14th International HCH and Pesticides Forum

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PERSISTENT PESTICIDES IN AIR FROM A FORMER HCH PRODUCTION SITE IN SPAIN

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INTRODUCTION

SABIÑÁNIGO

INQUINOSA (1975-1992)

100 t HCH and other chemicals

DNAPL- Dense Non Aqueous Phase Liquid

2,000 t DNAPL

BAILÍN Dumpsite (1985-1992)

Sardas Dumpsite (1978-1984)

30,000-80,000 t HCH waste in each dumpsite (Bailín and Sardas)

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INTRODUCTION

BAILÍN AREA

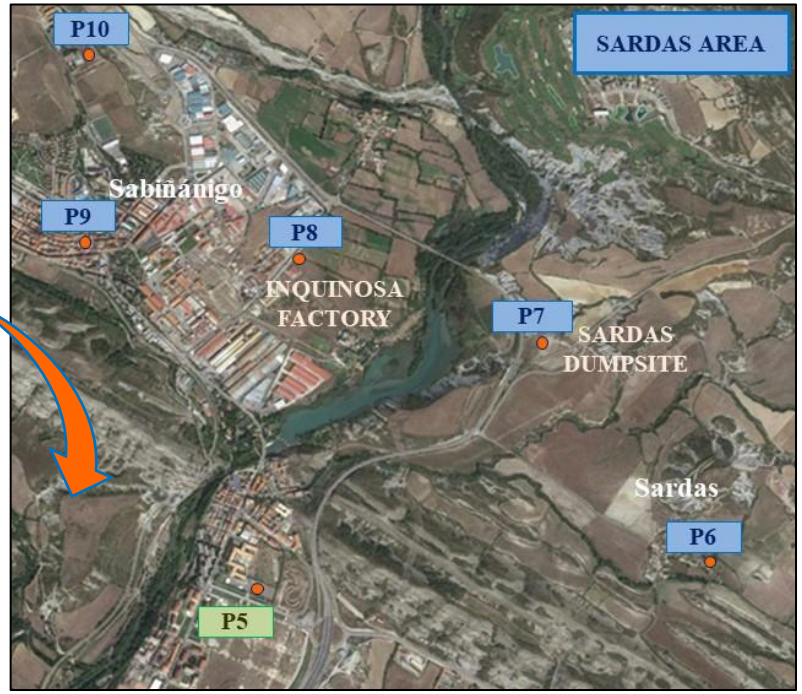
Source: Environ Sci Pollut Res (2013) 20: 1937-1950

2010: Construction of infrastructure

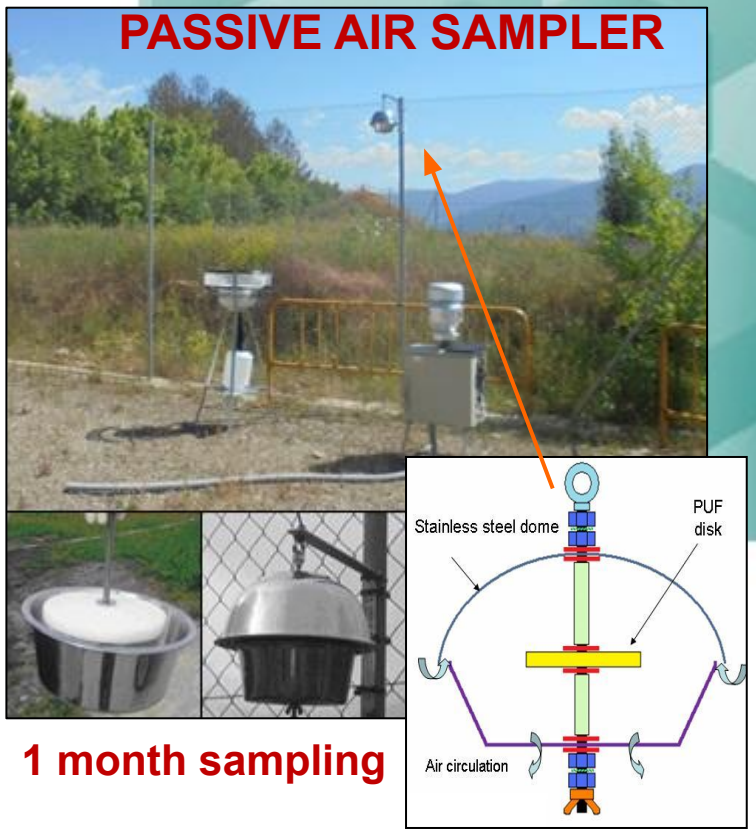
August 2014: Excavation started

October 2014: Provisional sealed (250,000 m^3 capacity)

SAMPLING



PASSIVE AIR SAMPLER



1 month sampling

BAILÍN AREA

P1 - P2: Dismantled HCH cell
P3: New HCH cell
P4: Offices
P5: 3 km from Bailín

From August 2014 to November 2021 → 74 sampling campaigns (SC)

SARDAS AREA

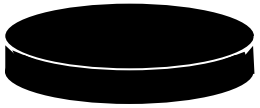
P6, P9, P10: Residential sites
P7: Sardas Dumpsite
P8: Inquinosa Factory

