

Jornadas sobre Riesgos Ambientales y Salud  
IV Conferencia sobre Disruptores Endocrinos  
Ministerio de Sanidad y Consumo  
Madrid, 3 abril 2001

**Concentraciones internas  
de compuestos organoclorados  
en la población española:  
el puzzle sin piezas y  
la protección de la salud pública**

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- "In spite of the 1972 U.S. ban of DDT, human exposure to DDT potentially is great because of its extensive former use and the persistence of the compound and its metabolites in the environment."

National Toxicology Program  
**8th. Report on Carcinogens (1998)**  
[http://ntp-server.niehs.nih.gov/Main\\_pages/NTP\\_8RoC\\_pg.html](http://ntp-server.niehs.nih.gov/Main_pages/NTP_8RoC_pg.html)

- DDT continues to be used. Total global use (worldwide) may be as great in the 1990s as it was in the 1970s.

– Smith D. *Int J Epidemiol* 1999.  
– Lindström G et al. *Env Health Perspect* 1995.

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**THE LANCET** • Vol 356 • December 16, 2000

Johannesburg, Dec. 4-10. POPs Convention:

→ allow about 25 endemic countries to use  
(with restrictions?) DDT against malarial  
mosquitoes pending development of safer  
solutions.

→ DDT should be used only for indoor  
residual spraying and should not be  
diverted for agricultural use.

→ find alternatives to DDT.

→ elimination of 8 chemicals: the  
pesticides pexachlorobenzene,  
endrin, mirex, toxaphene,  
chlordan, heptachlor, aldrin,  
and dieldrin.

→ PCBs, dioxins, and furans  
should be phased out (+25 y?).

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### Otros enlaces

- Attaran A, Maharaj R, Liroff R. Debate.  
BMJ 2000 (2 Dec); 321: 1403-5.  
[www.bmj.com](http://www.bmj.com)
- Lancet 2000; 356:
  - Editorial: 265.
  - Smith AG: 267-8.
  - Roberts DR et al: 330-2.
  - Correspondence: 1189-91.
  - Kapp C: 2076.
- [www.psrus.org/endofs.htm](http://www.psrus.org/endofs.htm)
- [www.worldwildlife.org/toxics](http://www.worldwildlife.org/toxics)

- Lang T. The new GATT round: whose development? Whose health? *JE&CH* 1999; 53: 681-2.
- Lang T. The new globalisation, food and health: is public health receiving its due emphasis? *JE&CH* 1998; 52: 538-9.
- McKee M, Lang T, Roberts JA. Deregulating health: policy lessons from the BSE affair. *J R Soc Med* 1996; 89:424-6.
- Lang T. Food policy and public health. *Public Health* 1992;106: 91-125.
- Morabia A, Porta M. *Perspect Biol Med* 1998; 41: 259-66.

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- Organochlorines predominantly accumulate in the lipid fractions of the human food chain, through which animal fatty foods have become a major source of exposure for humans.

Herrera A. *Bull Env Contam Toxicol* 1996

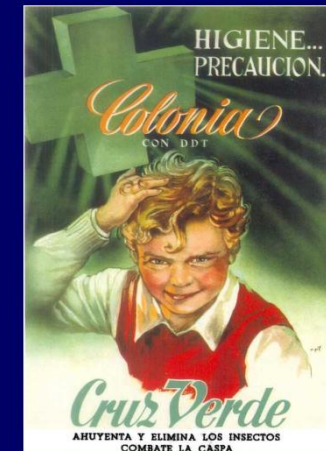
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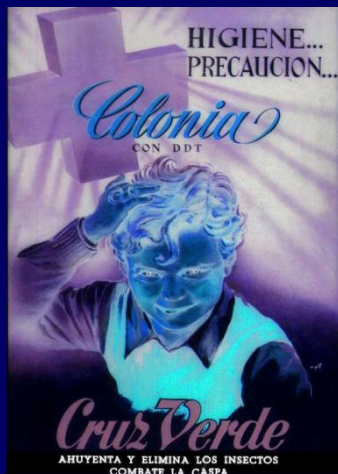
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## Low-dose effects

**Doses** of some OCs (including PCBs) **far below** those normally found to be safe [ppb] **can indeed cause** biological effects.

