

AIR QUALITY IN PARIS REGION 2012

Summary

March 2013





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This report is an English summary of the annual report on ambient air quality in the Paris region. It gives an overview of the concentrations for the European Union regulated pollutants during year 2012.

The complete report in French can be downloaded at
<http://www.airparif.asso.fr/pdf/publications/bilan-2012.pdf>

Air quality complete data in the Paris region can be found on AIRPARIF website
<http://www.airparif.asso.fr/telechargement/telechargement-statistique>

Annual pollution maps are available at <http://www.airparif.asso.fr/etat-air/bilan-annuel-cartes>

All data, reports and studies made by AIRPARIF are publicly available. Full and free access is granted on AIRPARIF website.

Any use of part of this report should mention "AIRPARIF Air quality Assessment Network in the Paris Region".

Cover illustration: roadside monitoring site Boulevard périphérique Est (photo AIRPARIF)

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I. Key facts for 2012

Year 2012 confirms the overall stability of chronic pollution levels by particles, nitrogen dioxide, ozone and benzene. These pollutants remain an issue in Ile-de-France region with quality objectives and limit values frequently and substantially exceeded.

In 2012, weather conditions were characterized by a strong variability. During the first three months, weather conditions were not favourable for atmospheric pollution: an intense cold wave in February, followed by a very dry and sunny period in March. Therefore, the number of pollution episodes during that time was important. The rest of the year was characterized by a cool and rainy summer, except a late heat wave in August, and a mild and rainy autumn, leading to low pollution levels. Mean levels in 2012 were slightly lower than those in 2011, but were still higher than those recorded in 2008.

From one year to another, the variations of meteorological conditions could explain most of the variation of major problematic pollutants levels in the Ile-de-France region. On the other hand, trends over several years reflect the effects of the mitigation measure implementation and the technologic evolutions.

➔ **Even if the levels were slightly lower than in 2011, due to more dispersive weather conditions, 2012 confirms the overall stability of nitrogen dioxide (NO₂) levels in the greater Paris urban agglomeration for roadside levels. Away from the traffic, a slight decrease of the levels seems to be confirmed in 2012.**

Along main roads, the levels are in average twice the annual limit value. **The limit value is thus largely exceeded over a wide portion of the Ile-de-France road network, as almost 1,600 km of roads are concerned.** Levels slightly decrease at most sites in 2012. However, other sites are continuously increasing, especially in the surrounding suburban areas. **The limit value is also exceeded at background sites, away from the traffic, in the centre of the agglomeration.**

All in all, around 3 million Ile-de-France inhabitants were potentially exposed in 2012 to NO₂ levels exceeding the annual limit value.

After a period of stability, a slight decrease of background levels of nitrogen dioxide seems to be observed over the past two years in the agglomeration. More stringent requirements for low emission vehicles have certainly been a favourable factor, despite the fact that emission standards are based on NO_x and not on NO₂. However, primary NO₂ emissions from diesel-powered vehicles are probably linked to a major issue on the evolution of nitrogen dioxide levels, both at background and at roadside sites. Although the particulate filters that now equip most new diesel vehicles contribute to reduce particulate emissions, those combined with oxidation catalyst contribute to a significant increase in NO₂ emissions. As a result, the proportion of NO₂ in NO_x emissions has been increasing steadily from 1996 to 2010, with an indication of stabilization these last two years, as indicated by observations made at roadside sites in Ile-de-France.

➔ **Daily and annual limit values for PM10 particles are still greatly exceeded on roadside sites. In 2012, around 2.4 million inhabitants in the agglomeration living close to main roads were potentially affected by the PM10 particles exceedance of the daily limit value.** This is slightly less than in 2011. In 2012, weather conditions were characterized by a strong variability: an intense cold wave in February and an average high temperature in March, favourable to PM pollution episodes but also both an early spring and a very rainy autumn. This has led to a lot of exceedances of the 50 µg/m³ daily threshold for PM10, but only in the first four months of the year. Therefore, 2012 average levels are overall below 2011.

For fine particles (PM2.5), in 2012, all the 11.7 million inhabitants of Ile-de-France were potentially affected by air quality objective exceedance. Background levels away from road traffic were, on average, 1.5 higher than the objective and up to three times higher on roadside situations. The 2012 limit value was exceeded near major roads, as monitored at the Paris ring-road and A1 highway stations.

➔ **Concerning ozone levels, every year, the quality objective, is exceeded in all parts of the region, and especially in sub-urban and rural areas. Except a short and late heat wave in August, summer was overall not very sunny.** Ozone levels in 2012 were rather stable compare to 2011, and

much lower than those recorded in 2003 and 2006, years in which there were long hot spells (historical heatwave in August 2003).

➔ **Benzene levels have, overall, been stable for several years, after a long period of reduction which began at the end of the 1990's.** Although the quality objective for background is met everywhere, this is not the case at roadside sites where the national quality objective is exceeded on about 500 km of regional roads. **Generally speaking, almost 300,000 Ile-de-France inhabitants, in the agglomeration and at roadside situations, are potentially exposed to an exceedance of the annual quality objective for benzene.**

Concerning pollution episodes, the information and warning procedure was triggered 44 days in 2012. This significant important number is due to the modification of the regional alert procedure at the end of 2011 that set lower thresholds for PM10. Should similar thresholds had been kept, 2012 would have been similar to 2011.

Most of these episodes are due to PM10 (36 days of exceedance of the information warning threshold), mainly occurring during the first four months of the year. The alert threshold has been exceeded 4 times for PM10 in 2012. Three exceedances of the information threshold have been recorded for ozone in summer, and only one for nitrogen dioxide.

	Trend 2000-2012		Standards to be met Limit value		Non-binding standards			
	Away from traffic	Roadside	Away from traffic	Roadside	Quality objective		Target value	
					Away from traffic	Roadside	Away from traffic	Roadside
PM10	➔	➔	Met	Exceeded	Met	Exceeded		
PM2.5	➔	➔	Met	Exceeded	Exceeded	Exceeded	Met	Exceeded
NO ₂	⤵	⤵	Exceeded	Exceeded	Exceeded	Exceeded		
O ₃	➔				Exceeded		Met	
Benzène	➔	➔	Met	Met	Met	Exceeded		

II. Pollutants exceeding air quality standards

Nitrogen dioxide in brief

Nitrogen dioxide remains an important issue in Ile-de-France: in 2012, around 3 million inhabitants living in the centre of the agglomeration were potentially exposed to an exceedance of the annual limit value.

Recurrent limit value exceedances are recorded, especially near road traffic.

A slight decrease of background levels is observed between 2011 and 2012 due to weather conditions more favourable to dispersion in 2012.

But after a significant decrease of background levels since the beginning of the 2000's, concentrations have been overall stable for several years.

The main source of nitrogen dioxide remains road traffic. Levels along major roads can be twice higher than the air quality standards.

Near road traffic, no improvement is emerging and the increasing proportion of NO₂ in NO_x emissions from diesel vehicles equipped with oxidation catalyzed particulate filters is leading to a raise of mean NO₂ concentrations on some sites.

exceedance intensity

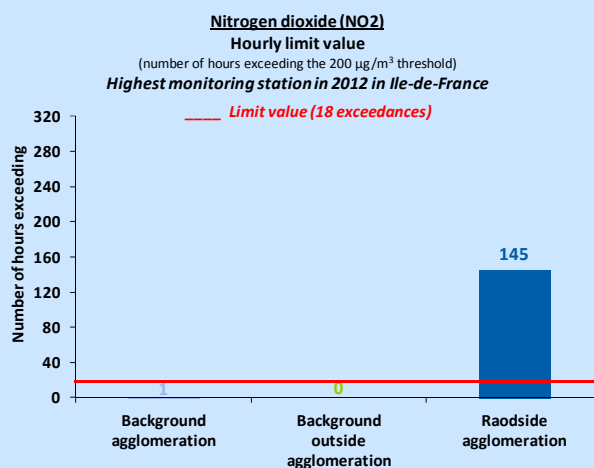
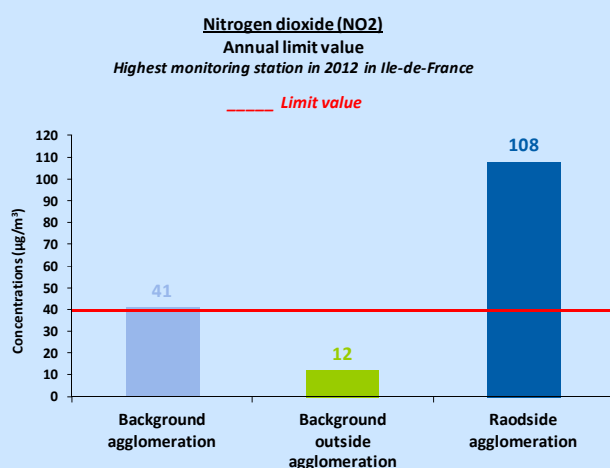
very important	> + 50 %
important	+ 30 à + 50 %
moderate	+ 10 à + 30 %
light	0 à + 10 %

no exceedance



Nitrogen dioxide (NO ₂)	2012			2001-2011		
	Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Annual limit value exceedance *	light	no exceedance	very important	2003, 2007, 2009, 2010, 2011	no exceedance	every year
Hourly limit value exceedance *	no exceedance	no exceedance	very important	no exceedance	no exceedance	2006 to 2011

* considering margins of tolerance decreasing from year to year



Summary of air quality standards exceedances for nitrogen dioxide (NO₂) in Ile-de-France

Nitrogen dioxide

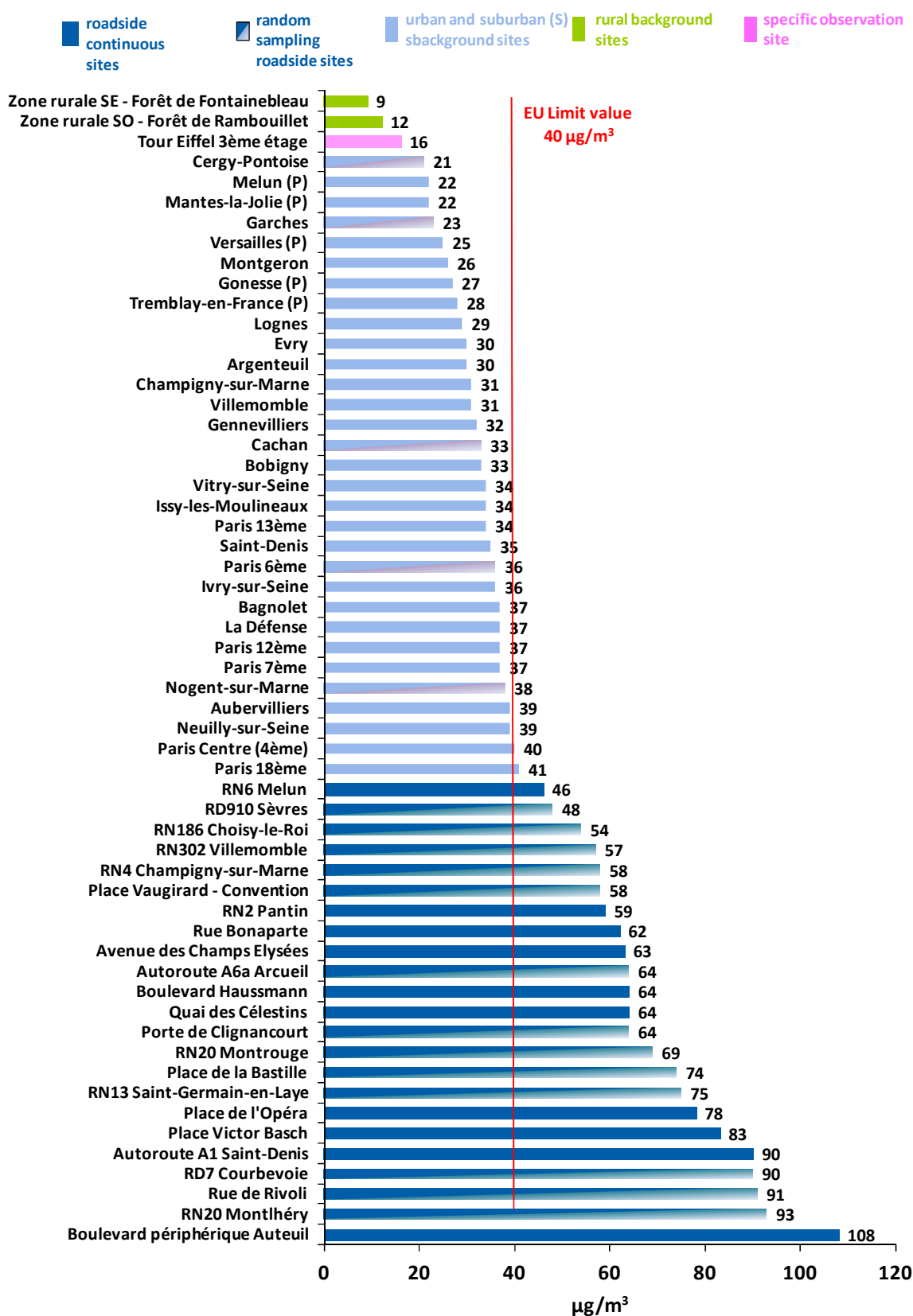


Figure 1: nitrogen dioxide (NO₂) annual mean concentration for all monitoring sites in the Paris region in 2012