From February 2016 to November 2021 → 58 sampling campaigns

657 air samples

METHODOLOGY

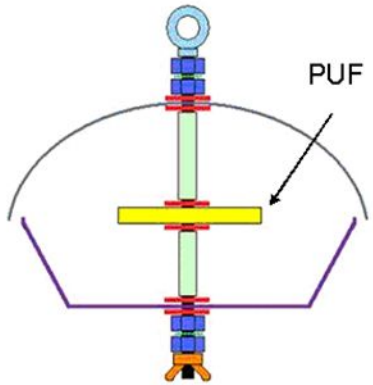
PUF disk



(14 x 1.2 cm, 0.03 g/cm)

Precleaned
Soxhlet extraction
(acetone and
diethyl ether, 24h)

Aluminum foil
Polyethylene bags
-20ºC



1 month sampling

Soxhlet extraction
(toluene, 24 h)

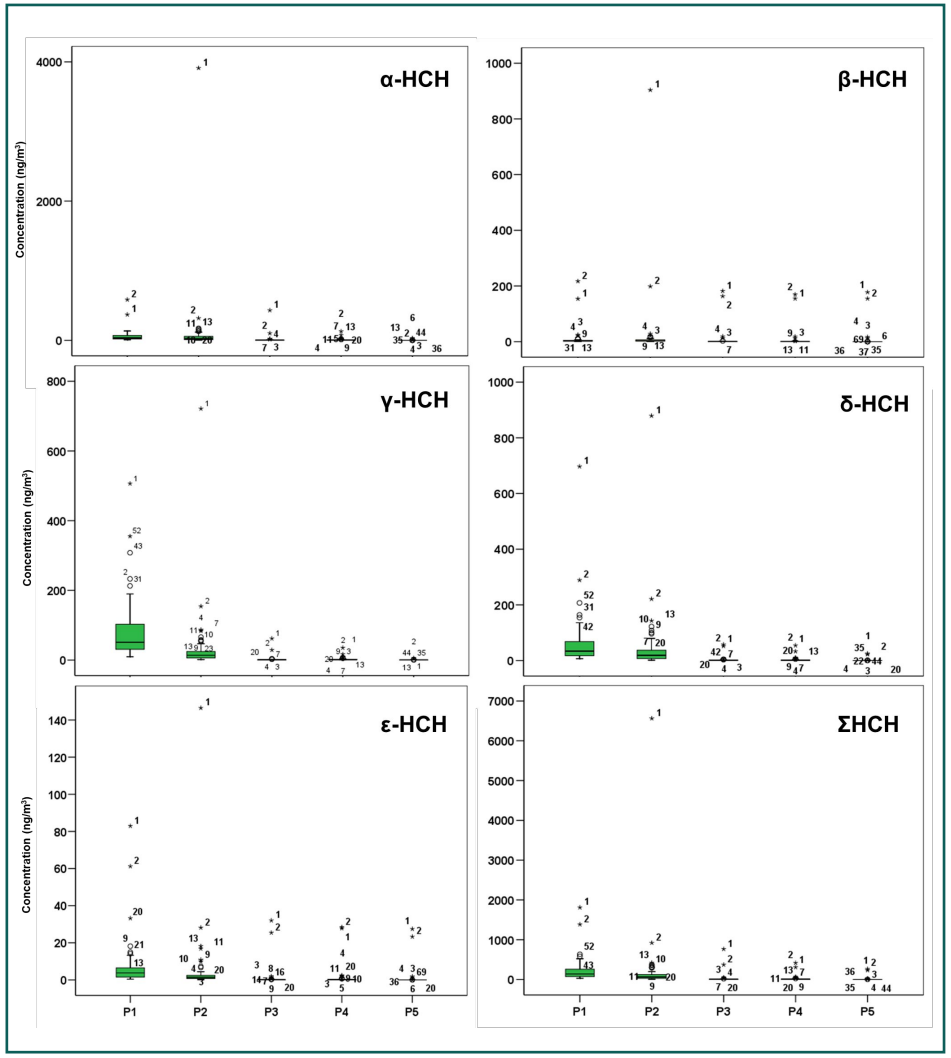
Cleanup
(florisil column)

HRGC-LRMS (TQ)

ES12/12224

RESULTS

BAILÍN AREA



Two different time periods:

