
AIR EMISSIONS IN FRANCE

Mainland France

Substances relative to the contamination by persistent organic pollutants

(Emissions_FRmt_POPEN)

*Note : the data presented in this document are revised annually in order to take into account the continuous improvements in knowledge, methodologies and reporting rules. Users are advised to ensure they are working from the most recent updates which may be published without prior notice.
Figures and data tables are not translated.*

These results come from work carried out with the financial support of Ministry of Ecology, Energy, Sustainable Development and Spatial Planning (MEEDDAT) / Department of Environment and Industry (SEI)

(last updated May 2008)

Substances and index currently monitored

Persistent Organic Pollutants (POP) : Dioxins and furans (PCDD-F), Polycyclic Aromatic Hydrocarbons (PAHs : benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3)pyrene), Polychlorobiphenyls (PCBs) and Hexachlorobenzene (HCB).

Emissions in relation to key indicators such as population, area, gross domestic product (GDP), primary energy consumption, etc.

Emissions are presented in the form of charts for each substance and the main source categories in five-year intervals until 2000 and, thereafter, annually. The years corresponding to the maximum and minimum values are also included. Results are provisional for 2007. More detailed data highlighting various parameters such as sectors, fuels, etc. are available (by downloading the complete report : www.citepa.org/emissions/nationale/index_en.htm). Data are also available on CD-ROM at CITEPA.

1 Dioxins and furans – PCDD-F

Source : CITEPA / CORALIE / SECTEN format – last updated 28 february 2008

Emissions		Variations	
Survey period :	from 1990		
Emissions in 2006 :	127 g ITEQ	Variation 2006 / 1990 :	-93%
Maximum observed :	1 894 g ITEQ in 1993	Variation 2006 / maximum :	-93%
Minimum observed :	127 g ITEQ in 2006	Variation 2006 / minimum :	0 %

Main emitters

Main emitters in 2006 (sub-sectors ≥ 95 % of total emissions) :

1 - Iron and steel industry	33 %
<i>including : Electric furnace steel plant</i>	10 %
<i>Sinter and palletizing plants</i>	23 %
2 - Waste treatment	33 %
3 - Residential	16 %
4 - Other energy conversion sectors	6.5 %
5 - Non-ferrous metal smelting	2.6%
6 - Other agriculture	1.1 %
7 - Solid mineral fuel conversion – steel industry	0.8 %
8 - Construction	0.8 %
9 - Electricity production	0.7 %

Comments

127 g ITEQ (International Toxic Equivalent) of dioxins and furans emissions were estimated in 2006. Since 1990, emissions fell sharply (-93%, i.e. -1 636 g ITEQ). The sharp decrease observed since 1990 as a result of considerable improvements in waste incineration and in iron and steel industry.

Still, a slight increase is observed in 2004, especially due to a dysfunction from a waste incinerator closed since then.

The formation of dioxins and furans is driven by complex phenomena with particular operating conditions during combustion which can be met in any sector but occurring more frequently in case of waste incineration, sinter plants and also in other particular processes.

The main sectors emitting dioxins and furans emissions were in 2006 :

- manufacturing industry (72%),
- residential/tertiary (17%).
- energy conversion (8%),

The other sectors contributed to less than 2% and even not at all.

Most of the emissions of energy conversion come from waste incineration with energy recovery. Thus, this share has fallen from 97% of the emissions of this sector in 2005 to 77% in 2006 due to reduction techniques following the application of the order of the 20th September 2002 (EU Directive 2000/76/EC).

Waste incineration without recovery, included in manufacturing industry, accounted for less than 1% of the emissions of this last sector in 2006, whereas it represented 43% in 1990. This drop is a result of improvements and particularly of the increase of energy conversion since 1990 from 69% to 97% of waste incinerated during the period. However, emissions of this sector in 2004 had a sharp increase due to a dysfunction from a waste incinerator which emitted 50 g ITEQ just by itself.

The improvements realised in iron and steel industries, especially for sinter plants, contributed to reduce their emissions since 1990 (-89%, i.e. about -325 g ITEQ during 1990-2006 period).