- Kaiser J. *Science* 2000; 288: 424-5.
- Kaiser J. *Science* 2000; 290: 695-7.





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## Spain:

- Highest DDT levels in human breast milk of Western Europe during '60s to '80s.

– Smith D. *Int J Epidemiol* 1999

## OCs in pasteurized milk, Spain (97 samples)

Pesticides	Positive (%)	Mean (ppm)
$\alpha$ -HCH	32.3	0.015
$\beta$ -HCH	23.7	0.039
$\gamma$ -HCH (Lindane)	42.3	0.007
$\delta$ -HCH	86.6	0.070
$\Sigma$ HCH	95.9	0.123
p,p'-DDT	1.00	0.0007
o,p'-DDD	23.7	0.016
p,p'-DDD	26.8	0.009
p,p'-DDE	45.4	0.045
DDT metabolites	73.5	0.067

Martínez MP et al. *Food Chem Toxicol* 1997

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## OCs in animal & human MILK, Spain

Hernández LM, González MJ, et al.  
(CSIC Madrid).

*Bull Environ Contam Toxicol*

1982, 1993, 1994, 1996...

## Food surveys in Spain:

- 83% of lamb samples contained DDT. HCB and HCH were detected in 100% of lamb and pork. PCBs in 50% of fish (congeners 138, 153 and 180).

– Herrera A et al. *J Food Protect* 1994, 1999; *J Agricult Food Chem* 1996, 1998; *Food Addit Contam* 1995.

## PCB residues in food, Spain

Food	138	153	180	TCBs
Legumes	ND	ND	ND	ND
Vegetables	ND	ND	ND	ND
Fruits	ND	ND	ND	ND
Meat	ND	ND	ND	ND
Egg-based	ND	ND	ND	ND
Fish-based	21%	8%	38%	50%

Lázaro R et al. *J Food Protect* 1999

## DDE residues in meat products

Type of meat	N	% with DDE	Mean ( $\mu\text{g}/\text{kg}$ fat)
Pork cured sausage	26	88.5	6.3
Pork cured ham	30	90	7.0
Pork bologna	20	100	16.0
Fresh sausage - beef pork	22	100	6.6
Fresh beef sausage	13	92.3	7.7
Fresh poultry sausage	18	77.8	6.3

Ariño A et al. *Food Addit Contam* 1995

## Mean pesticide levels ( $\mu\text{g}/\text{kg}$ fat)

	Meat (n=75)	Meat products (n=76)	Milk (n=208)
HCB	40	12	19
$\alpha$ HCH	22	13	43
$\beta$ HCH	14	<4	16
Lindane	54	25	12
Dieldrin	<4	2.3	26
DDTs	14	9	56

Herrera A. *Bull Env Contam Toxicol* 1996

## Basque Country, Spain

160 samples, % positive :

21% for DDE: fish, eggs, dairy p., meat.

17% for  $\gamma$ -HCH: milk & dairy, meat, cereals, eggs, high levels in bread.

15% for HCB: eggs, meat, dairy prods.

Urieta I. Food Addit Contam 1996; 13: 29-52.

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# ¿y en humanos?