- **SC1-SC2:** (dismantling old landfill and sealing new one)
- **SC3-SC74**

α-HCH, β-HCH, γ-HCH, δ-HCH, ε-HCH and ∑HCH

SC1-SC2 > SC3-SC74

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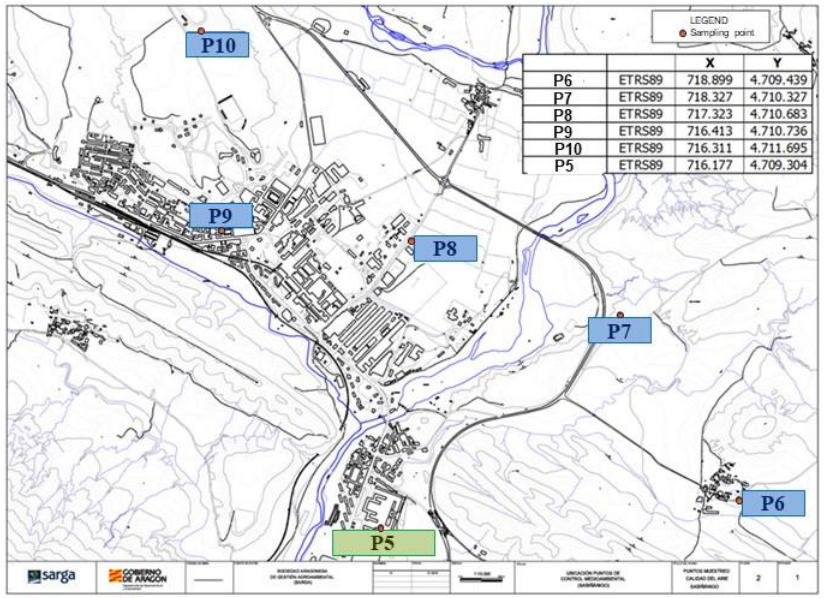
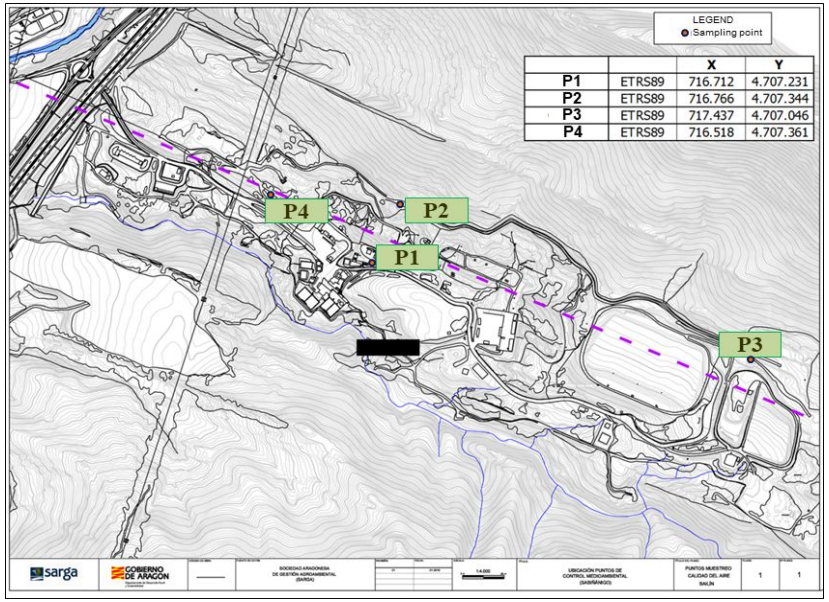
RESULTS



		X	Y
P6	ETRS89	718.899	4.709.439
P7	ETRS89	718.327	4.710.327
P8	ETRS89	717.323	4.710.683
P9	ETRS89	716.413	4.710.736
P10	ETRS89	716.311	4.711.695
P5	ETRS89	716.177	4.709.304