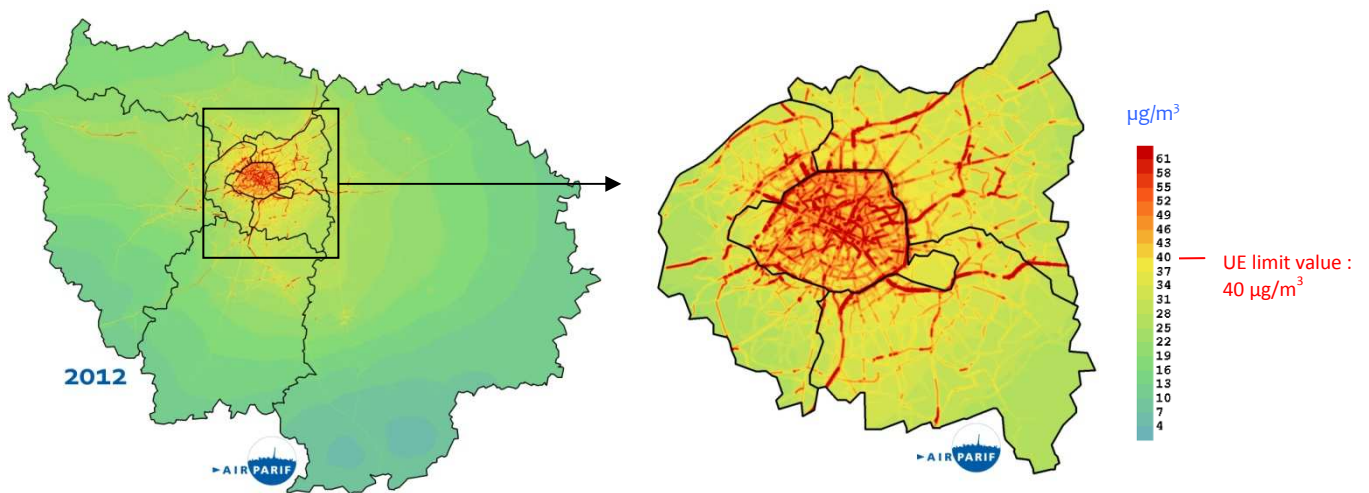


Figure 2: nitrogen dioxide (NO₂) annual mean concentration in the Paris region, background and roadside, focus on Paris and near suburbs, 2012

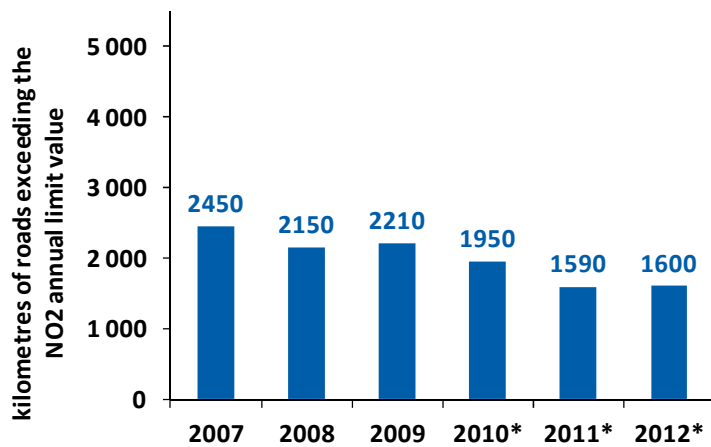


Figure 3: kilometres of main road network exceeding the nitrogen dioxide (NO₂) EU annual limit value in the Paris region, 2007 to 2012

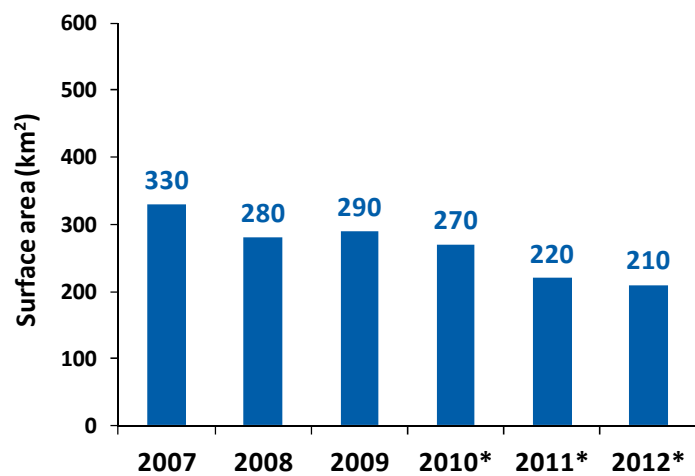


Figure 4: trend in surface area exceeding the annual limit value (40 µg/m³ in nitrogen dioxide (NO₂)) in the Paris region, 2007 to 2012

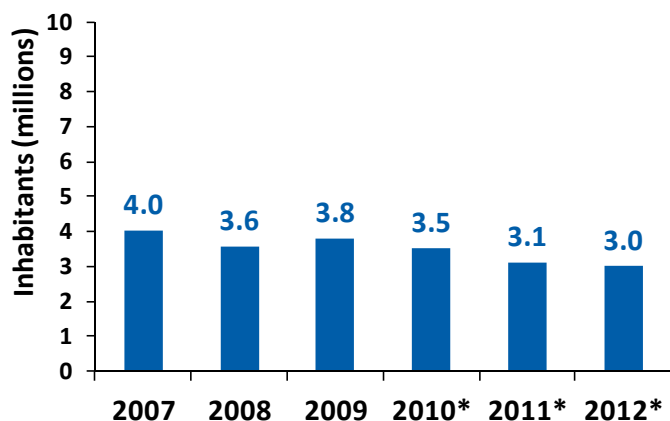


Figure 5: millions of inhabitants potentially exposed to nitrogen dioxide (NO₂) level exceeding EU annual limit value in the Paris region, 2007 to 2012

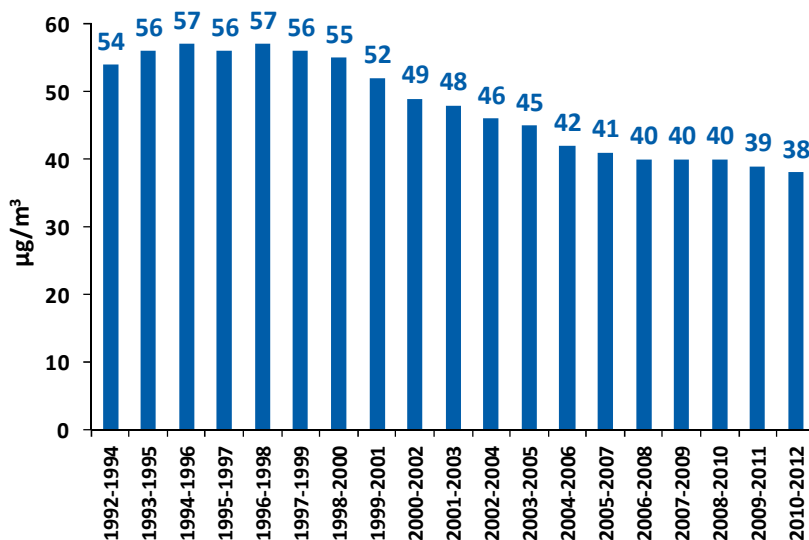


Figure 6: trend in the nitrogen dioxide (NO₂) tri-annual mean concentration, sample of the same six urban background sites in the Paris agglomeration, 1992-1994 to 2010-2012

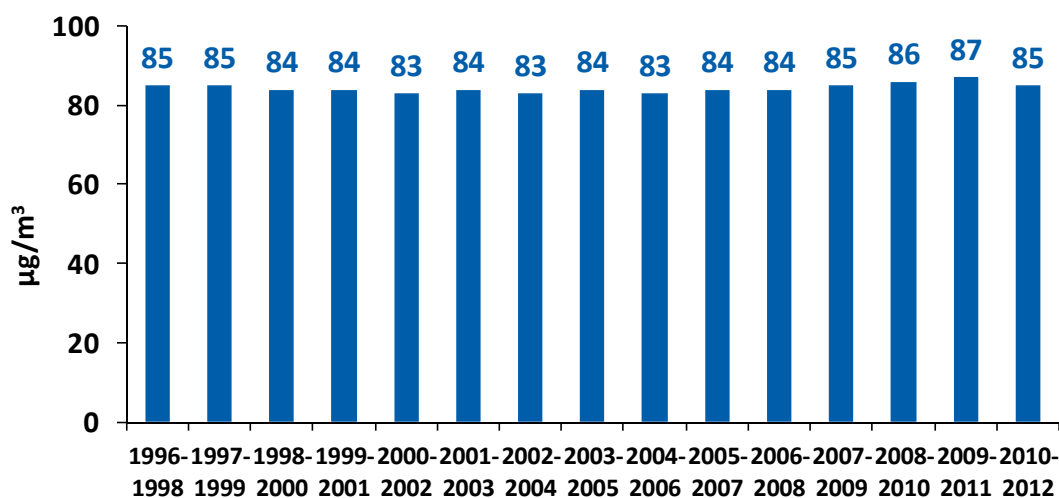


Figure 7: trend in the nitrogen dioxide (NO₂) tri-annual mean concentration, sample of the same five roadside sites in the Paris agglomeration, 1996-1998 to 2010-2012

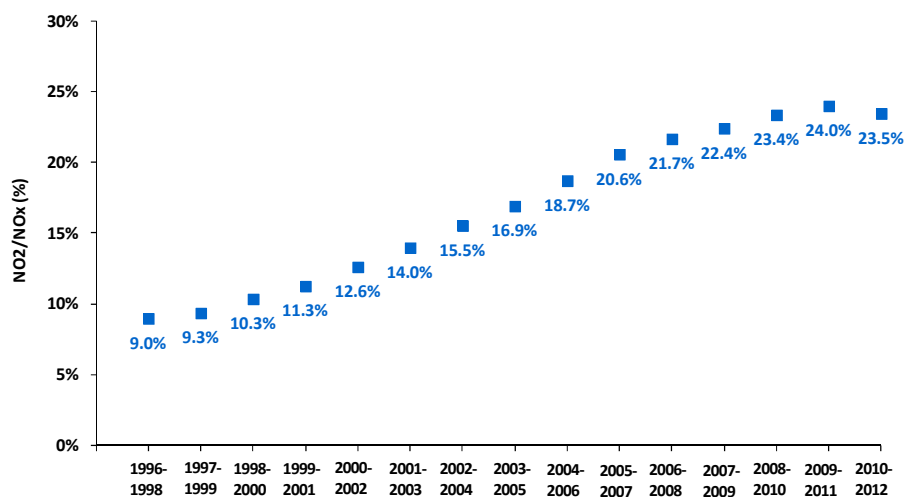


Figure 8: $[NO_2]/[NO_x]$ ratio trend, averaged roadside sites in the Paris agglomeration (background level subtracted), 1998 to 2012

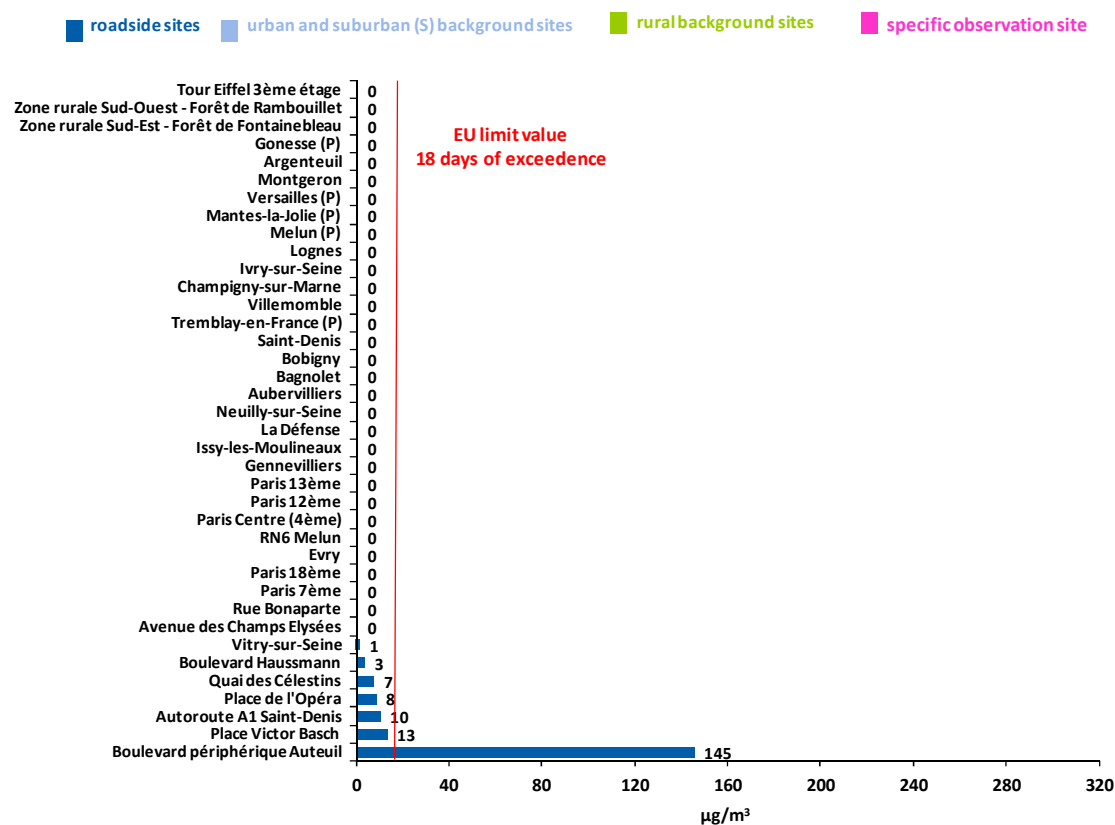


Figure 9: NO_2 annual number of hours exceeding $200 \mu g/m^3$ for all continuous monitoring sites in the Paris region in 2012

Particulate matter in brief

2.4 million inhabitants are potentially exposed to an exceedance of the PM10 daily limit value.