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## OCs in BUTTER, Spain

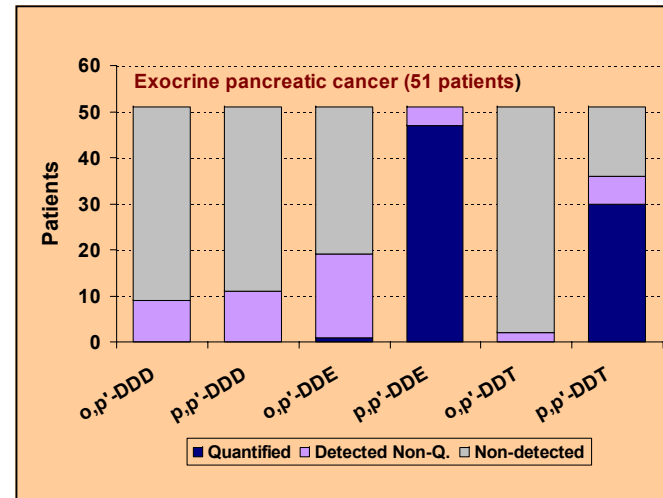
36 and 20 samples

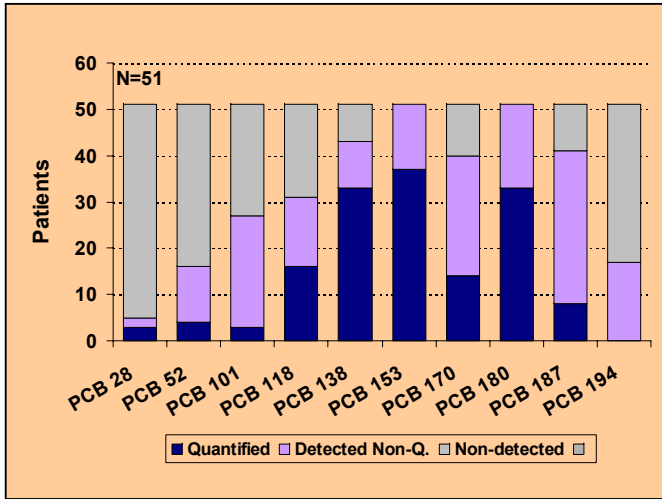
Significantly higher levels than other European countries of:

$\gamma$ -HCH  $\beta$ -HCH HCB p,p'DDE

Non-punctual source of contamination.

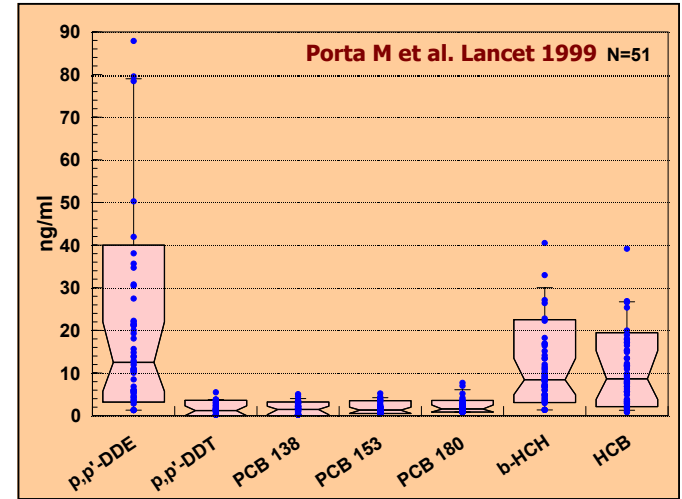
Badia-Vila M. J Env Sci Health 2000; B35(2): 201-10.





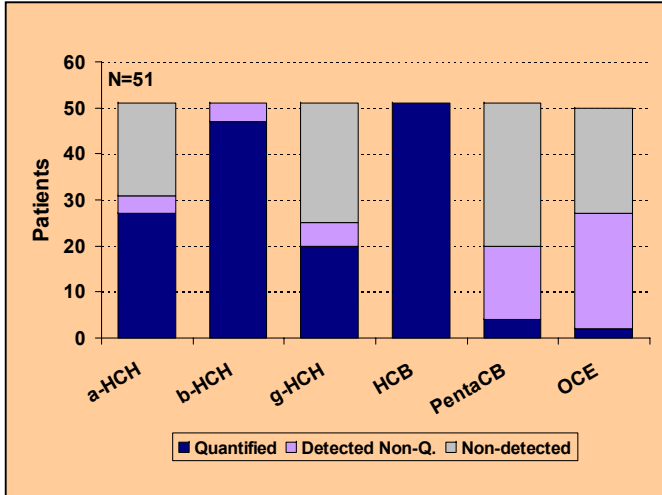
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## Organochlorine concentrations Pancreatic cancer in Spain (n=51) and in San Francisco (n=108)