PCDD-F

EMISSIONS DANS L'AIR EN FRANCE METROPOLITAINE
(unité g ITEQ)

Source CITEPA / CORALIE / format SECTEN mise à jour : 28 février 2008 Secten_niv_1_POP-d/DIOX.xls

Année	Transformation énergie	Industrie manufacturière	Résidentiel / tertiaire	Agriculture/sylviculture hors UTCF (**)	Transport routier	Autres transports (*)	UTCF (**)	TOTAL	Hors total (*)
1990	836	865	52	1,7	9,2	0,2	0	1 763	1,1
1993	933	901	50	1,4	8,6	0,2	0	1 894	1,0
1995	732	910	44	1,5	6,9	0,2	0	1 695	0,9
2000	268	215	31	1,3	4,1	0,3	0	520	1,2
2001	202	148	29	1,4	3,7	0,3	0	385	1,1
2002	181	148	24	1,4	3,3	0,3	0	358	1,0
2003	99	108	25	1,4	2,9	0,3	0	237	1,1
2004	164	106	24	1,4	2,6	0,3	0	299	1,3
2005	94	96	23	1,4	2,4	0,3	0	216	1,2
2006	11	92	21	1,4	2,1	0,3	0	127	1,3
2007 (e)	11	91	20	1,4	1,9	0,3	0	125	1,3

(*) selon définitions de la CEE-NU - les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources biotiques des forêts et les émissions des sources non-anthropiques.

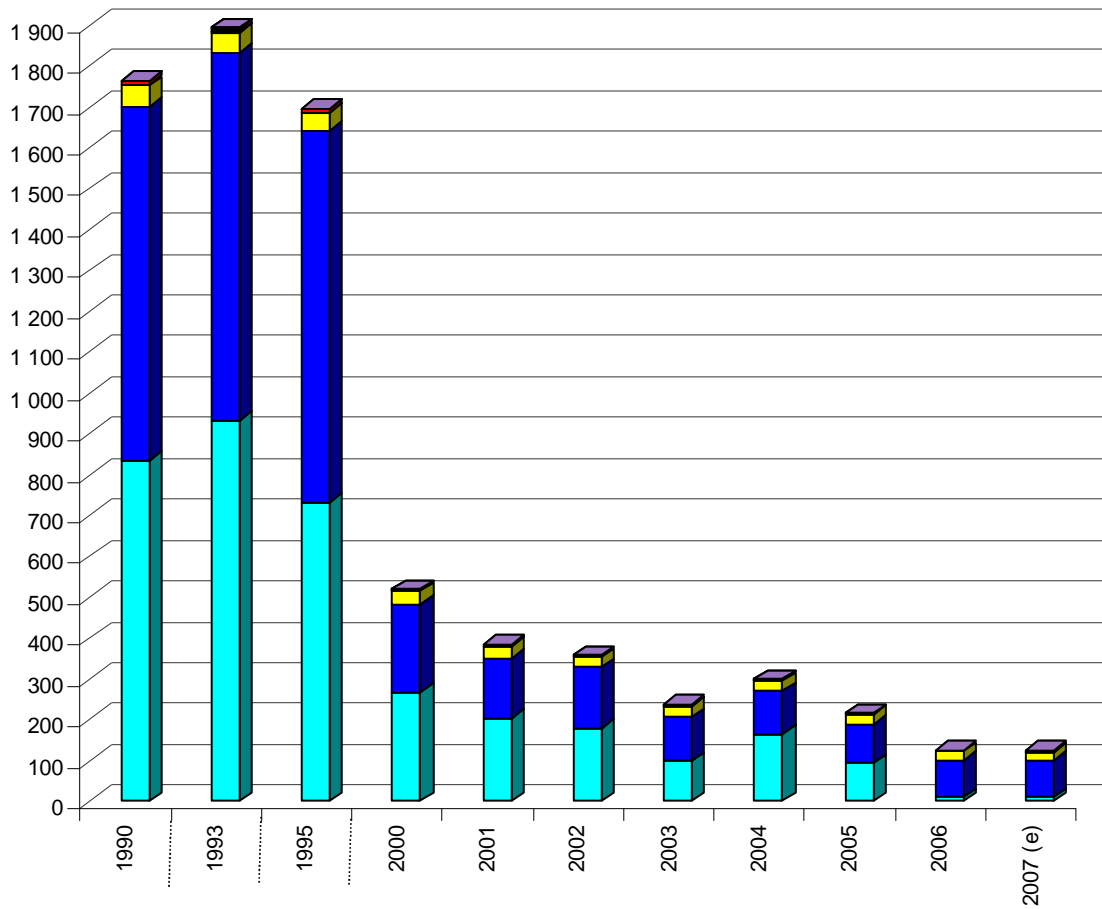
(**) Utilisation des Terres, leur Changement et la Forêt