Recurrent and severe exceedances of PM10 limit value near traffic.

PM2.5 background levels are almost twice the quality objective threshold, and 3 times higher near traffic. All the Ile-de-France inhabitants, that is to say 11.7 million people, would be exposed to an exceedance of this threshold.

exceedance intensity

very important	> + 50 %
important	+ 30 à + 50 %
moderate	+ 10 à + 30 %
light	0 à + 10 %

no exceedance

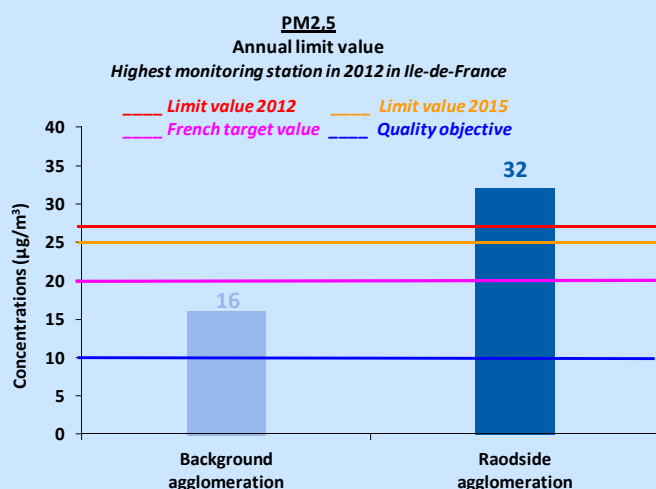
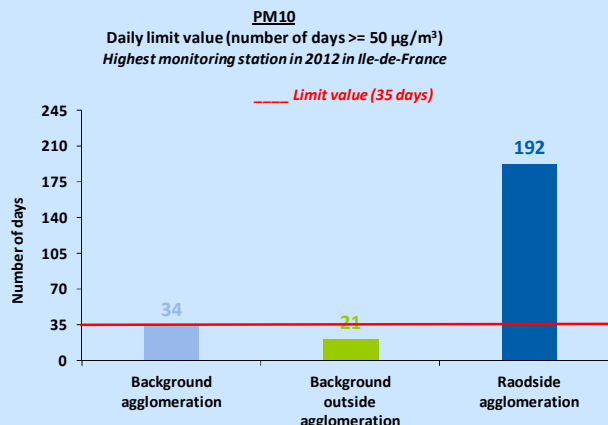
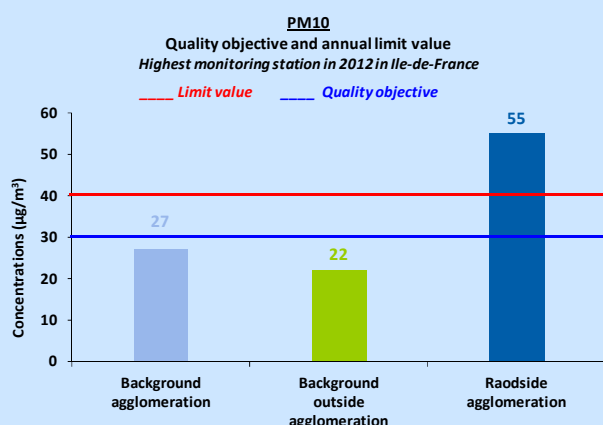


	2012		
	Background agglomeration	Rural background	Roadside
Particulate Matter (PM10)			
Annual quality objective exceedance			
Annual limit value exceedance			
Daily limit value exceedance	max station = threshold		

	2007-2011		
	Background agglomeration	Rural background	Roadside
Particulate Matter (PM10)			
Annual quality objective exceedance	2007, 2009 : max site = threshold		
Annual limit value exceedance			
Daily limit value exceedance	2007		

	2012		
	Background agglomeration	Rural background	Roadside
Particulate Matter (PM2,5)			
Quality objective exceedance		no	
French target value exceedance		no	
Limit value (2015) exceedance		no	
Limit value (2011) exceedance		no	

	2007-2011		
	Background agglomeration	Rural background	Roadside
Particulate Matter (PM2,5)			
Quality objective exceedance		no measurement	
French target value exceedance		no measurement	
Limit value (2015) exceedance		no measurement	every year
Limit value (2011) exceedance	non applicable		



Summary of air quality standards exceedances for particulate matter (PM10 and PM2.5) in Ile-de-France

PM10 Particles

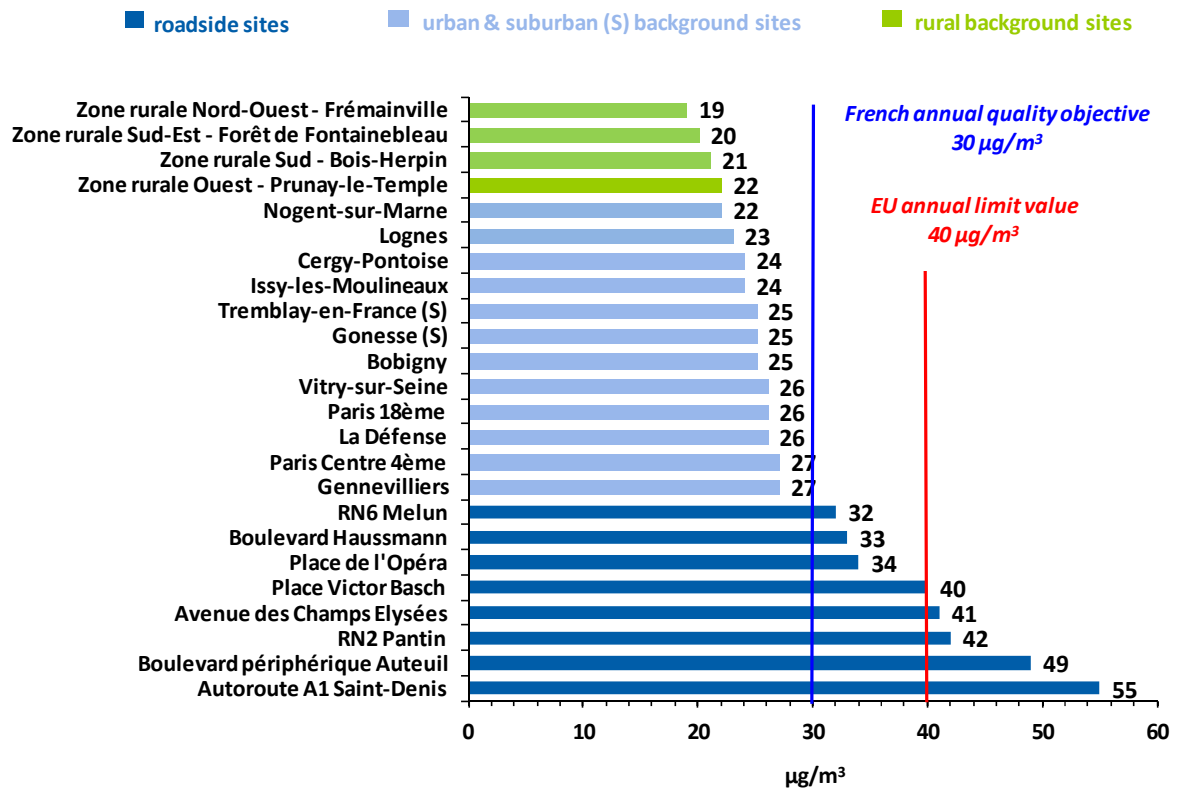


Figure 10: PM10 annual mean concentration for all continuous monitoring sites (TEOM FDMS) in the Paris region in 2012

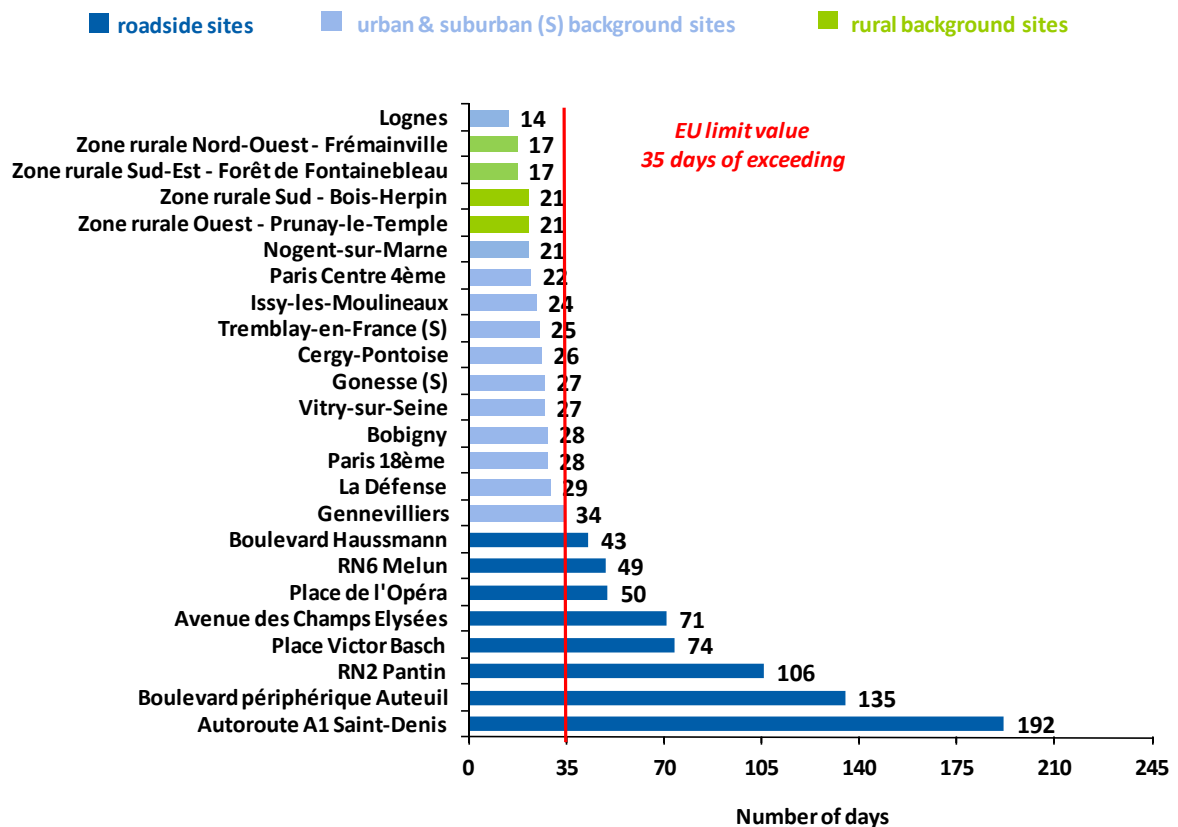


Figure 11: PM10 annual number of days exceeding the 50 µg/m³ EU threshold for all continuous monitoring sites (TEOM FDMS) in the Paris region in 2012

