1} (hold 15 minute) at 6 °C min^{-1} . GC separation for PBDEs used a capillary column DB-5HT (15 m · 0.247 mm internal · 0.10 μm) Agilent Technology (J&W Scientific). The oven temperature programs was as follow: start at 100 °C (hold 2 minute), 100-250 °C at 10 °C min^{-1} , 250-265 °C at 0.8 °C min^{-1} , 265-325 °C at 12 °C min^{-1} (hold 12 minute). A sample of 2 μL was injected on splitless mode at 250 °C.

S2: PUF disk samples were analyzed for a suite of target compounds that included 19 OCPs, 15 PAHs, 21 PCBs and 27 PBDEs. The OCPs screened and the target/qualified ions (in brackets) were: α -, β -, γ -, δ -HCHs (181/219), hexachlorobenzene (284/286), aldrin (263/293), heptachlor (272/237), cis- and trans-heptachlor epoxide (353/355), cis-chlordane (373/237), trans-chlordane (373/237), trans-nonachlor (407/409), endosulfan I (195/237), endosulfan II (195/241), endosulfan sulphate (272/274), o,p'-DDE, p,p'-DDE (246/248), o,p'-DDD, p,p'-DDD (235/237), o,p'-DDT, p,p'-DDT (235/237) (Ultra Scientific, North Kingstown, RI, USA). PAHs congeners and target/qualified ions were monitored as follow: acenaphthylene (152), acenaphthene (154), fluorene (166), phenanthrene (178), anthracene (178), fluoranthene (202), pyrene (202), benz(a)anthracene (228), chrysene (228), benzo(b)fluoranthene (252), benzo(k)fluoranthene (252), benzo(a)pyrene (252), indeno(1,2,3-cd)pyrene (276), dibenzo(a,h)anthracene (278/276), benzo(g,h,i)perylene (276) (Supelco Analytica, USA). PCBs congeners were: PCBs 3Cl:- 17, 18, 28/31, 33 (256/2589), PCBs-4Cl: 52, 44, 56/60 (290/292), PCBs-5Cl: 95,101,99, 118, 105 (326/328), PCBs-6Cl: 149, 153, 138 (360/362), PCBs-7Cl: 170,180 (394/396), PCB-8Cl: 194 (428/430), PCB-10Cl: 209 (496/498). For PBDEs the congeners were: 3, 7, 15, 17, 47, 49, 66, 71, 77, 85, 99, 100, 119, 126, 138, 153, 154, 156, 183, 184, 191, 196, 197, 206, 207 and 209 (79/81) (Supelco Analytica, USA).

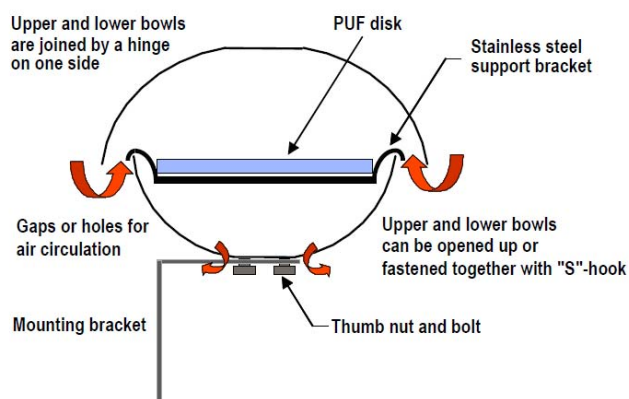


Figure S1. Schematic representation of the PUF disk sampler and photo of PAS deployed.

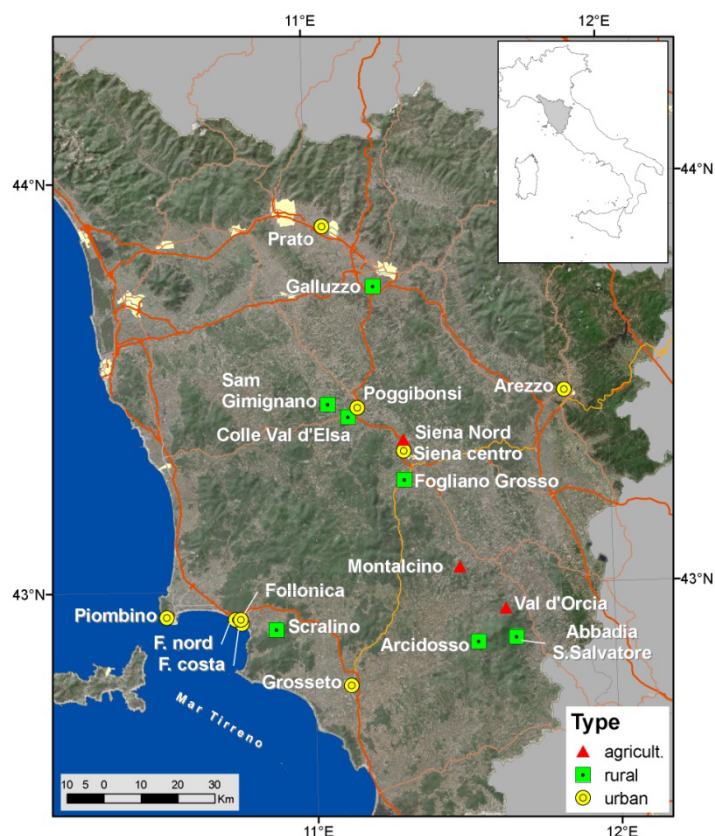


Figure S2. Map showing location of urban, rural and agricultural air sampling sites in the Tuscany region of central Italy.