Compound	Lipid basis (ng / g lipid)	
	Mean	Median
<i>p,p'</i> -DDE – Spain	2730	1856
<i>p,p'</i> -DDE – San Francisco	2054	1287
A / B	33%	44%
<b>Total PCBs – Spain</b>	<b>1330</b>	<b>1098</b>
Total PCBs – San Francisco	433	329
A / B	207%	234%
<b>Hexachlorobenzene – Spain</b>	<b>1610</b>	<b>1080</b>
Hexachlorobenzene – S Francisco	28	22
A / B	5650%	4809%

A: Porta M et al. Lancet 1999.

B: Hoppin JA et al. Cancer Epidemiol Biomarkers Prev 2000.

## PANKRAS II and FLIX Studies. Subjects with levels detected (%)

COMPOUND (n)	PANKRAS II		F L I X				CONTROLS	
	1 (51)	4 (26)	5 (59)	6 (128)	7 (421)	8 (26)	9 (17)	
<i>p,p'</i> -DDT	71	69	54	70	61	19	88	
<i>p,p'</i> -DDE	100	100	97	98	98	100	100	
<i>o,p'</i> -DDE	37	54	10	12	8	0	0	
PCB 101	53	77	5	12	8	0	0	
PCB 118	61	81	39	66	37	12	94	
PCB 138	84	100	90	87	85	85	100	
PCB 153	100	100	90	84	82	62	100	
PCB 180	100	100	90	88	87	96	100	
Hexachlorobenzene	100	100	100	100	100	100	100	
$\alpha$ -hexachlorocyclohexane	61	27	5	8	9	0	0	
$\beta$ -hexachlorocyclohexane	100	100	78	87	88	100	100	
$\gamma$ -hexachlorocyclohexane	49	89	2	5	2	0	24	
Octachlorostyrene	54	54	53	41	19	0	0	

1: All cases of exocrine pancreatic cancer. 4: Controls from Hospital del Mar, Barcelona.  
5: Factory workers. 6: Factory ex-workers. 7: Inhabitants, never workers. 8: Controls from Hospital del Mar. 9: Controls from a Health Centre in Barcelona.

## Niveles de OCs en sangre de cordón umbilical

	Periodo	PCBs	p,p'DDE	HCB
Canadá*	1993-1995	0.50	0.41	0.04
USA*	1993-1998	0.54	0.48	0.03
Alemania	1994-1995	0.96	-	0.61
Barcelona	1998	0.52	0.70	0.60
Ribera Ebro*	1997-1999	0.25	1.0	0.96
Flix*	1997-1999	0.31	0.85	1.45

\* Muestras representativas de la población general

Sala M, Sunyer J et al. Chemosphere 2001 (en prensa)

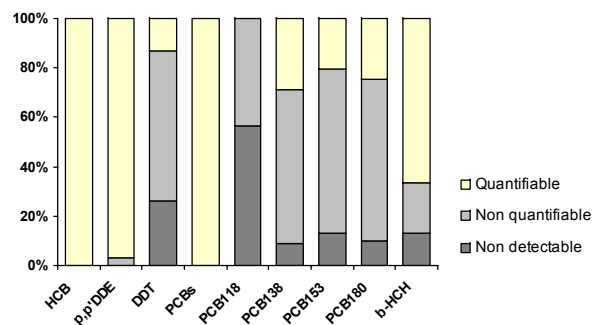
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## OCs levels in cord blood of newborns (n=69)