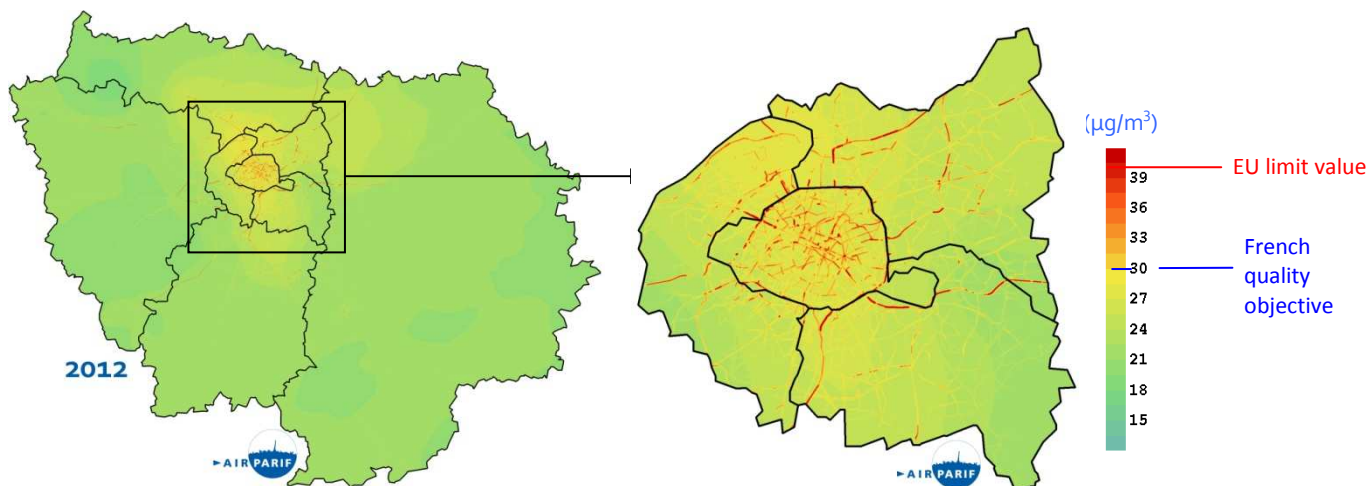


Figure 12: PM₁₀ annual mean concentration in the Paris region, background and roadside, focus on Paris and near suburbs, 2012

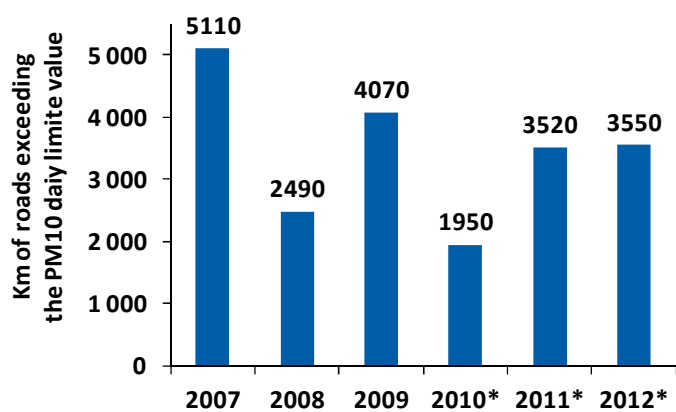


Figure 13: Kilometres of roads exceeding the PM₁₀ daily limit value in the Paris region, 2007 to 2012

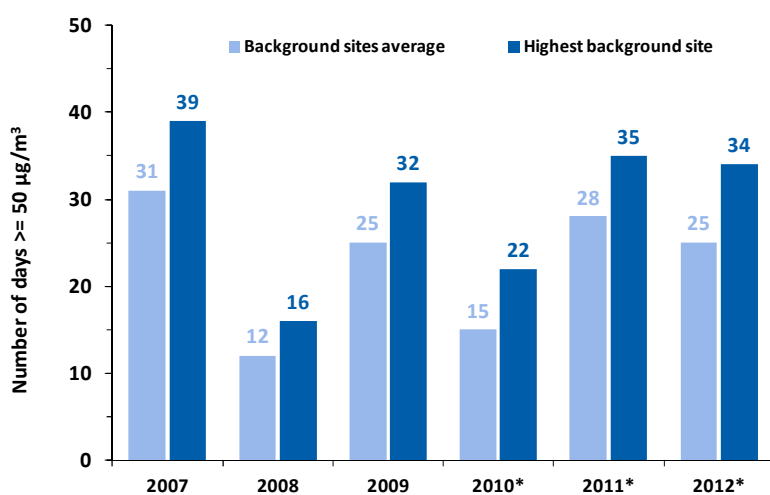


Figure 14: number of days exceeding PM₁₀ 50 µg/m³ threshold, average and highest background site

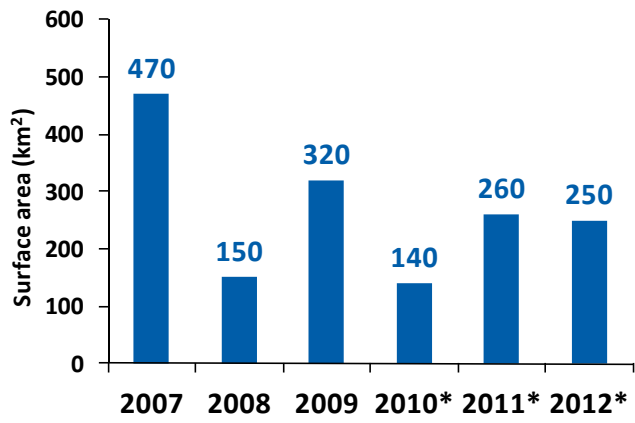


Figure 15: Trend in surface area exceeding daily limit value in PM₁₀ in the Paris region, 2007 to 2012

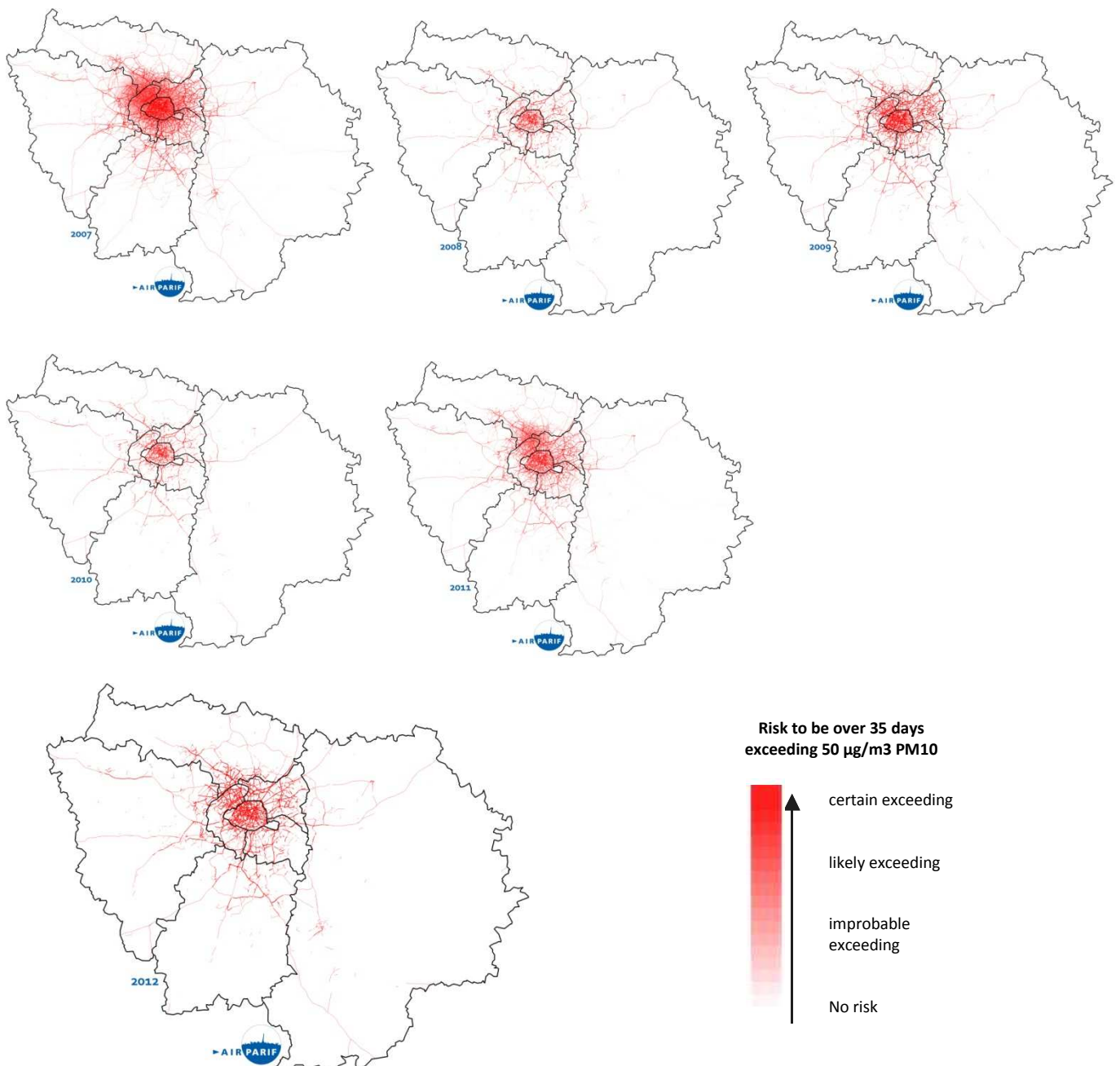


Figure 16: Risk of exceeding the EU daily limit value in PM₁₀ in the Paris region, background and roadside

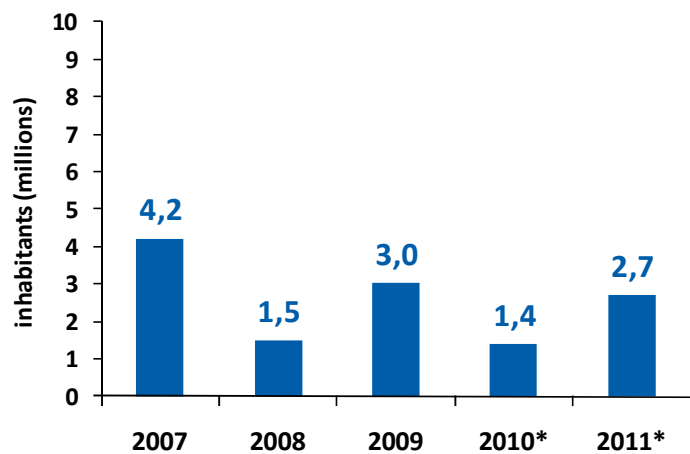


Figure 17: millions of inhabitants potentially exposed to PM₁₀ level exceeding the EU daily limit value in the Paris region, 2007 to 2011

PM2.5 Particles

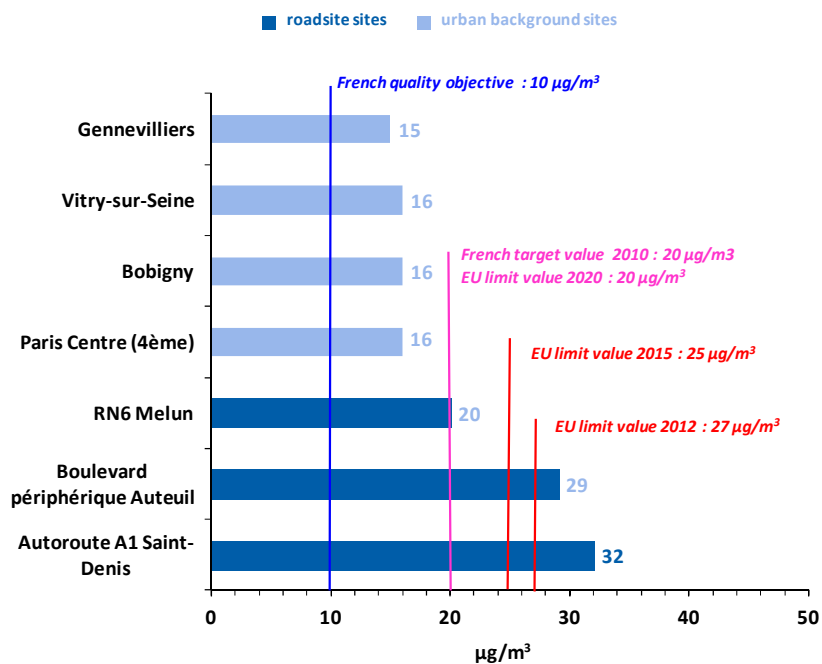


Figure 18: PM_{2,5} annual mean concentration for all continuous monitoring sites (TEOM FDMS) in the Paris region in 2012