Table S1. Sampling sites information, temperature (°C) and deployment time

Sampling sites	Categories	Latitude N	Longitude E	T (°C)	days	Started	Final
Fogliano Grosso	Ru	43°15'45.18"	11°18'45.22"	16	90	10/05/08	08/08/08
Galuzzo	Ru	43°44'11.58"	11°13'28.74"	18	69	23/04/08	01/07/08
Scarlino	Ru	42°54'13.39"	10°52'28.99"	16	162	07/04/08	16/09/08
Sam Gimignano	Ru	43°27'03.10"	11°03'46.01"	16	86	01/04/08	26/06/08
ColleVE	Ru	43°25'07.81"	11°07'49.34"	17	82	06/04/08	26/06/08
Abbadia S.S	Ru	42°52'17.72"	11°40'18.45"	15	60	09/07/08	09/09/08
Arcidoso	Ag	42°51'45.12"	11°32'43.08"	16	60	09/07/08	09/09/08
Poggibonsi	Ur	43°26'27.54"	11°09'41.33"	17	82	05/04/08	26/06/08
Follonica costa	Ur	42°55'11.68"	10°45'38.63"	18	112	02/04/08	23/07/08
Piombino	Ur	42°56'16.73"	10°30'37.87"	18	103	12/04/08	24/07/08
Arezzo	Ur	43°28'16.36"	11°51'20.09"	18	127	05/04/08	10/08/08
Follonica centro	Ur	42°55'46.99"	10°44'23.46"	18	93	05/04/08	07/07/08
Siena centro	Ur	43°19'56.86"	11°18'49.18"	16	138	05/04/08	21/08/08
Follonica nord	Ur	42°55'47.28"	10°45'23.58"	18	93	05/04/08	07/07/08
Prato (Galciiana)	Ur	43°53'07.73"	11°03'27.14"	18	112	06/04/08	27/07/08
Grosseto center	Ur	42°45'47.66"	11°07'11.39"	18	102	07/04/08	26/07/08
Siena nord	Ag	43°21'37.80"	11°18'47.88"	16	91	01/04/08	01/07/08
Montalcino	Ag	43°2'51.84"	11°29'25.14"	16	60	09/07/08	09/01/08
Val d'orcìa	Ag	42°56'36.57"	11°38'22.03"	16	60	09/07/08	09/91/08

Abbreviations: T(°C) average Temperature; (days) sampling days. Ru = Rural, UR = Urban and Ag = Agricultural.

Table S2. Air concentrations (pg m^{-3}) of PAHs at each sampling site, MDL, IDL and sampled air volumes (V_{AIR})

	Acept	AceP	Fl	Phe	An	Flu	Py	BaA	Chry	BbF	Total Σ PAHs
Fogliano Grosso	< 1	< 1	40	170	< 1	50	30	< 0.2	< 0.2	4	290
Galuzzo	< 1	< 1	260	1 000	< 1	190	120	< 0.2	< 0.2	< 0.7	1 600
Scarlino	370	< 1	80	190	< 1	60	40	< 0.2	< 0.2	< 0.7	750
San Gimignano	860	< 1	150	770	< 1	260	200	< 0.2	30	< 0.7	2 300
Colle_V_E	< 1	40	90	200	< 1	50	50	< 0.2	14	< 0.7	450
Abbadia S.S.	80	70	280	770	70	300	170	11	20	10	1 800
Arcidosso	50	50	210	560	60	170	140	14	20	11	1 300
Poggibonsi	< 1	30	70	280	< 1	110	70	< 0.2	10	< 0.7	600
Follonica costa	< 1	110	180	790	< 1	220	200	8	20	< 0.7	1 500
Piombino	870	200	220	1 200	< 1	360	220	15	50	< 0.7	3 100
Arezzo	< 1	170	280	1 200	< 1	330	280	8	30	< 0.7	2 200
Follonica centro	100	90	120	440	< 1	80	60	< 0.2	0	< 0.7	900
Siena centro	< 1	340	370	1 600	< 1	430	340	13	30	9	3 100
Follonica nord	< 1	230	420	1 360	< 1	420	240	10	20	< 0.7	2 700
Prato	1 300	< 1	150	1 300	< 1	450	350	< 0.2	30	< 0.7	3 500
Grosseto	320	120	290	1 350	< 1	470	440	< 0.2	50	< 0.7	3 100
Siena nord	1 800	210	650	1 400	< 1	300	290	< 0.2	40	< 0.7	4 700
Montalcino	< 1	180	240	1 400	< 1	470	370	15	30	10	2 700
Val d'orcia	60	50	190	860	60	610	210	15	40	16	2 100
MDL	1	0.5	1	1	1	2	1	0.2	0.2	0.7	
IDL	2	1	2	2	2	4	2	0.4	0.4	1.4	
V_{air} m^3 (60 days)	50	50	110	170	170	230	230	240	240	240	
V_{air} m^3 (160 days)	50	50	130	280	280	530	560	630	630	650	