		X	Y
P1	ETRS89	716.712	4.707.231
P2	ETRS89	716.766	4.707.344
P3	ETRS89	717.437	4.707.046
P4	ETRS89	716.518	4.707.361

BAILÍN AREA

P1 - P2: Dismantled HCH cell
P3: New HCH cell
P4: Offices
P5: 3 km from Bailín

SC3-SC74

α-HCH, β-HCH, δ-HCH, ε-HCH, ∑HCH → **P1 ≈ P2 > P4 ≈ P3 > P5**

γ-HCH → **P1 > P2 > P4 ≈ P3 > P5**

P1 → γ-HCH no decrease with time

$r_s > 0.586$; $p < 0.01$ all HCH isomers

COMMON ORIGIN

Bailín Landfill

HCH source after dismantling

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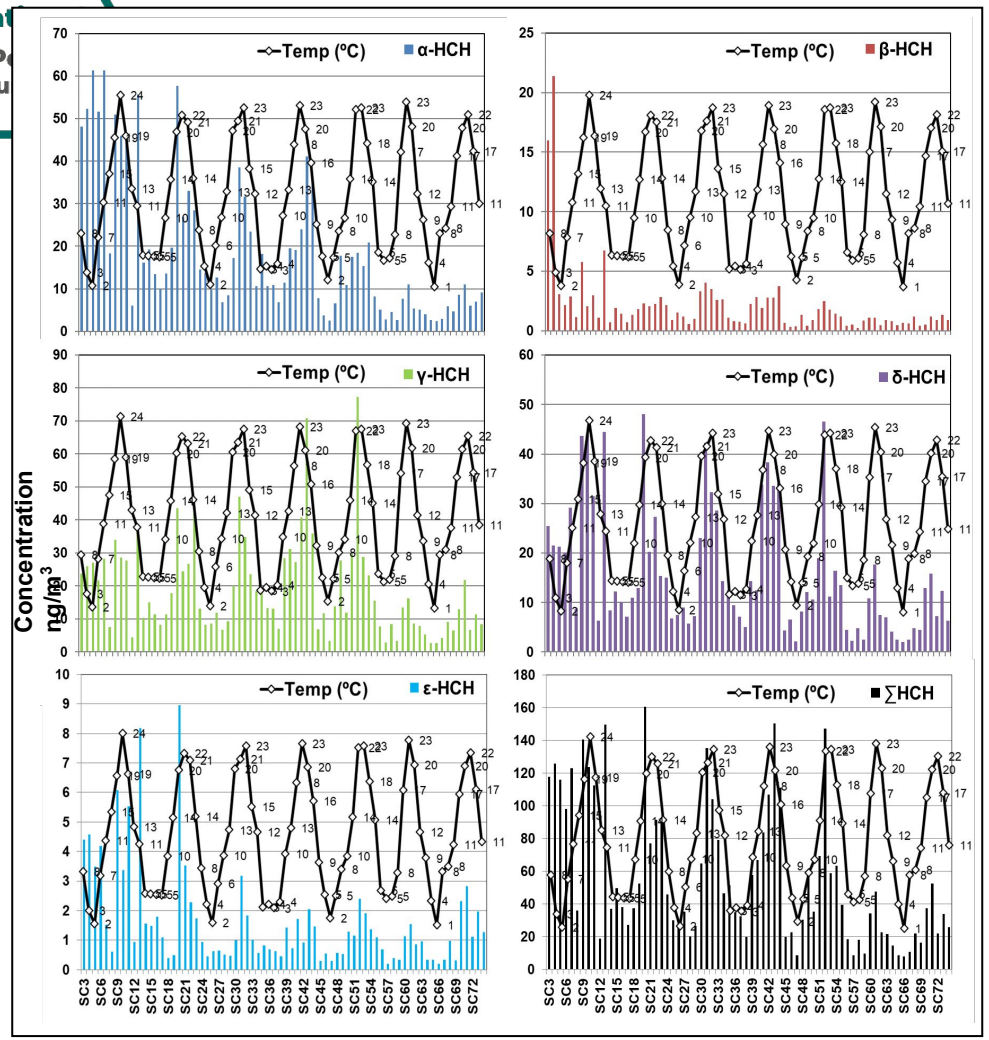
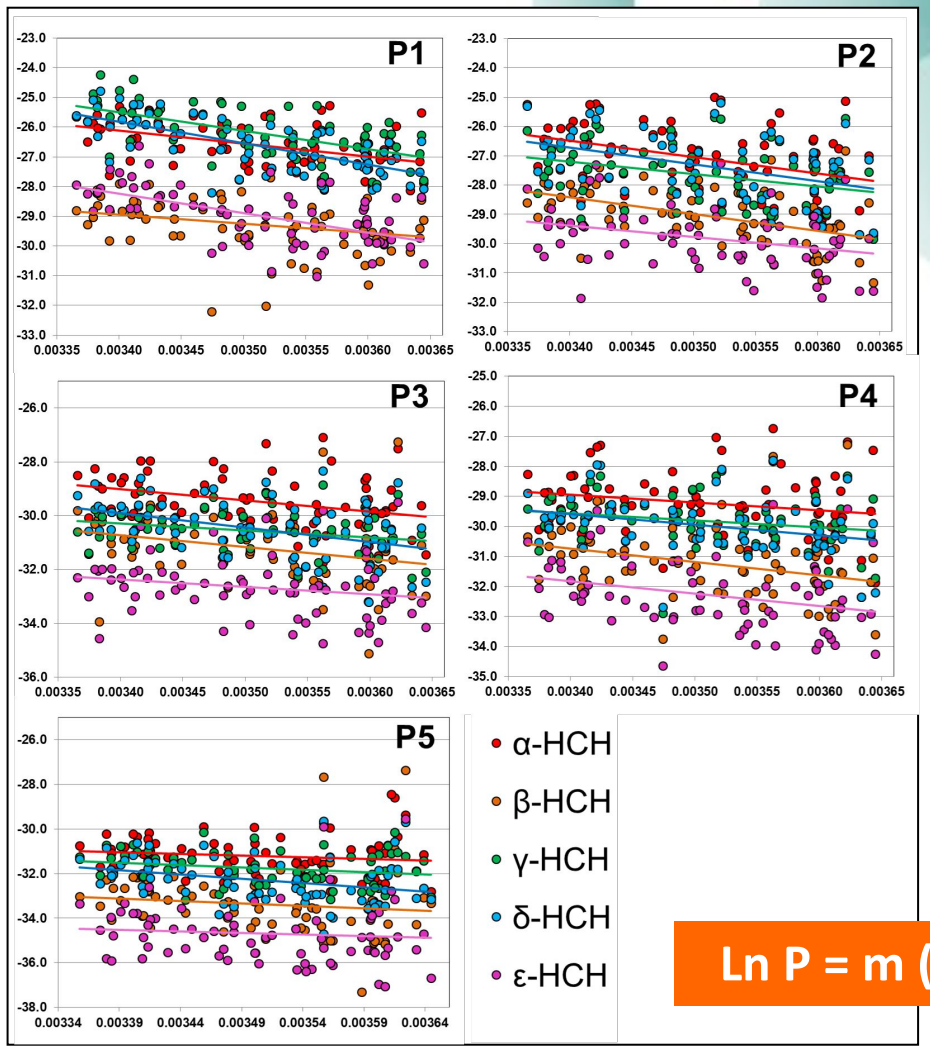
RESULTS