(e) estimation préliminaire

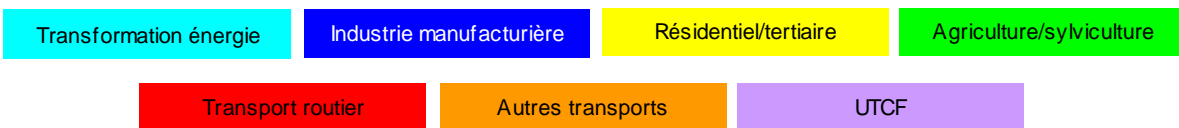
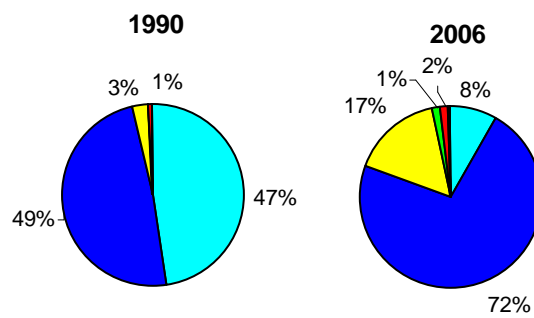
Avertissement : ces valeurs sont régulièrement révisées et complétées afin de tenir compte de l'amélioration permanente des connaissances, des méthodes d'estimation et des règles de restitution. Les utilisateurs sont invités à s'assurer de l'existence de mises à jour plus récentes.

PCDD-F

Emissions atmosphériques par secteur en France métropolitaine
en g ITEQ



(e) estimation préliminaire



2 Polycyclic aromatic hydrocarbons – PAHs

Source : CITEPA / CORALIE / SECTEN format – last updated 28 february 2008

Emissions		Variations	
Survey period :	from 1990		
Emissions in 2006 :	24 t	Variation 2006 / 1990 :	-43%
Maximum observed :	50 t in 1991	Variation 2006 / maximum :	-52%
Minimum observed :	24 t in 2006	Variation 2006 / minimum :	0 %

Main emitters

Main emitters in 2006 (sub-sectors \geq 95 % of total emissions) :

1 - Residential	75 %
2 - Catalysed diesel-engined passenger cars	7.8 %
3 - Non-catalysed diesel-engined light duty vehicles	3.4 %
4 - Non-catalysed diesel-engined passenger cars	2.7 %
5 - Diesel-engined heavy duty vehicles	2.2 %
6 - Other agriculture	2.0 %
7 - Catalysed diesel-engined light duty vehicles	1.7 %

Comments

PAH emissions (Polycyclic Aromatic Hydrocarbons) presented are : benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and indeno(1,2,3-cd)pyrene. These 4 PAHs are those defined by the Aarhus protocol and by the 850/2006 regulation of the European parliament and the Council of the 29 April 2004.

Emissions of those 4 PAHs were estimated at 24 t in 2006. Between 1990 and 2006, emissions accounted a reduction of 43% (-18.4 t). On the whole, emissions decreased in all the sectors, except road transport.

The two major sources of PAH emissions were by importance order :

- residential/tertiary : 75%,
- road transport : 19%, especially diesel vehicles.

The other sectors contributed to the emissions for a low level (energy conversion sector, manufacturing industry, agriculture/forestry and other transports). The LULUCF (UTCF in French) sector did not emit PAHs at all.

It is presumed that PAHs are emitted in large amounts during combustion of fuels and especially biomass when the process is not well controlled, for instance with open combustion plants in the residential sector.

Changes in emissions depend on weather conditions due to the close link between emissions and energy consumption, regarding the year 1991. Progressive installation of appliances biomass combustion more efficient in the domestic sector should lead to gradually reduce emissions in the future.