Abbreviations: BDL = below detection limit; Acept (Acenaphthylene), AceP (Acenaphthene), Fl (Fluorene), Phe (Phenanthrene), An (Anthracene) Flu (Fluoranthrene), Py (Pyrene), BaA (Benzo(a)anthracene), Chry (Chrysene), BbF(Benzo(b)fluoranthene).

Table S3. Air concentrations ($\mu\text{g m}^{-3}$) of the OCPs, PCBs and PBDEs at each sampling site, MDL, IDL and sampled air volumes (V_{AIR})

Locations	Category	PBDEs				PCBs						OCPs					
		47	99	100	Σ PBDEs	28/31	52	99	149	118	105	Σ PCBs	α -hch	γ -hch	HCB	Endo1	ppDDT
Fogliano Grosso		3	<0.3	2	5	<2	<7	<2	<7.6	<2	45	45	<5	76	170	1990	270
Galuzzo		<0.3	<0.3	<0.5		<2	28	<2	<7.6	<2	<2	28	<5	<8	<1.4	<13	<21
Scarlino		2	<0.3	<0.5	2	<2	<7	<2	<7.6	<2	<2		<5	170	37	64	<21
Sam Gimignano	Rural	<0.3	<0.3	<0.5		<2	<7	<2	<7.6	<2	<2		<5	340	23	<13	170
ColleVE		<0.3	<0.3	<0.5		<2	<7	<2	<7.6	<2	14	14	<5	<8	21	<13	<21
Abbadia S.S.		19	2	<0.5	21	<2	<7	<2	<7.6	<2	<2		<5	<8	150	<13	<21
Arcidoso		5	<0.3	25	30	<2	<7	<2	<7.6	<2	<2		<5	<8	8	<13	<21
Poggibonsi		<0.3	<0.3	<0.5		<2	<7	<2	<7.6	<2	16	16	<5	<8	<1.4	<13	67
Follonica costa		<0.3	<0.3	<0.5		<2	<7	<2	<7.6	<2	<2		570	730	<1.4	<13	65
Piombino		<0.3	<0.3	<0.5		<2	<7	<2	<7.6	260	48	310	280	340	31	2000	180
Arezzo		<0.3	<0.3	<0.5		<2	<7	<2	<7.6	<2	<2		530	590	<1.4	<13	<21
Follonica centro	Urban	<0.3	<0.3	0.2	0.2	<2	<7	<2	<7.6	<2	33	33	200	<8	<1.4	1400	<21
Siena centro		<0.3	<0.3	<0.5		<2	9	<2	5	<2	<2	14	<5	1100	<1.4	<13	<21
Follonica nord		<0.3	<0.3	<0.5		11	15	<2	<7.6	<2	33	59	270	310	<1.4	<13	100
Prato		<0.3	<0.3	<0.5		<2	<7	13	<7.6	260	<2	270	<5	<8	<1.4	1100	<21
Grosseto		<0.3	<0.3	<0.5		<2	<7	<2	<7.6	<2	<2		480	760	22	<13	<21
Siena nord		<0.3	<0.3	0.5	0.8	<2	<7	<2	<7.6	<2	<2		610	720	37	2200	730
Montalcino	Agricultural	<0.3	<0.3	<0.5		<2	<7	<2	<7.6	<2	<2		<5	<8	12	<13	<21
Val d'orcia		2	2	<0.5	4	<2	<7	<2	<7.6	<2	<2		<5	<8	6	<13	<21
Media					9							50	150	270	30	340	80
SD					8							100	230	340	50	700	180
MDL		0.3	0.3	0.5		2	7	2	8	2	2		5	8	1.4	13	21
IDL		0.5	0.6	1		3	14	3	15	4	3		10	15	3	26	41
$V_{\text{air}}, \text{m}^3$ (60 days)		240	240	240		200	210	230	240	240	240		170	190	140	220	240
$V_{\text{air}}, \text{m}^3$ (160 days)		630	640	640		390	470	580	610	620	630		270	340	200	530	620

Abbreviations: Ru = Rural, UR = Urban and Ag = Agricultural.