BAILÍN AREA





$$Ln\ P = m\ (1/T) + b$$

INFLUENCE OF THE METEOROLOGICAL PARAMETERS

(+) Temperature

(+) Solar radiation

(-) Humidity

$p < 0.05$

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ISOMER PROFILE

BAILÍN AREA

		Concentration (ng/m^3)					Contribution (%)				
		α-HCH	β-HCH	γ-HCH	δ-HCH	ε-HCH	α-HCH	β-HCH	γ-HCH	δ-HCH	ε-HCH
SC1-SC2	P1	477	185	370	493	72	31	12	22	30	5
	P2	2114	551	438	550	87	47	18	14	19	3
	P3	266	173	45	55	29	42	34	8	11	6
	P4	102	162	26	44	28	28	46	7	12	8
	P5	28	166	4.6	24	25	11	67	2	10	10
SC3-SC4	P1	91	23	46	39	8.1	44	12	22	18	4
	P2	114	25	66	63	8.8	40	9	24	24	3
	P3	18	16	3.2	5.2	1.7	41	36	7	12	4
	P4	26	15	8.4	8.3	2.3	42	27	14	14	4
	P5	1.9	14	0.5	1.7	1.59	9	72	2	9	8
SC5-SC74	P1	45	3.1	73	49	4.8	27	2	41	27	3
	P2	36	4.1	18	27	2.3	39	6	22	30	3
	P3	2.8	0.5	0.8	1.0	0.1	51	10	18	19	2
	P4	3.9	0.5	1.8	1.7	0.2	44	6	25	21	3
	P5	0.5	0.1	0.3	0.2	0.02	48	6	29	16	2

Two different time periods: SC1-SC4, SC5-SC74

SC5-SC74 → Stability

P1: γ-HCH > α-HCH ≈ δ-HCH > β-HCH ≈ ε-HCH

P2-P5: α-HCH > γ-HCH ≈ δ-HCH > β-HCH ≈ ε-HCH

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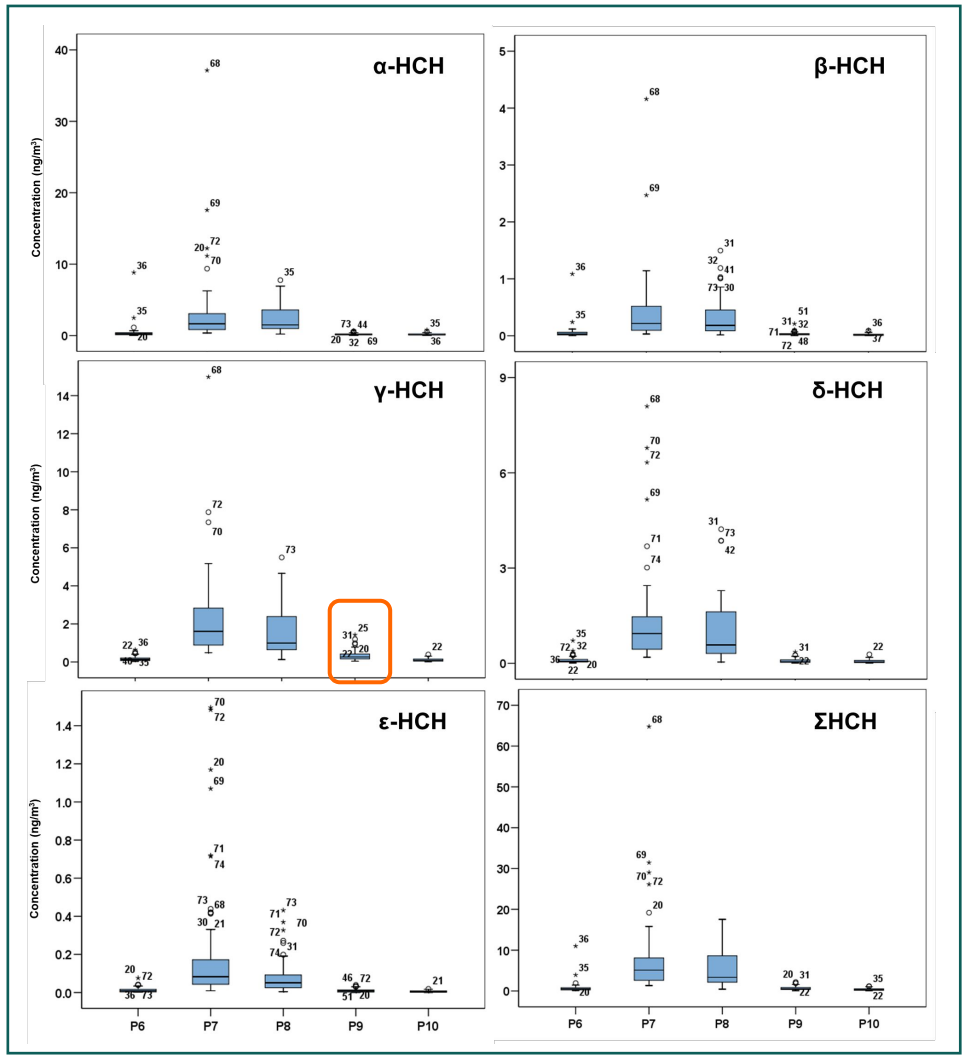
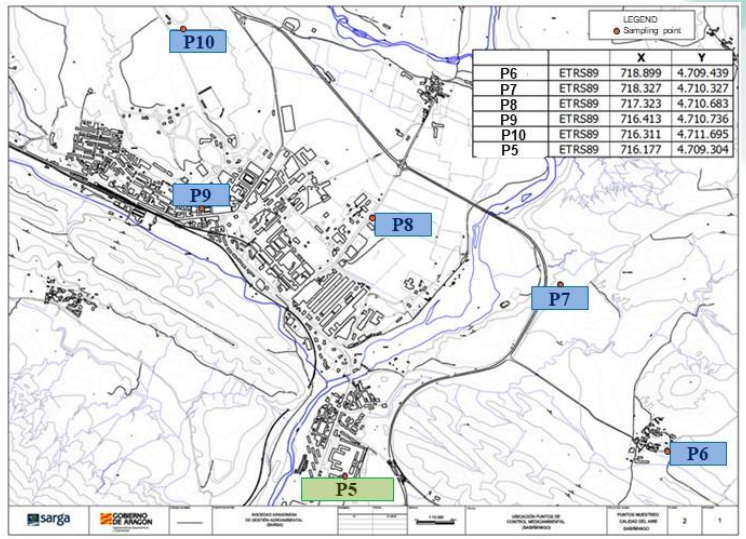
RESULTS