EMISSIONS ^(a) DANS L'AIR EN FRANCE METROPOLITAINE (unité Mg = t)

Source CITEPA / CORALIE / format SECTEN mise à jour : 28 février 2008 Secten_niv_1_POP-d/HAP.xls

Année	Transformation énergie	Industrie manufacturière	Résidentiel / tertiaire	Agriculture/sylviculture hors UTCF (**)	Transport routier	Autres transports (*)	UTCF (**)	TOTAL	Hors total (*)
1990	0,8	0,6	38	0,6	2,5	0,2	0	42,4	16,4
1991	0,8	0,6	45	0,6	2,7	0,2	0	49,9	3,0
1995	0,7	0,6	34	0,5	3,2	0,2	0	39,1	5,6
2000	0,3	0,4	27	0,5	3,7	0,2	0	31,9	5,4
2001	0,3	0,4	24	0,5	4,0	0,2	0	29,8	4,0
2002	0,3	0,4	21	0,5	4,1	0,2	0	26,9	13,0
2003	0,2	0,4	22	0,5	4,2	0,2	0	27,7	13,8
2004	0,2	0,4	21	0,5	4,3	0,2	0	26,6	3,4
2005	0,2	0,4	19	0,5	4,4	0,2	0	25,2	5,1
2006	0,2	0,4	18	0,5	4,5	0,2	0	24,0	2,1
2007 (e)	0,2	0,4	17	0,5	4,8	0,2	0	23,1	2,1

(*) selon définitions de la CEE-NU - les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources biotiques des forêts et les émissions des sources non-anthropiques.

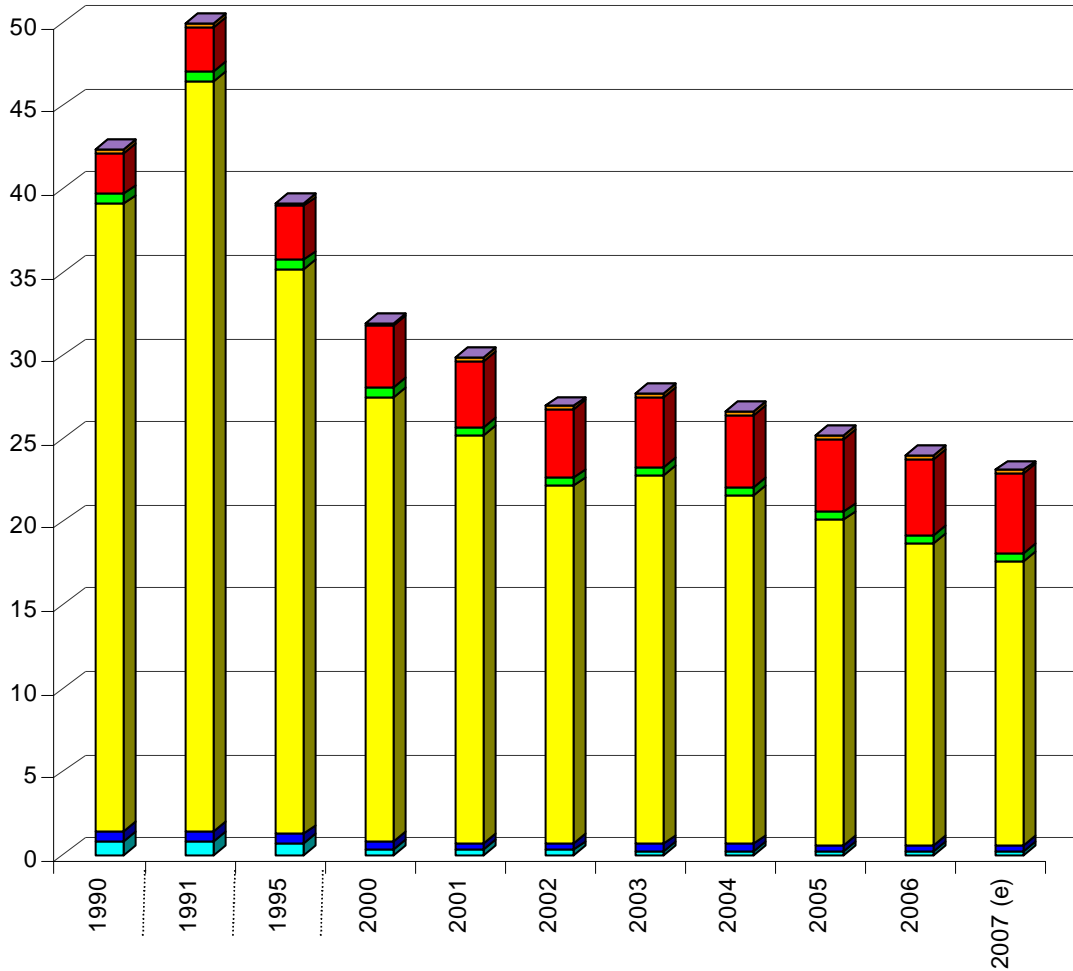
(**) Utilisation des Terres, leur Changement et la Forêt