## Serum hexachlorobenzene levels in the population of Flix, Spain

Exposure Level	N	HCB ng/ml Mean (SD)
Total Population	604	39.8 (127.7)
Workers	185	93.4 (223.3)*
Non-Workers	419	16.9 (17.1)

\* p<0.01 in comparison with non workers



**Comparison of serum levels of hexachlorobenzene (ng/mL) in different populations**

N	Area	Mean (range)	Reference
604	Flix	<b>39.8</b> (1.1-1616)	Present study
100	Barcelona	<b>4.13</b> (0.7-19.7)	To-Figueras, 1995
370	USA	0.189 (0.05-3.21)	Needham, 1990
15	Croatia	1.0 (0.5-4)	Krauthacker, 1993
6	Germany	1.23 (0.33-2.66)	Van der Ven, 1992

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**OCs in farmers, Navarra, Spain**

(N=147) ~1986 Serum	+	Mean (ppb)
HCB	90%	22.22
p,p'DDE	100%	15.16
p,p'DDT	31%	5.46
$\beta$ -HCH	76%	5.08
$\gamma$ -HCH	9%	4.32

Pérez de Ciriza et al. 1as. Jdas. nacionales  
HCB. Barcelona, 1988: 123-139.

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**OCs in humans, Navarra, Spain**

(N=86) 1991 Fat tissue	Mean ( $\mu$ g/g lipid)
HCB	<b>3.37</b>
p,p'DDE	<b>3.93</b>
p,p'DDT	<b>0.40</b>
$\beta$ -HCH	<b>1.53</b>
PCBs	<b>2.44</b>

Gómez-Catalán J et al.  
Bull Environ Contam Toxicol 1995

**OCs in humans, Catalonia, Spain**

(N=256) 1985-1988 Fat tissue	Mean ( $\mu$ g/g lipid)
HCB	<b>2.99</b>
p,p'DDE	<b>6.00</b>
p,p'DDT	<b>1.18</b>
$\gamma$ -HCH (Lindane)	<b>0.06</b>
$\beta$ -HCH	<b>1.97</b>

Gómez-Catalán J et al.  
Bull Environ Contam Toxicol 1993

## Mujeres de 5 ciudades europeas

**Málaga: los niveles más altos de p,p' DDE (media: 3,34 µg/g) (tejido adiposo)**

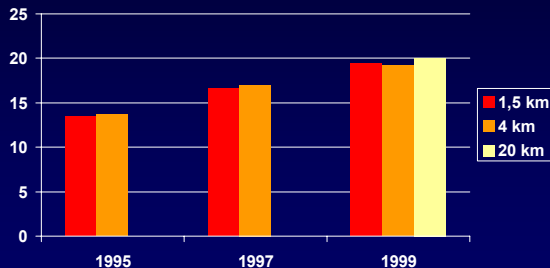
**Diferencia estadísticamente significativa respecto a las otras 4 zonas (Berlin, Zurich, Coleraine, Zeist).**

## Estudio habitantes incineradora Mataró (Barcelona) 1995, 1997, 1999.

	MATARÓ				ARENYS
	EXPOSED		CONTROLS		
	1999 (µg/L)	1995-99 change	1999 (µg/L)	1995-99 change	
PCB 138	0.50	-2.0%	0.46	0.0%	0.61
PCB 153	0.78	+9.9%	0.71	10.9%	0.85
PCB 180	0.66	+8.2%	0.60	7.1%	0.72
138+153+180	1.94	+6.6%	1.77	6.6%	2.18

González CA, Pera G, Kogevinas M, Gadea E et al.  
Consorci Sanitari de Mataró 2000