SARDAS AREA



$r_s > 0.423$; $p < 0.01$ all HCH isomers

COMMON ORIGIN



α-HCH, β-HCH, δ-HCH, ε-HCH, ∑HCH

P7 ≈ P8 > P6 ≈ P9 ≈ P10

γ-HCH → **P7 > P8 > P9 > P6 ≈ P10**

P9 → γ-HCH increase ($p < 0.01$)
γ-HCH source with influence in P9

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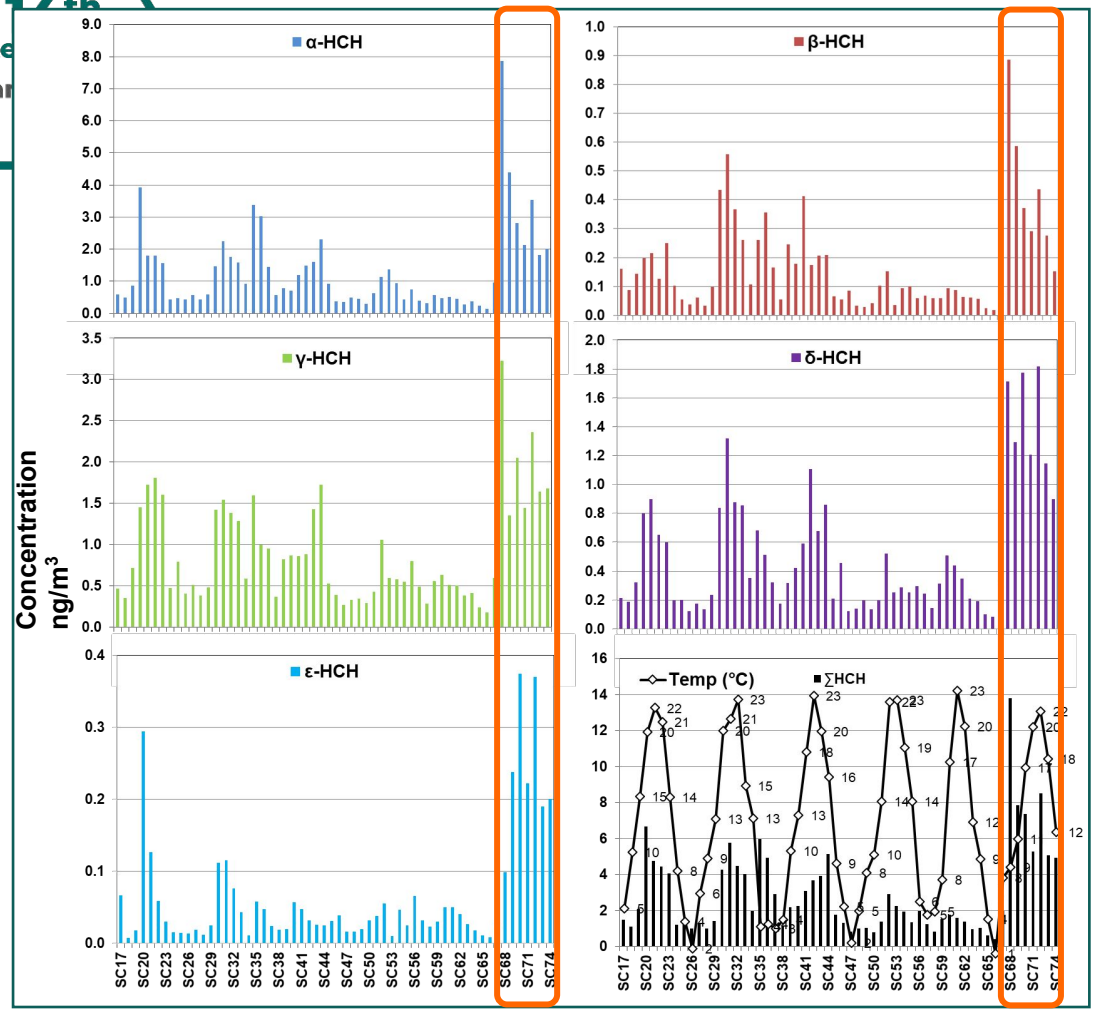
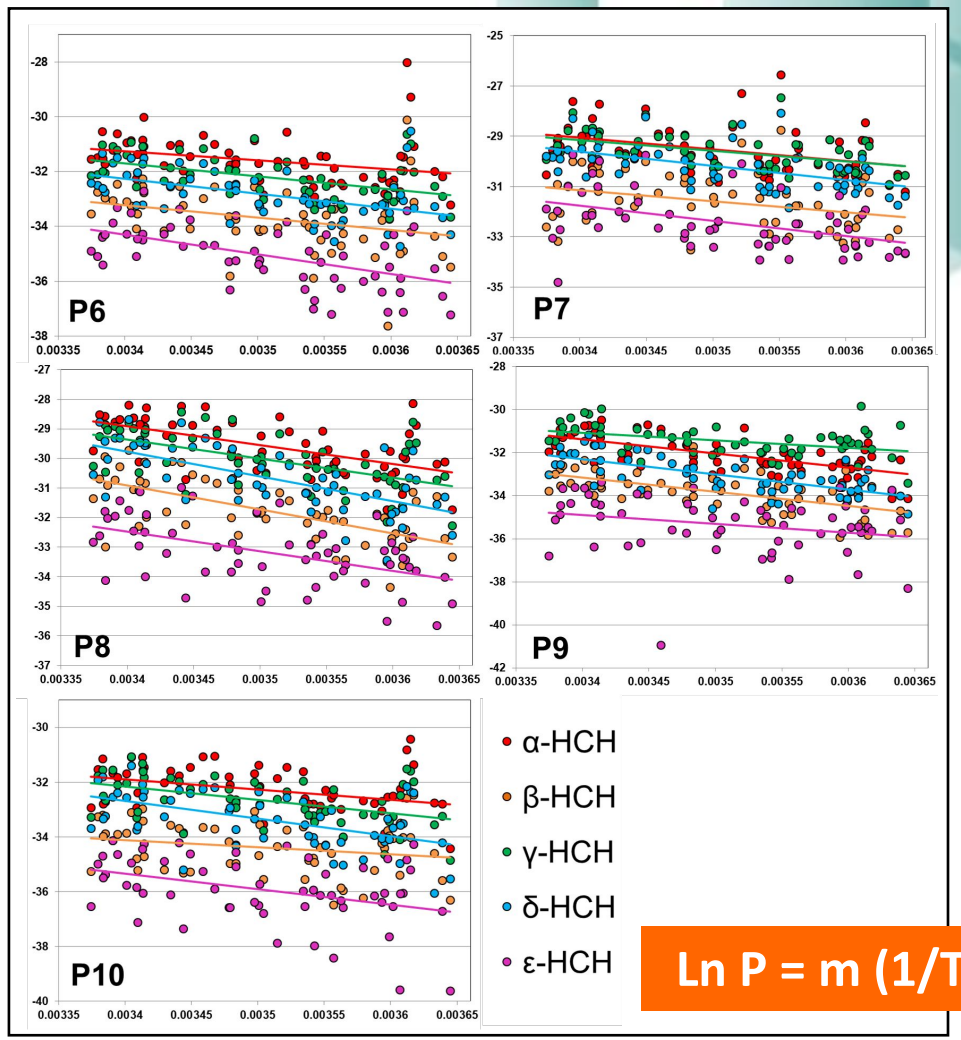
RESULTS



Increase in all HCH isomers since SC68 → P7

SARDAS AREA



$Ln\ P = m\ (1/T) + b$

INFLUENCE OF THE METEOROLOGICAL PARAMETERS

(+) Temperature

(+) Solar radiation

(-) Humidity

$p < 0.05$

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ISOMER PROFILE

		Concentration (ng/m^3)					Contribution (%)				
		α-HCH	β-HCH	γ-HCH	δ-HCH	ε-HCH	α-HCH	β-HCH	γ-HCH	δ-HCH	ε-HCH