(a) somme des HAP tels que définis par la CEE-NU : benzo(a)pyrène, benzo(b)fluoranthène, benzo(k)fluoranthène et indeno(1,2,3-cd)pyrène

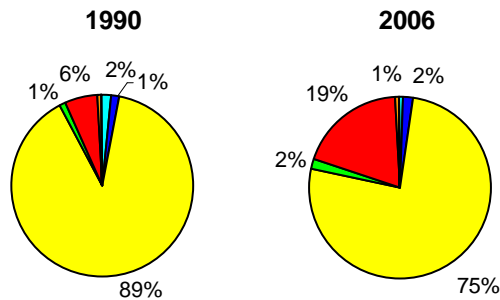
(e) estimation préliminaire

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HAP Emissions atmosphériques par secteur en France métropolitaine en t



(e) estimation préliminaire



3 Polychlorobiphenyls – PCBs

Source : CITEPA / CORALIE / SECTEN format – last updated 28 february 2008

Emissions

Survey period : from 1990
Emissions in 2006 : 26 kg
Maximum observed : 46 kg in 1991
Minimum observed : 26 kg in 2006

Variations

Variation 2006 / 1990 : -38 %
Variation 2006 / maximum : -43 %
Variation 2006 / minimum : 0 %

Main emitters

Main emitters in 2006 (sub-sectors \geq 95 % of total emissions) :

1 - Residential	59 %
2 - Waste treatment	12 %
3 - Chemical industry	5.0 %
4 - Paper, cardboard	4.5%
5 - Electricity production	3.8%
6 - Petroleum refining	3.5 %
7 - Other manufacturing industry	3.0%
8 - Tertiary, commercial and institutional	1.9 %
9 - Food and drink industry	1.7 %

Comments

Total air emissions of Polychlorobiphenyls (PCBs) amounted to approximately 26 kg in 2006.

A fall of the emissions is observed during the period 1990-2006 (around -37%, i.e. -15.6 kg). On the whole, this decrease is observed in all the emitting sectors.

Among all the sectors, three sources mainly emitted PCBs, others represented very low emissions or even none. These sectors are by importance order :

- residential/tertiary : 61%,
- manufacturing industry : 28%,
- energy conversion : 9%.

PCB emissions from residential/tertiary are mostly attributed to "residential" (around 98% of the emissions of the sector). Emissions vary according to the years.

They are directly linked to energy consumption.

Regarding manufacturing industry and energy conversion, emissions have been reduced respectively by 74% and by 48% between 1990 and 2006 thanks to :

- the diminution of the emissions in hospital waste incineration sector due to less quantities incinerated and,
- the reduction of incinerator emissions for household and municipal waste, linked to, in one hand, the development of incinerators with energy recovery (included in the "energy conversion" sector) and, in the other hand, to improvements realised in a result of treatments of atmospheric effluents.

PCB

EMISSIONS DANS L'AIR EN FRANCE METROPOLITAINE (unité kg)

Source CITEPA / CORALIE / format SECTEN		mise à jour : 28 février 2008					Secten_niv_1_POP-d/PCB.xls			
Année	Transformation énergie	Industrie manufacturière	Résidentiel / tertiaire	Agriculture/sylviculture hors UTCF (**)	Transport routier	Autres transports (*)	UTCF (**)	TOTAL	Hors total (*)	
1990	9	14	18	0,1	0	0,4	0	41,6	1,4	
1991	10	13	22	0,1	0	0,4	0	45,9	1,4	
1995	10	10	18	0,2	0	0,4	0	38,7	1,2	
2000	5	7	17	0,1	0	0,4	0	29,6	1,6	
2001	4	6	16	0,1	0	0,4	0	27,4	1,4	
2002	4	7	15	0,1	0	0,4	0	26,3	1,3	
2003	3	7	16	0,1	0	0,5	0	26,8	1,4	
2004	3	7	16	0,1	0	0,5	0	27,5	1,7	
2005	3	8	16	0,1	0	0,5	0	27,5	1,5	
2006	2	7	16	0,1	0	0,5	0	26,0	1,6	
2007 (e)	2	7	16	0,1	0	0,5	0	26,0	1,6	

(*) selon définitions de la CEE-NU - les émissions répertoriées hors total ne sont pas incluses, à savoir les émissions maritimes et aériennes internationales, ainsi que les émissions des sources biotiques des forêts et les émissions des sources non-anthropiques.