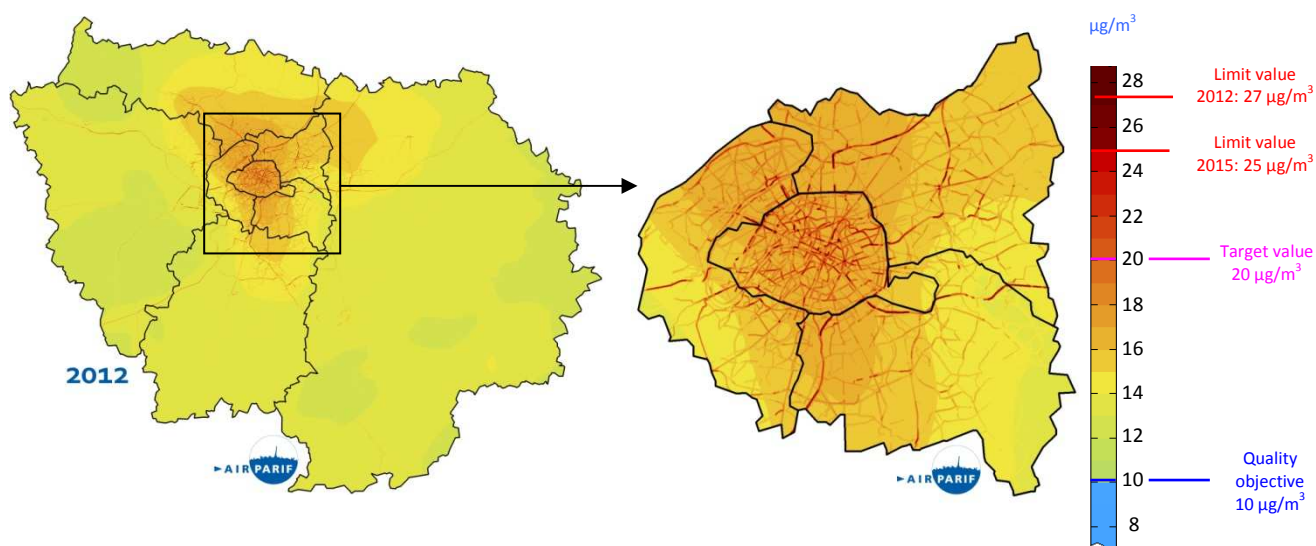


Figure 19: annual mean concentration of fine particles PM_{2,5} in the Paris region and focus on Paris and suburbs, background and roadside in 2012

Ozone in brief

Stabilization of the mean levels increase.

Many exceedances of the quality objective. They are less important than in 2011, despite a short late heat wave in august, because main part of the summer was mild and rainy.

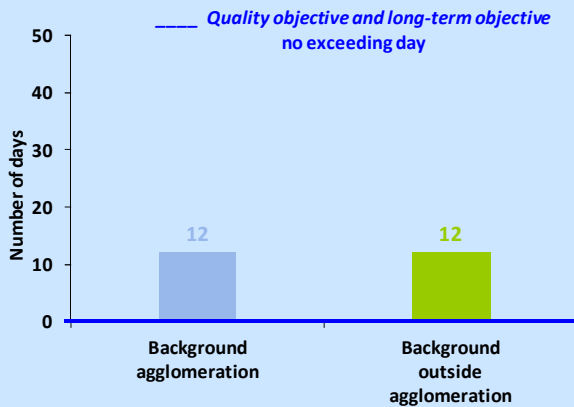
exceedance intensity		no exceedance
very important	> + 50 %	
important	+ 30 à + 50 %	
moderate	+ 10 à + 30 %	
light	0 à + 10 %	

Ozone (O ₃)	2012		
	Background agglomeration	Rural background	Roadside
Quality objective exceedance (health)			no measurement
Long term objective applicable in 2020 (health)			no measurement
Target value exceedance applicable in 2012 (health)			no measurement
Quality objective exceedance (vegetation)			no measurement
Long term objective applicable in 2020 (vegetation)			no measurement
Target value exceedance applicable in 2012 (vegetation)			no measurement

2001-2011		
Background agglomeration	Rural background	Roadside
every year	every year	no measurement
every year until 2006	every year until 2006	no measurement
every year	every year	no measurement
		no measurement

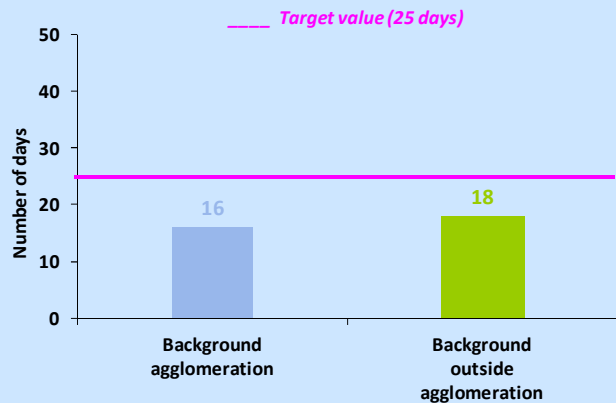
Ozone (O₃) health

Quality objective and long-term objective
Highest monitoring station in 2012 in Ile-de-France



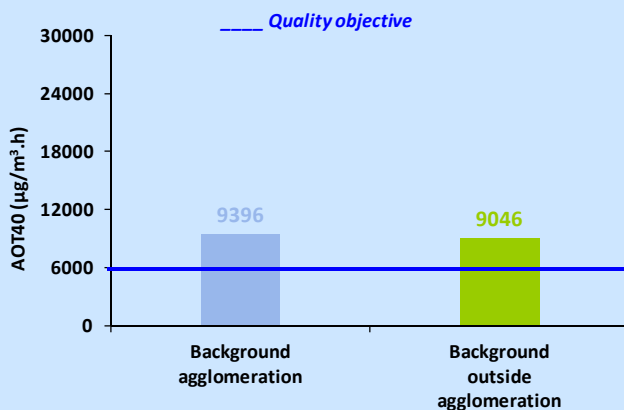
Ozone (O₃) health

Target value
Highest monitoring station in 2012 in Ile-de-France



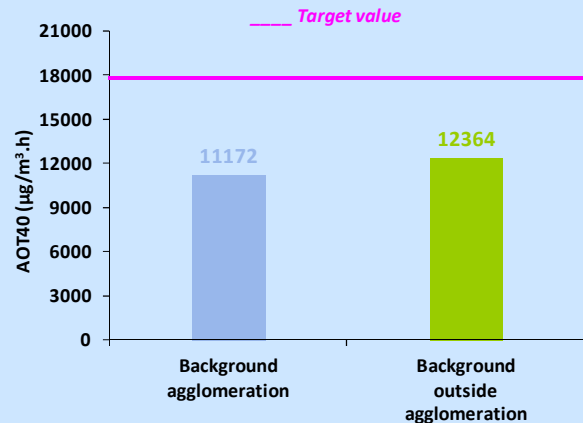
Ozone (O₃) vegetation

Quality objective and long-term objective
Highest monitoring station in 2012 in Ile-de-France



Ozone (O₃) vegetation

Target value
Highest monitoring station in 2012 in Ile-de-France



Summary of air quality standards exceedances for ozone (O₃) in Ile-de-France

Ozone

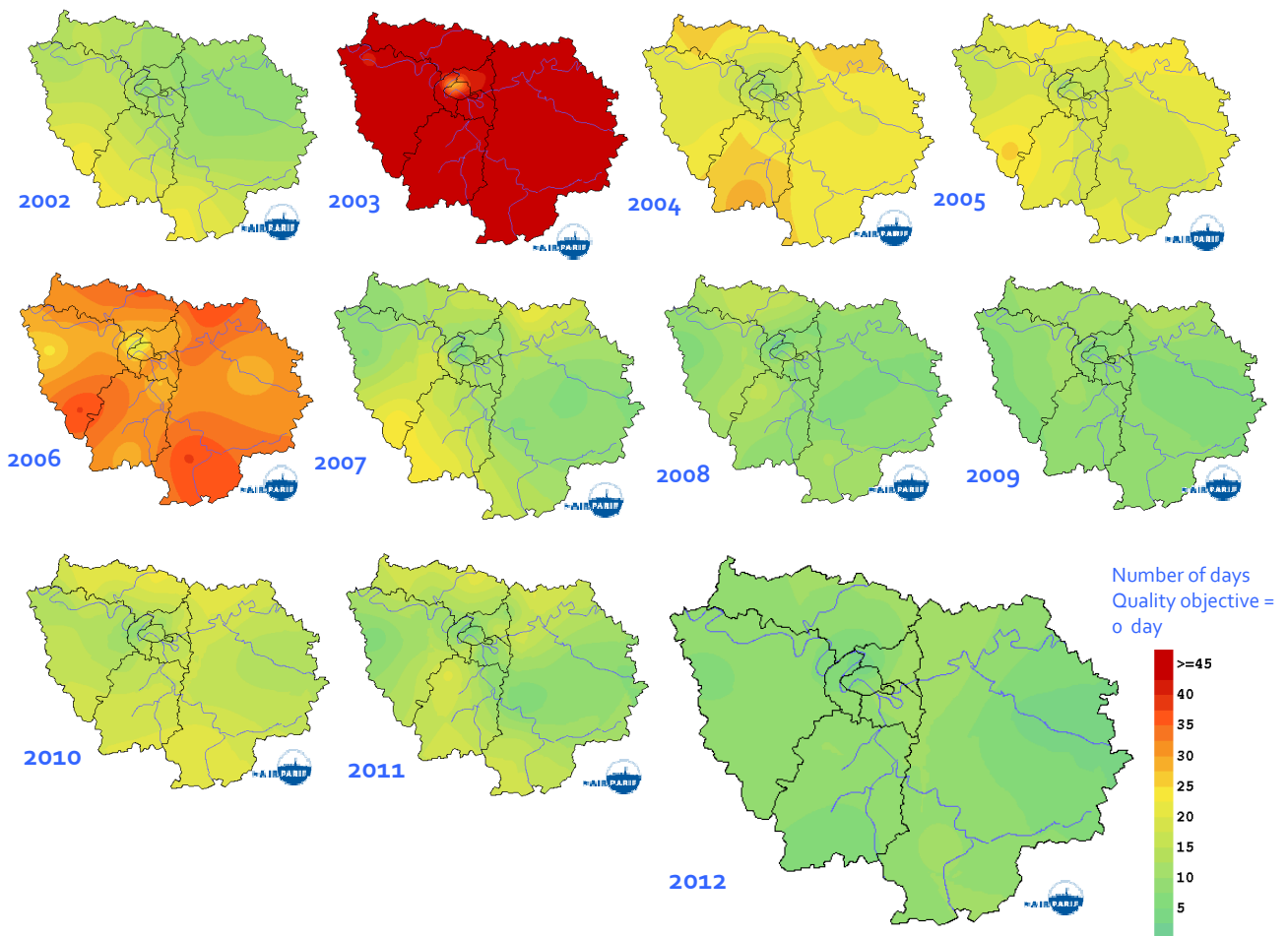


Figure 20: number of days exceeding the French quality objective (=EU long-term objective), threshold $120 \mu\text{g}/\text{m}^3$ 8-hour mean, objective = no exceeding) for ozone (O_3) in the Paris region, 2002 to 2012

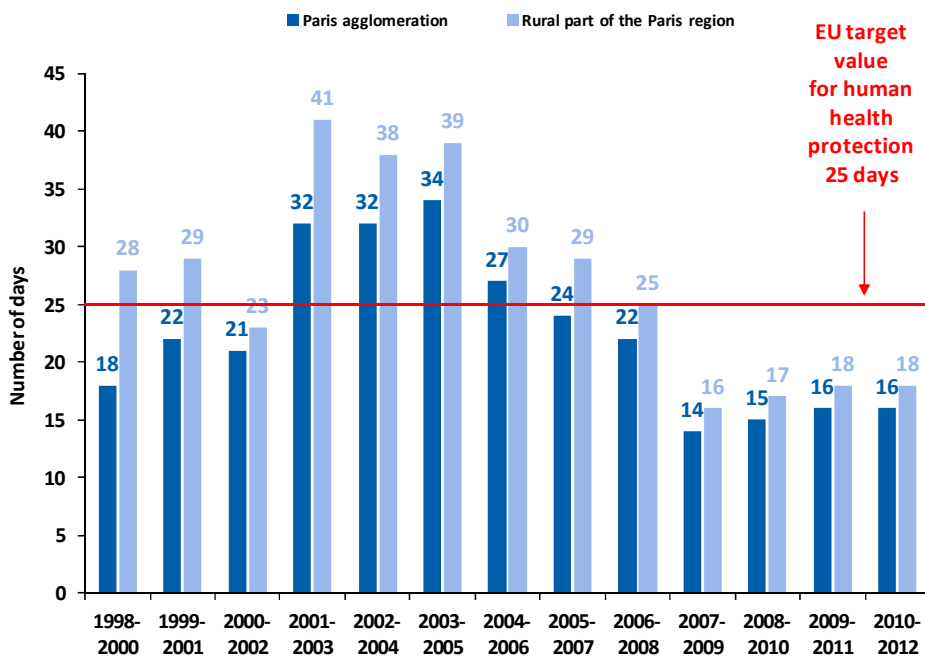


Figure 21: number of days exceeding the threshold of the EU target value for protection of human health ($120 \mu\text{g}/\text{m}^3$ 8-hour average, not over 25 days of exceeding on a 3 years period) in the Paris region, for the highest monitoring site in urban and rural parts of the region, 1998-2000 to 2010-2012