SC17-SC67	P6	0.46	0.06	0.17	0.10	0.01	49	7	28	15	2
	P7	1.97	0.29	1.73	0.93	0.12	37	6	36	19	2
	P8	2.26	0.29	1.45	0.86	0.06	47	6	30	16	2
	P9	0.17	0.03	0.34	0.07	0.01	27	6	54	11	2
	P10	0.16	0.02	0.11	0.06	0.00	44	7	31	16	2
SC68-SC74	P6	0.40	0.05	0.21	0.14	0.03	48	6	26	17	3
	P7	12.63	1.46	6.66	4.91	0.91	41	5	28	21	5
	P8	3.92	0.56	2.48	1.77	0.25	46	6	26	19	3
	P9	0.40	0.05	0.36	0.14	0.017	41	5	38	13	2
	P10	0.19	0.02	0.10	0.07	0.009	50	5	27	17	2
SC17-SC74	P5	0.54	0.06	0.25	0.15	0.01	47	6	29	16	2

Two different time periods: SC17-SC67, SC68-SC74

SC17-SC67

P6, P7, P8, P10: α-HCH > γ-HCH > δ-HCH > β-HCH > ε-HCH → ≈ P5

P9: γ-HCH > α-HCH > δ-HCH > β-HCH > ε-HCH

SC68-SC74

P7 → α-HCH > γ-HCH > δ-HCH > β-HCH > ε-HCH

CONCLUSIONS

- [HCH] much higher than those related to other Spanish locations.