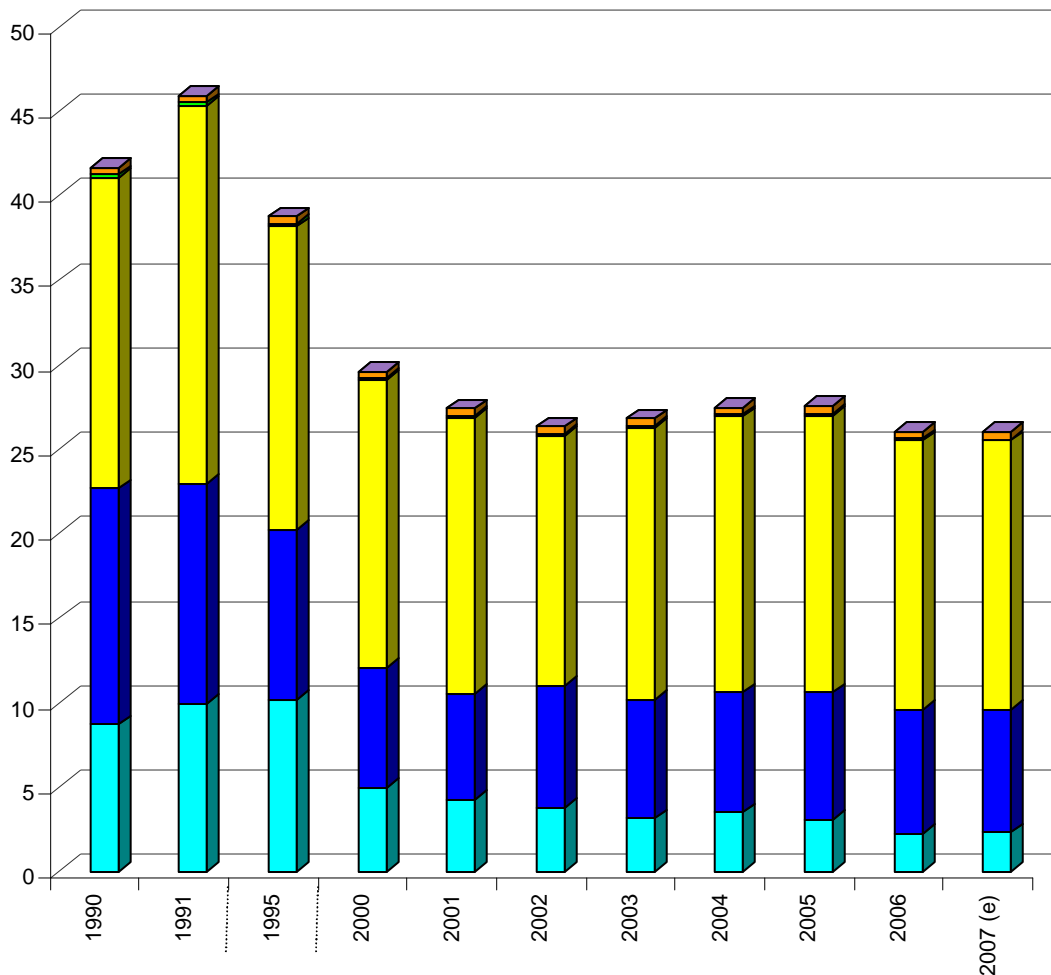
(**) Utilisation des Terres, leur Changement et la Forêt