## Niveles promedios de dioxinas (I-TEQ) según distancia residencia / incineradora Mataró (Barcelona) 1995, 1997, 1999



Gonzalez CA, Kogevinas M et al. Epidemiology 2001

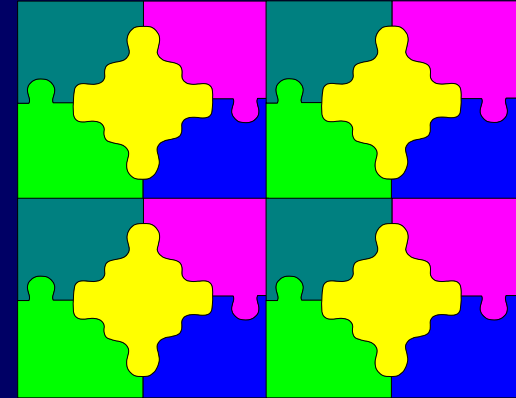
**¿Cuales son las concentraciones internas (sangre, tejidos) de OCs en las españolas y españoles?**

**Según...**

- zonas geográficas
- grupos de edad y género
- hábitos alimentarios
- ocupación y educación
- otros factores...

En España no disponemos de un estudio científico **poblacional** sobre los factores que condicionan las **concentraciones internas** en **humanos** del DDT y los otros residuos OCs.

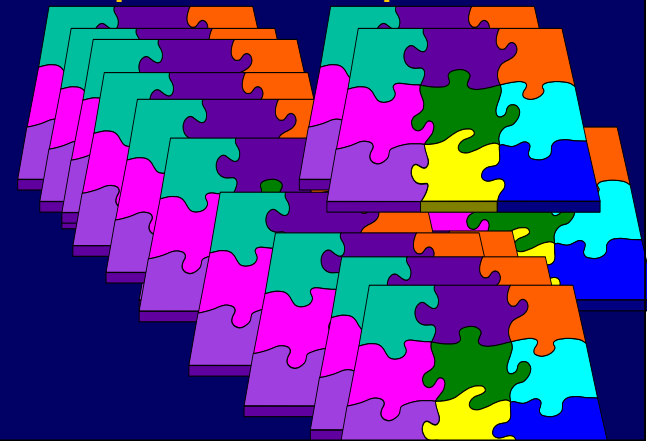
### OCs en la población española



### ¿OCs en la población española?



### Las piezas reales del "puzzle"



Las piezas que conocemos



## ¿Y la protección de la salud pública?

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En España es necesario efectuar un estudio científico **poblacional** sobre los factores que condicionan las **concentraciones internas** en **humanos** del DDT y los otros residuos OCs.

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→ "Role of public health authorities in the evaluation of biological levels of environmental contaminants among persons for the assessment of risk of adverse effects."

Rhains M. Arch Env Health 1999

### Estudios poblacionales / 1

- **NCHS – EPA – NHANES II.** Murphy R, Harvey C. Envir Health Perspect 1985.
- "Agricultural Health Study". Brock JW et al. Toxicol Ind Health 1998.

## Estudios poblacionales / 2

- “National Report on Human Exposure to Environmental Chemicals”.

basado en NHANES 1999

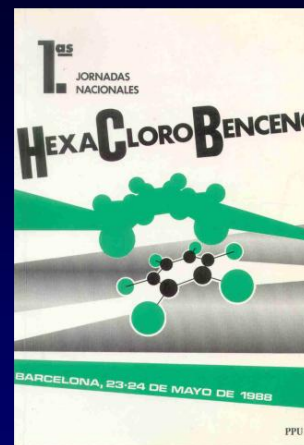
[www.cdc.gov/nceh/dls/report](http://www.cdc.gov/nceh/dls/report)

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## Estudios poblacionales / 3

- “Nurses’ Health Study”. Laden F. Env Health Perspect 1999.
- P. Químicos en leche materna.
  - LaKind JS. Envir H Perspect 2001.
  - Slorach SA, Vaz R. EHP 1985.
- Población anciana de Alemania. DeVoto E et al. Arch Env Health 1998.



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We must seek to have food production, transport and distribution *moderated by social consensus and regulation* in favour of practices that are both *health supporting* and *ecologically sustainable*.

McMichael AJ. *Journal of Epidemiology & Community Health* 1999; 53: 742-743.