Bailín landfill → **HCH pollution source**
also after dismantling old cell and sealing new one
[HCH] at Bailín area > [HCH] at Sardas area

Sardas landfill and INQUINOSA → **HCH pollution source**

Sabiñánigo ≈ HCH POLLUTION MEGASITE

- **[γ-HCH] at P1-P4 < 0.5 mg/m^3** (occupational exposure limit established by the Spanish National Institute for Safety, Health and Welfare at Work (INSST).
- **[γ-HCH] at P3-P10 < 0.0003 mg/m^3** (chronic inhalation reference exposure level calculated by California Environmental Protection Agency (CalEPA).
- **[α-HCH] at P5-P10 < 0.00025 mg/m^3** (inhalation reference concentration - RfC; Stockholm Convention).
- [HCH] higher during the warmest months.

Despite of remediation and containment measures implemented, further pollution control activities should be carried out to protect the environmental compartments and the human health.

ACKNOWLEDGEMENTS

Scientific Committee
&
Organizing Committee

FOR ACCEPTING OUR RESEARCH GROUP
AS PART OF THIS EVENT

GOVERNMENT OF ARAGON
Department of Rural Development and Sustainability

THANK YOU FOR YOUR ATTENTION

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RESULTS

SARDAS AREA

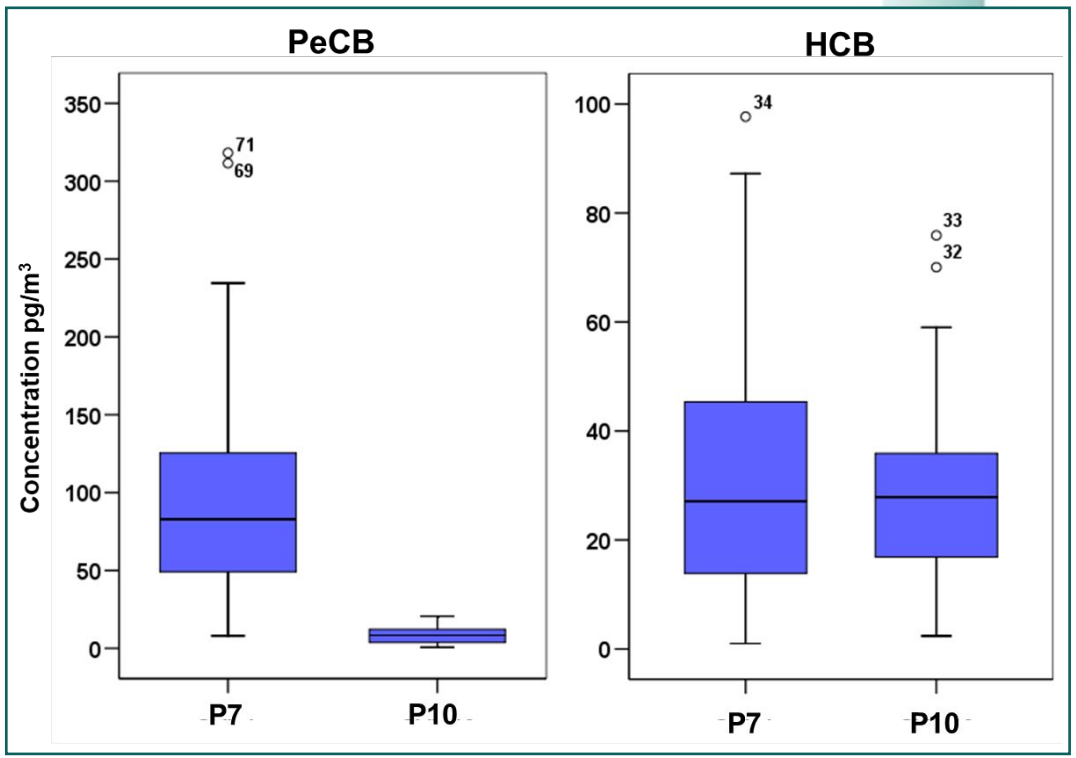
From October 2016 to November 2021

51 sampling campaigns

INFLUENCE OF THE METEOROLOGICAL PARAMETERS

(+) Solar radiation

[PeCB] at P7



PeCB: P7 > P10

HCB: P7 ≈ P10

		Concentration (pg/m^3)			Contribution (%)	
		PeCB	HCB	∑CB	PeCB	HCB
SC24-74	P7	95	30	126	73	27
	P10	9	29	38	23	77

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