(e) estimation préliminaire

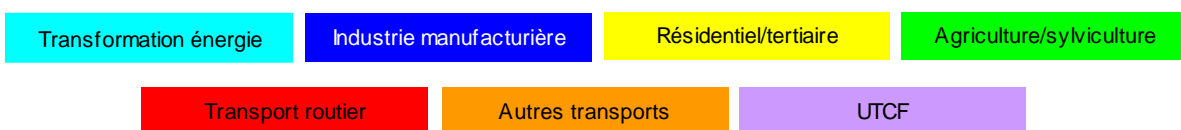
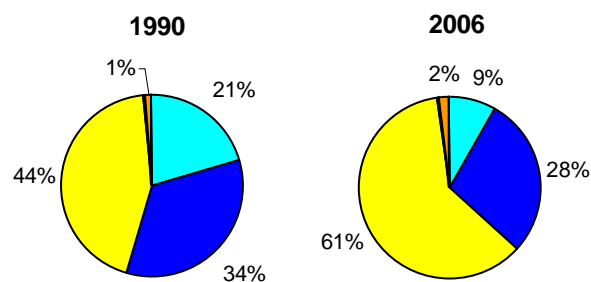
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PCB

Emissions atmosphériques par secteur en France métropolitaine
en kg



(e) estimation préliminaire



4 Hexachlorobenzene – HCB

Source : CITEPA / CORALIE / SECTEN format – last updated 28 february 2008

Emissions		Variations	
Survey period :	from 1990		
Emissions in 2006 :	13 kg	Variation 2006 / 1990 :	-99%
Maximum observed :	1 248 kg in 1992	Variation 2006 / maximum :	-99%
Minimum observed :	13 kg in 2006	Variation 2006 / minimum :	0 %

Main emitters

Main emitters in 2006 (sub-sectors \geq 95 % of total emissions) :

1 - Diesel-engined heavy duty vehicles	21 %
2 - Other energy conversion sectors	19 %
3 - Catalysed diesel-engined passenger cars	18 %
4 - Waste treatments	11 %
5 - Catalysed diesel-engined light duty vehicles	7.7 %
6 - Residential	7.6 %
7 - Non-catalysed diesel-engined passenger cars	6.2 %
8 - Non-catalysed diesel-engined light duty vehicles	3.9 %

Comments

Total emissions of HCB (HexaChloroBenzene) amounted to 13 kg in 2006.

Among the 7 sectors distinguished, the two main sectors were as follows :

- road transport (56% of total emissions in mainland France in 2006),
- energy conversion (20%).

The major source in manufacturing industry emissions was waste treatment, especially incineration of sewage sludge generated by waste water treatment (94% of the sector). The drop of HCB emissions in the manufacturing industry is due to reduction techniques following the application of the order of the 20th September 2002 (EU Directive 2000/76/EC) for PCDD-F impacting on HCB.

Inside of the manufacturing industry sector, emissions from the non ferrous metal smelting sector (aluminium production of second fusion) have fallen sharply since 1993 until null since 1999. Chlorine is used to refine aluminium to eliminate traces of magnesium.

Until early 1990s, hexachloroethane was used as chlorine contribution, which was the origin of HCB emissions. From the lawful point of view, hexachloroethane is banned since 1993 for refining second fusion aluminium, so this sub-sector does not emit HCB anymore since then.

Furthermore, road transport emissions increase in proportion to the number of vehicles and catalysed vehicles.

Wood and coal combustion also contributed very slightly to HCB emissions, which explains the low level of the residential/tertiary sector.

HCB

EMISSIONS DANS L'AIR EN FRANCE METROPOLITAINE (unité kg)

Source CITEPA / CORALIE / format SECTEN mise à jour : 28 février 2008 Secten_niv_1_POP-d/HCB.xls

Année	Transfor- mation énergie	Industrie manufac- turière	Rési- dentiel / tertiaire	Agricul- ture/syl- viculture hors UTCF (**)	Transport routier	Autres transports (*)	UTCF (**)	TOTAL	Hors total (*)
1990	12,8	1 182	1,2	0,01	3,3	0,10	0	1 199	0,2
1992	14,7	1 228	1,4	0,01	3,9	0,09	0	1 248	0,2
1995	11,6	57	1,2	0,01	4,8	0,09	0	75	0,2
2000	4,3	38	1,1	0,01	5,9	0,08	0	50	0,2
2001	3,4	30	1,1	0,01	6,3	0,09	0	41	0,2
2002	3,1	23	1,0	0,01	6,6	0,10	0	33	0,2
2003	2,6	18	1,1	0,01	6,9	0,10	0	29	0,2
2004	2,7	13	1,1	0,01	7,1	0,10	0	24	0,2
2005	2,8	8	1,1	0,01	7,2	0,10	0	19	0,2
2006	2,7	2	1,0	0,01	7,6	0,10	0	13	0,2
2007 (e)	2,8	2	1,0	0,01	8,1	0,10	0	14	0,2