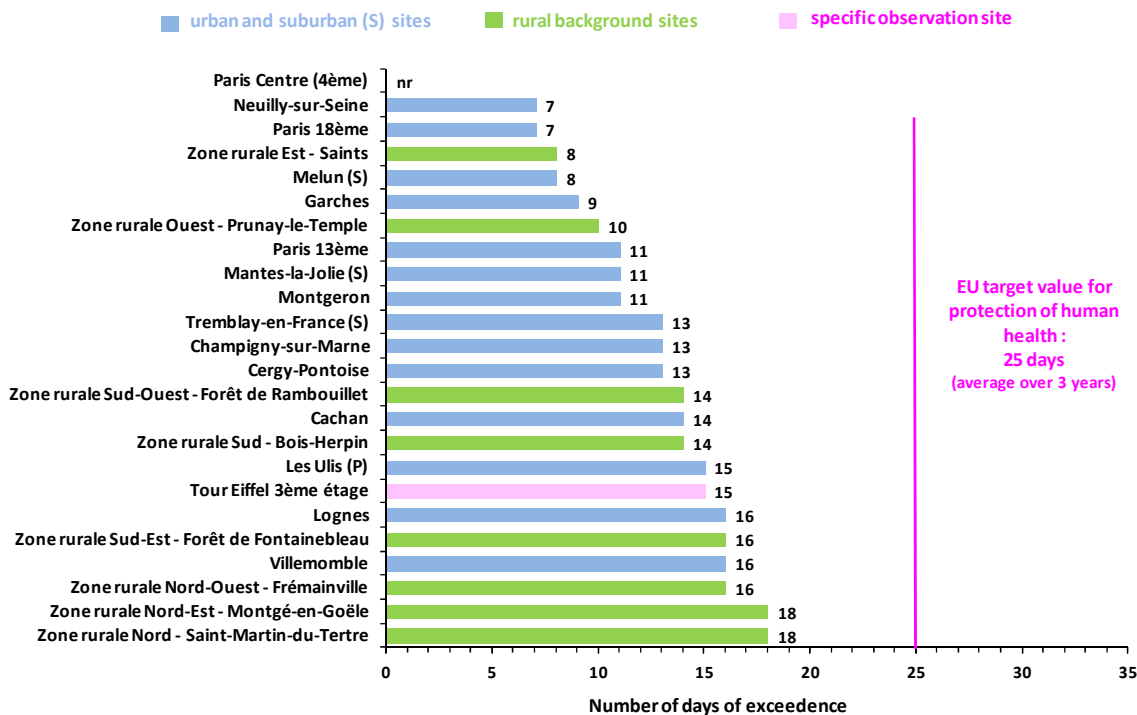


Figure 22: number of days exceeding the threshold of the EU target value for protection of human health ($120 \mu\text{g}/\text{m}^3$ 8-hour average) in the Paris region (3 years average 2010-2012)

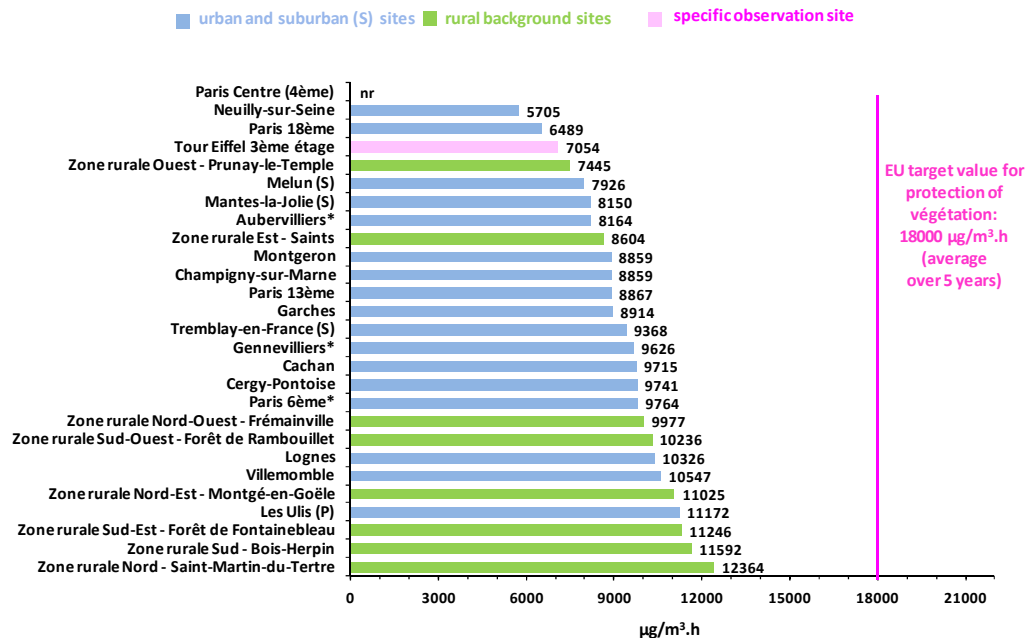


Figure 23: target value in ozone for the protection of vegetation (AOT₄₀, threshold of $18000 \mu\text{g}/\text{m}^3.\text{h}$) in the Paris region (average 2008-2012)

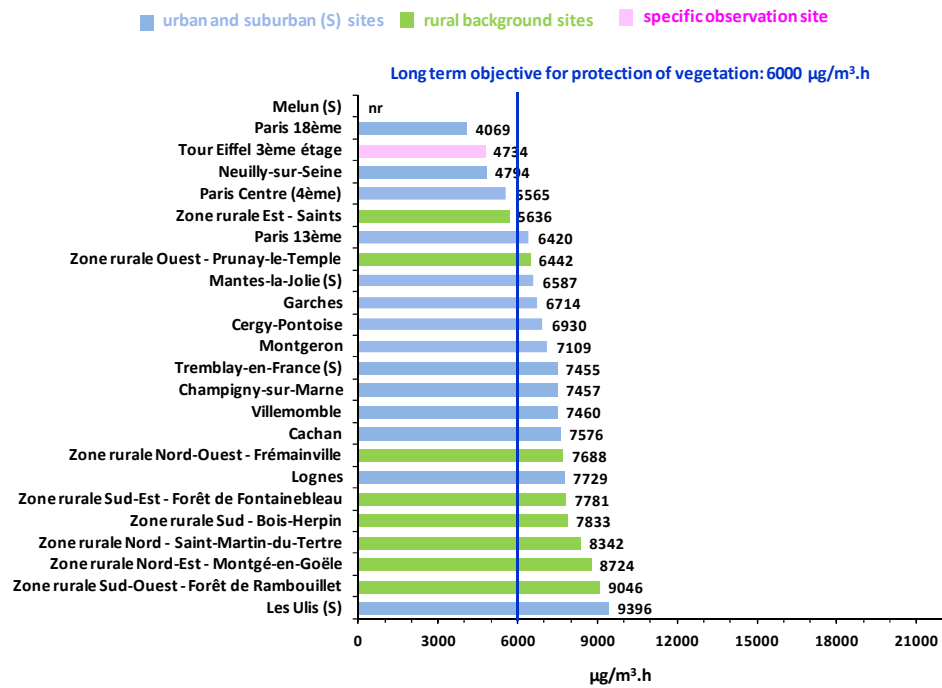


Figure 24: long-term objective in ozone (O_3) for the protection of vegetation (AOT40, threshold of 6000 $\mu\text{g}/\text{m}^3\cdot\text{h}$) in the Paris region in 2012

Benzene

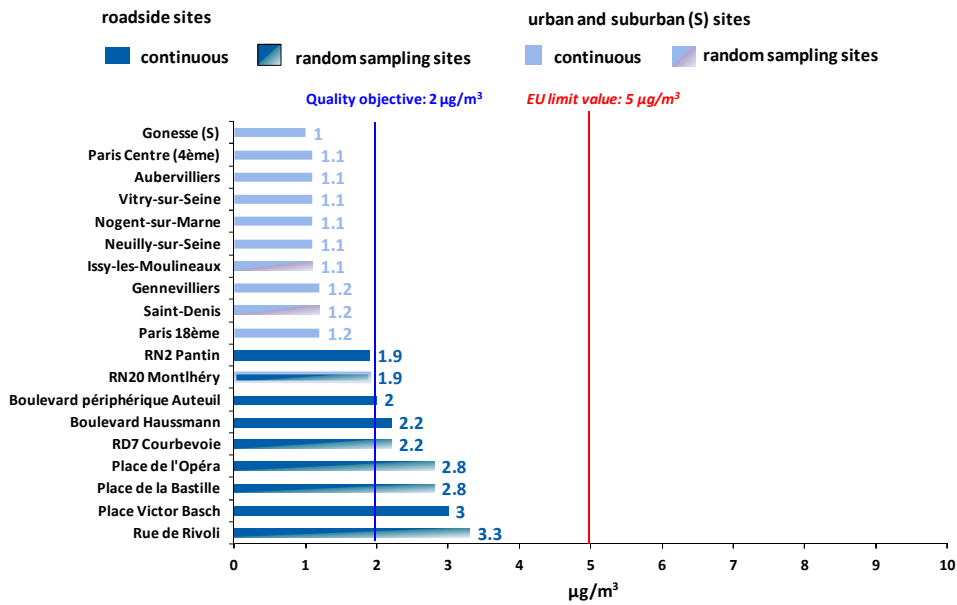


Figure 25: annual mean concentration of benzene in the Paris region in 2012

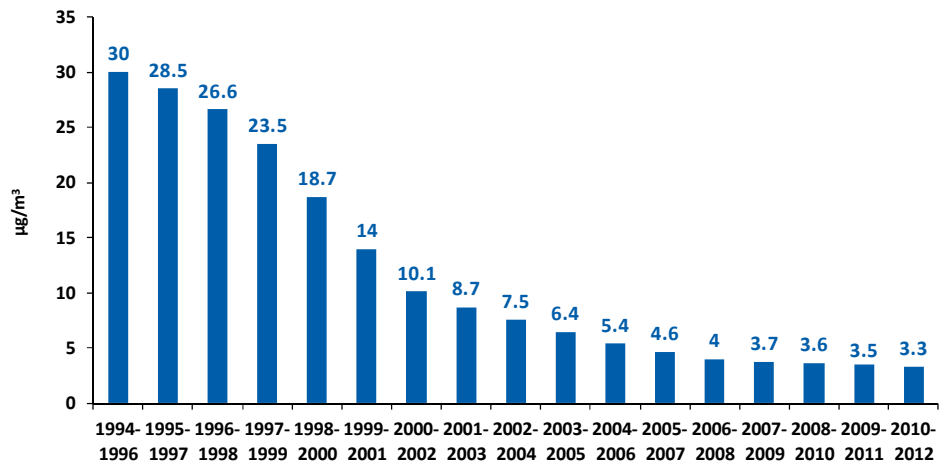


Figure 26: trend in the benzene annual mean concentration on Place Victor Basch Paris roadside monitoring site, 1994 to 2012

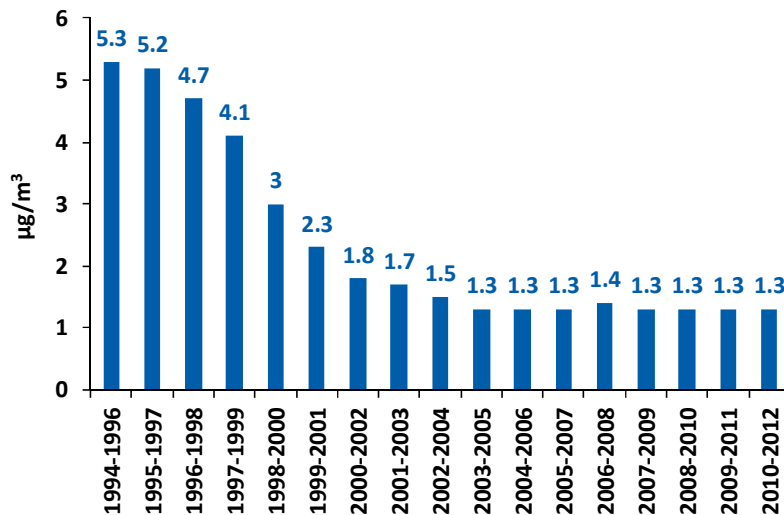


Figure 27: trend in the benzene tri-annual mean concentration, sample of five to ten urban background sites in the Paris agglomeration, 1994-1996 to 2010-2012

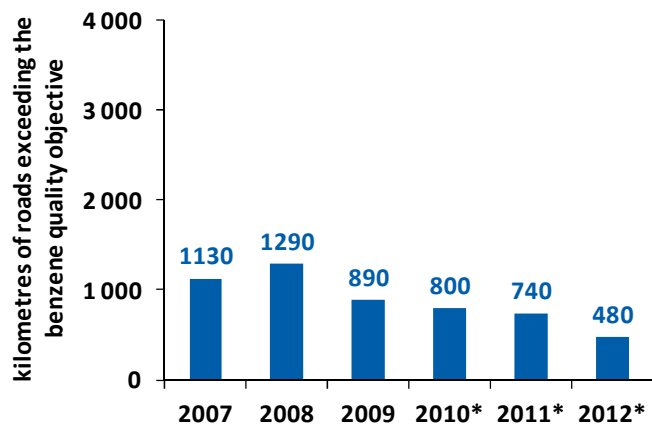


Figure 28: kilometres of main road network exceeding the benzene French quality objective ($2 \mu\text{g}/\text{m}^3$) in the Paris region, 2007 to 2012



Figure 29: benzene annual mean concentration in the Paris region, background and roadside, focus on Paris and near suburbs, 2012

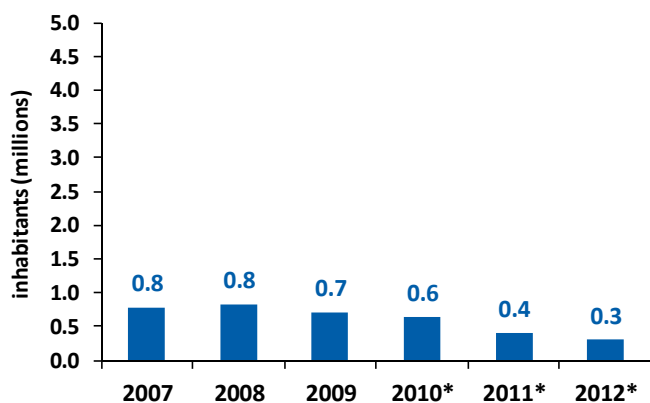


Figure 30: millions of inhabitants potentially exposed to an exceeding of the benzene French quality objective ($2 \mu\text{g}/\text{m}^3$) in the Paris region, 2008 to 2012

III. Pollutants meeting air quality standards

Sulfur dioxide (SO₂)

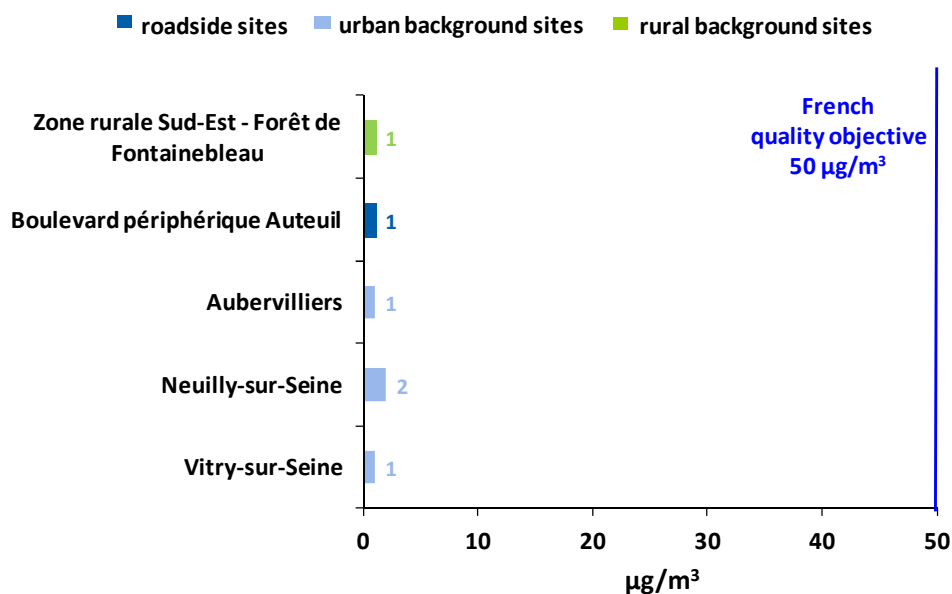


Figure 31: sulphur dioxide (SO₂) annual mean concentration for all continuous monitoring sites in the Paris region in 2012

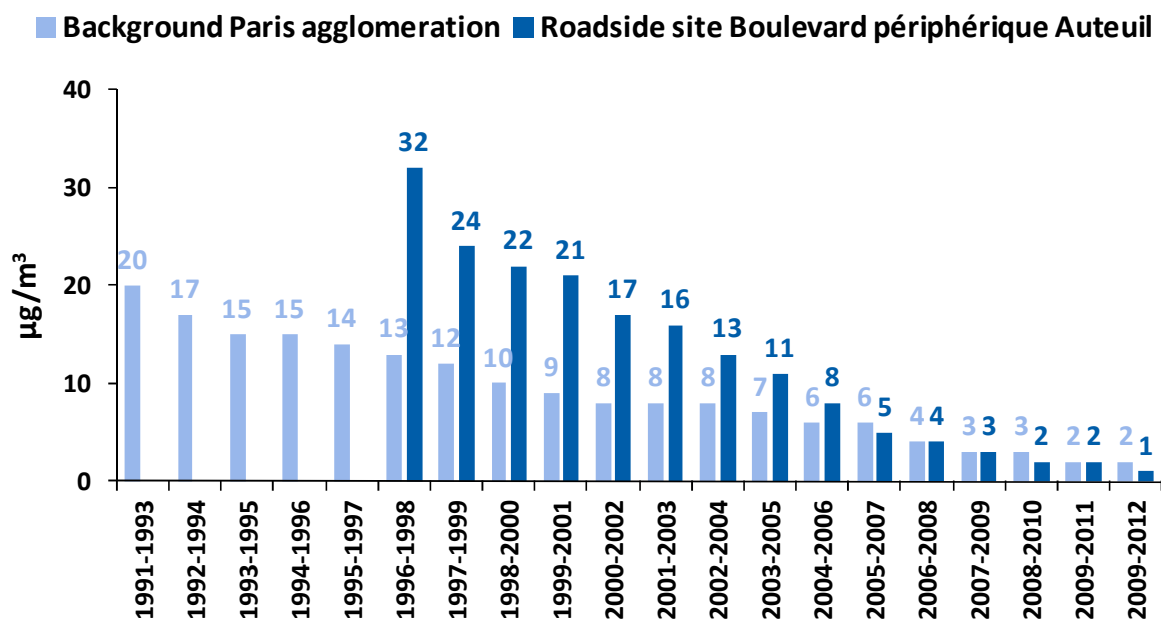


Figure 32: trend in the sulphur dioxide (SO₂) tri-annual mean concentration, changing sample of urban background sites in the Paris agglomeration and roadside site on Paris ring road, 1991-1993 to 2010-2012

Carbon monoxide (CO)

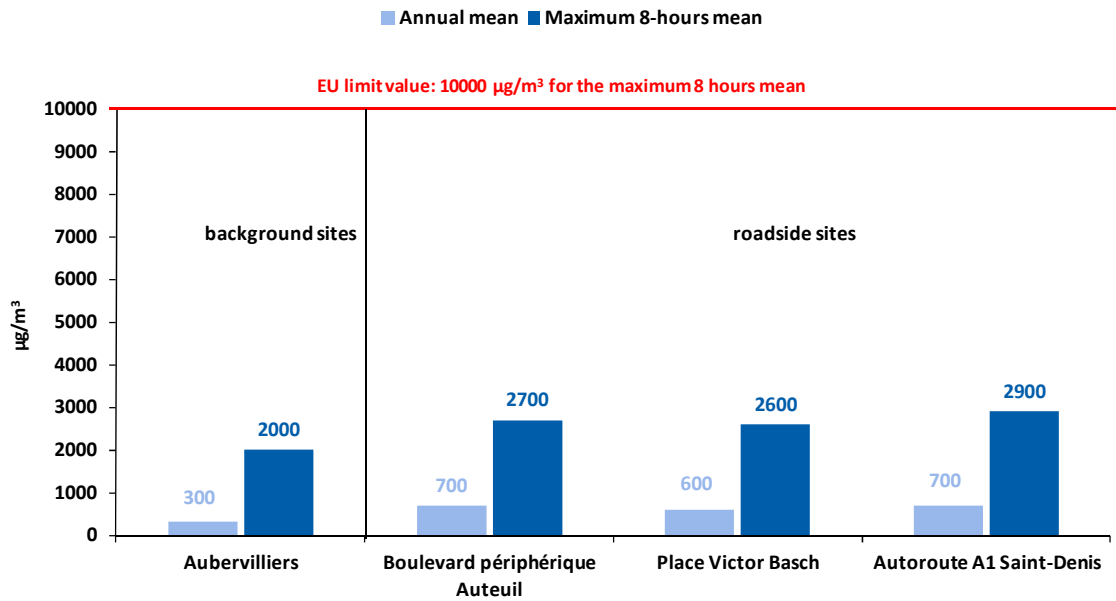


Figure 33: carbon monoxide (CO) annual mean and annual maximum 8-hour mean concentration for all continuous monitoring sites in the Paris region in 2012

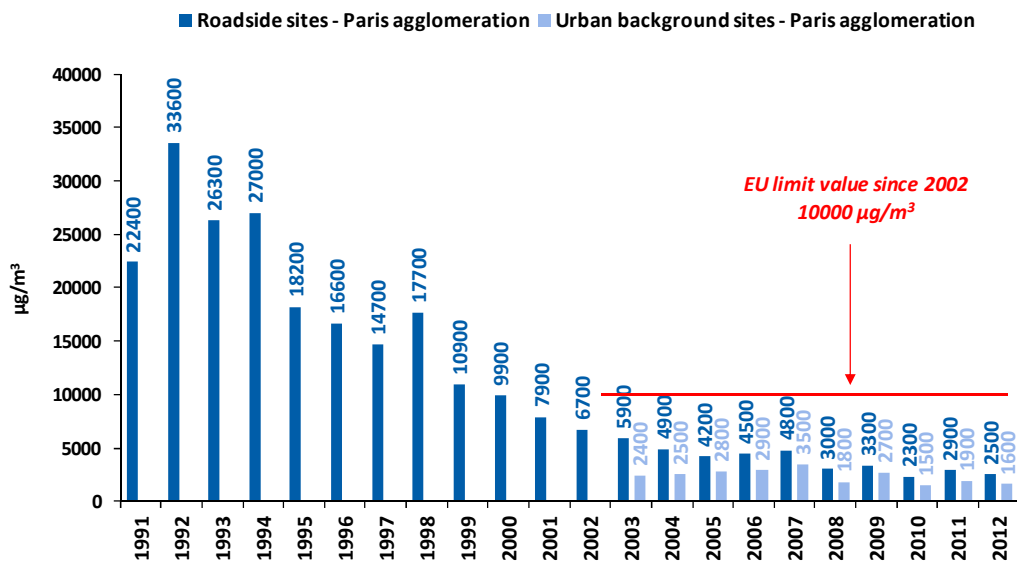


Figure 34: trend in the carbon monoxide (CO) annual maximum 8-hour mean concentration, urban background sites and roadside sites in the Paris agglomeration, 1991 to 2012

Metals (Lead, Arsenic, Cadmium and Nickel)

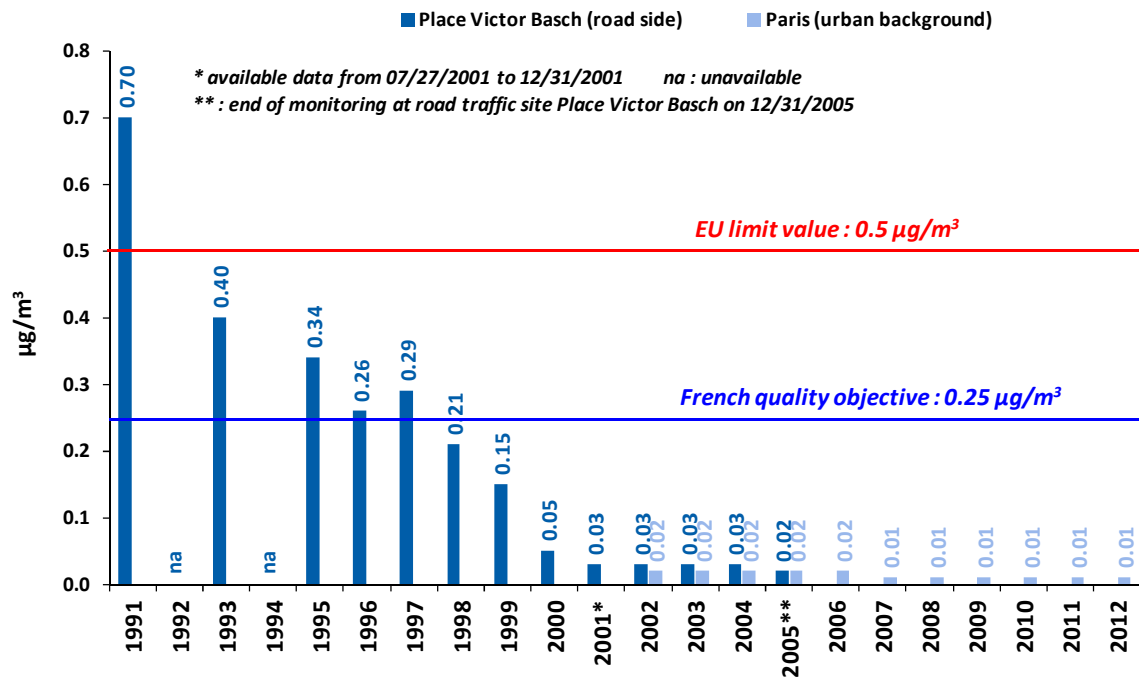


Figure 35: trends in the lead annual mean concentration, urban background and roadside sites in Paris, 1991 to 2012