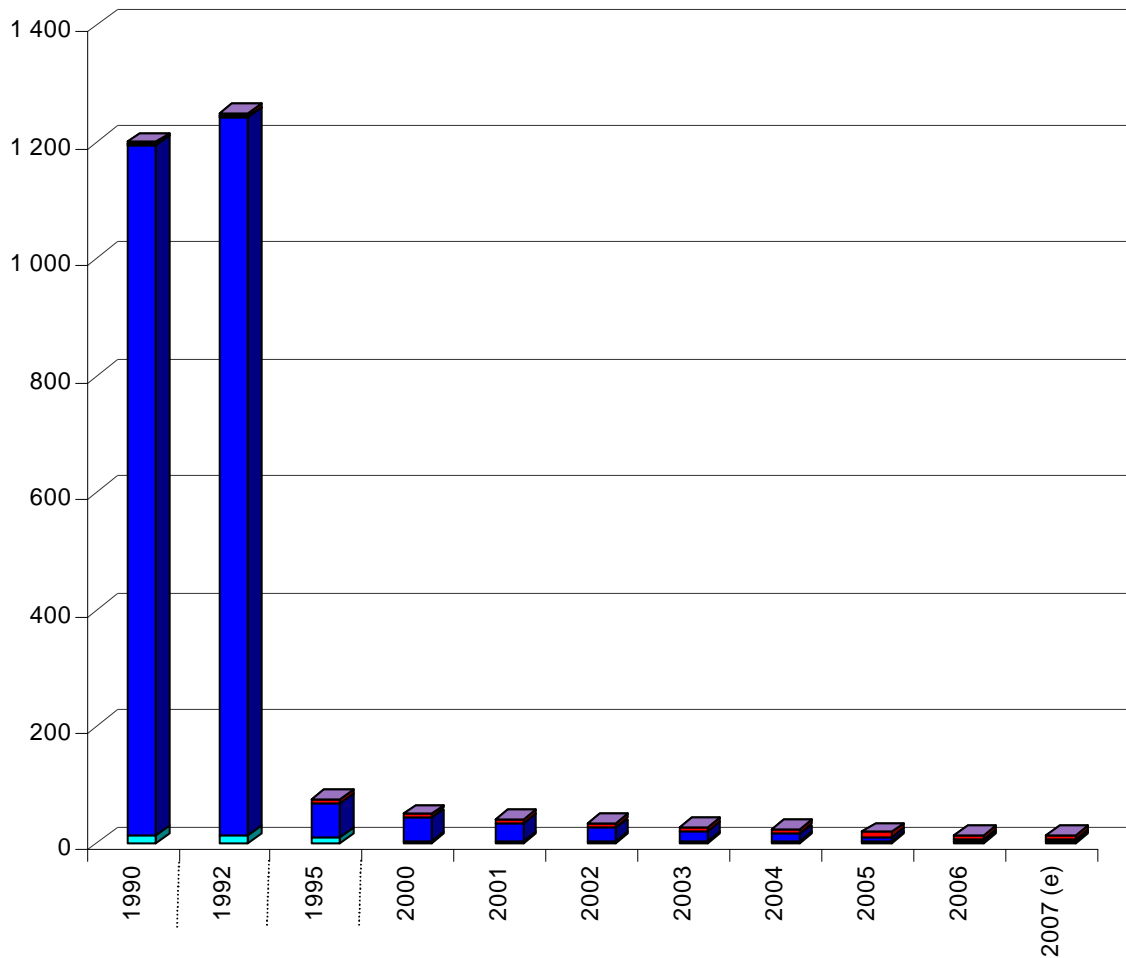
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(**) Utilisation des Terres, leur Changement et la Forêt

(e) estimation préliminaire

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<h1>HCB</h1>	<h2>Emissions atmosphériques par secteur en France métropolitaine</h2> <p>en kg</p>
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(e) estimation préliminaire