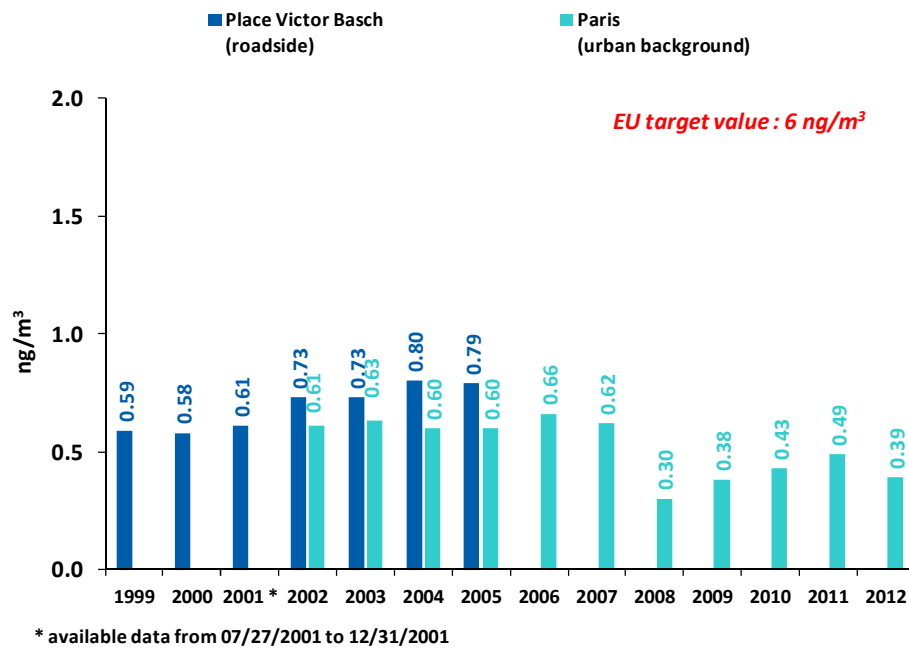


Figure 36: trends in the arsenic annual mean concentration, urban background and roadside sites in the Paris region, 1999 to 2012

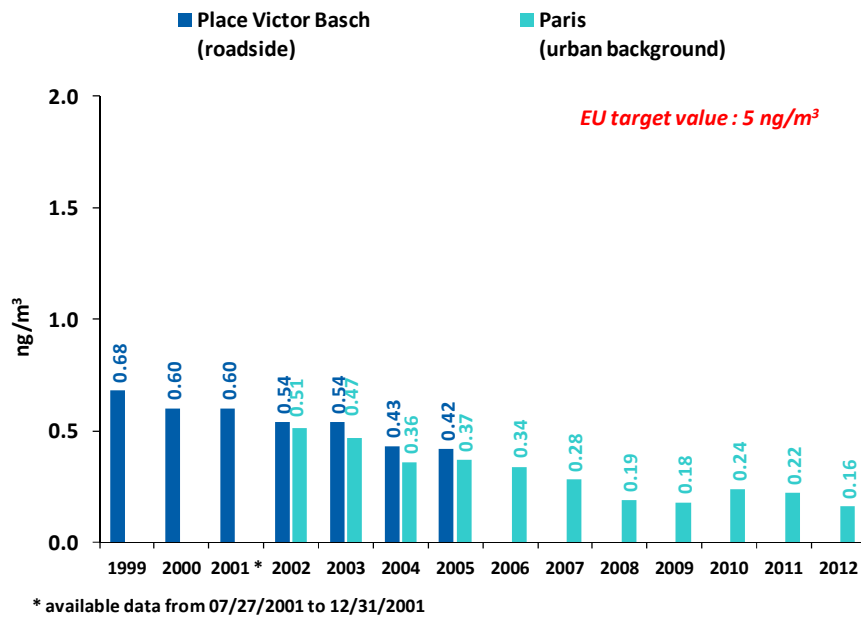


Figure 37: trends in the cadmium annual mean concentration, urban background and roadside sites in the Paris region, 1999 to 2012

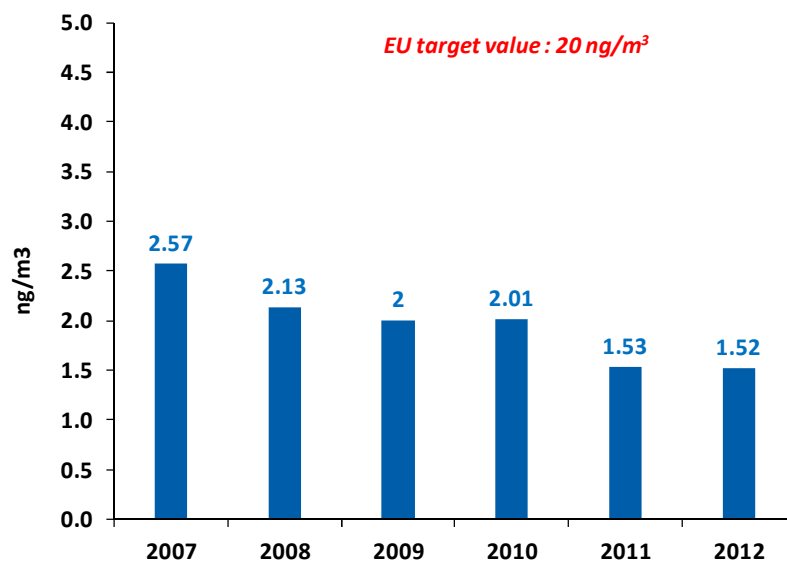


Figure 38: nickel annual mean concentration, urban background site in Paris, 2007 to 2012

Benzo(a)pyrene

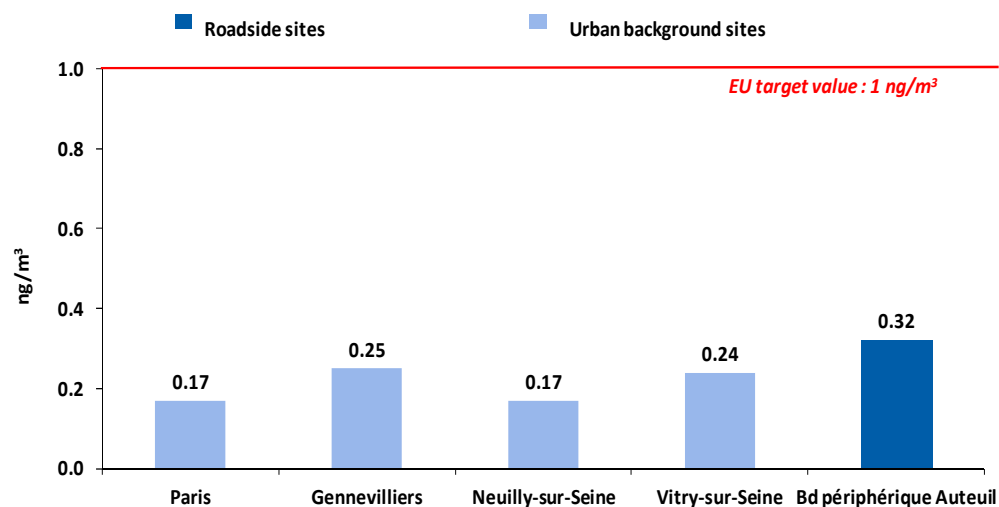


Figure 39: benzo(a)pyrene annual mean concentration for all monitoring sites in the Paris region in 2012

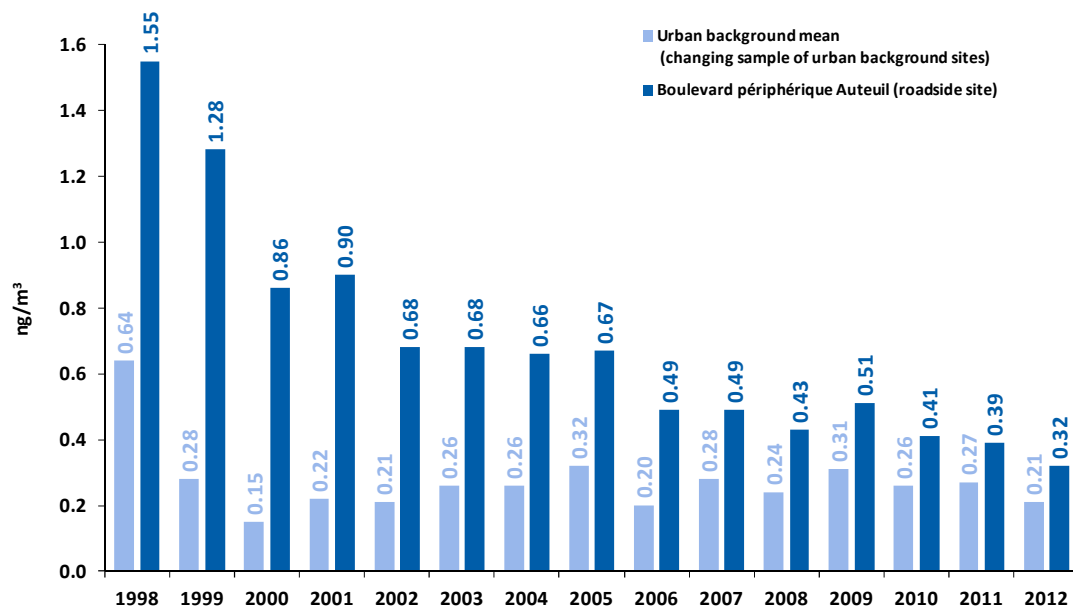


Figure 40: trend in the benzo(a)pyrene annual mean concentration, urban background sites mean and roadside site in the Paris agglomeration, 1998 to 2012

IV. Situation towards air quality standards in 2012

		exceedance intensity			no exceedance		
		very important	> + 50 %				
		important	+ 30 à + 50 %				
		moderate	+ 10 à + 30 %				
		light	0 à + 10 %				
Ozone (O₃)		2012			2001-2011		
		Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Quality objective exceedance (health)				no measurement	every year	every year	no measurement
Long term objective applicable in 2020 (health)					every year until 2006	every year until 2006	no measurement
Target value exceedance applicable in 2012 (health)				no measurement	every year	every year	no measurement
Quality objective exceedance (vegetation)				no measurement			no measurement
Long term objective applicable in 2020 (vegetation)							no measurement
Target value exceedance applicable in 2012 (vegetation)				no measurement			no measurement
Nitrogen dioxide (NO₂)		2012			2001-2011		
		Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Annual limit value exceedance *					2003, 2007, 2009, 2010, 2011		every year
Hourly limit value exceedance *							2006 to 2011
<small>* considering margins of tolerance decreasing from year to year</small>							
Particulate Matter (PM10)		2012			2007-2011		
		Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Annual quality objective exceedance					2007, 2009 : max site = threshold		
Annual limit value exceedance							
Daily limit value exceedance		max station = threshold			2007		
Particulate Matter (PM_{2,5})		2012			2007-2011		
		Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Quality objective exceedance			no			no measurement	
French target value exceedance					2007, 2009	no measurement	
Limit value (2015) exceedance			no			no measurement	every year
Limit value (2011) exceedance			no		non applicable		
Benzene		2012			2001-2011		
		Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Quality objective exceedance			no		except 2001	no measurement	every year
Limit value exceedance			no			no measurement	
Carbon monoxide (CO)		2012			2001-2011		
		Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Quality objective exceedance			no			no measurement	
Limit value exceedance			no			no measurement	
Sulfur dioxide (SO₂)		2012			2001-2011		
		Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Quality objective exceedance							
Hourly limit value exceedance							
Daily limit value exceedance							
Benzo(a)pyrene		2012			2001-2011		
		Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Target value (2013) exceedance			no			no measurement	
Lead		2012			2001-2011		
		Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Quality objective exceedance			no			no measurement	
Limit value exceedance			no			no measurement	
Arsenic, Cadmium, Nickel		2012			2001-2011		
		Background agglomeration	Rural background	Roadside	Background agglomeration	Rural background	Roadside
Target value (2013) exceedance			no	no measurement		no measurement	

Figure 41: situation towards air quality standards in the Paris region in 2012