

# AIR POLLUTION IN PARIS AND ABATEMENT EFFORTS

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# PARIS: MARCH 11, 2014



Source: <http://www.france24.com/en/20150320-paris-city-smog-pollution-plume-labs-hidalgo-public-transport-diesel>

# PARIS: DECEMBER 5, 2016



**Source:**  
<http://www.independent.co.uk/news/world/europe/paris-pollution-increase-air-smog-france-capital-car-limits-fossil-fuels-weather-a7500426.html>

# ENVIRONMENTAL SITUATION

- Paris actually presents a favorable environment for atmospheric pollution dispersion
  - Flat, low altitude, and common rainy and windy conditions
  - However, pollution problems persist due to the large concentration of the population
- 90% of the population resides in 20% of the available area
  - Thus, most of the pollution is concentrated in the metropolitan area
    - >75% of NO<sub>x</sub> emissions
    - 70% of hydrocarbons
    - 50% of particles

# SOURCES OF POLLUTION

## ■ Transportation

- Biggest Problem: Accounts for 53% of NO<sub>x</sub> emissions, 15% of volatile organic compounds (VOCs), and 25% of particles
- French government places biggest blame on diesel vehicles

## ■ Heating

- Smoke from wood-burning chimneys used to heat homes and businesses

## ■ Industry

- Industrial pollutants



# ROADSIDE INDEX

Year	NO2 Year average	PM10 year average	PM10 exceedences daily average	O3, # of days with 8-hour average $\geq 120\mu\text{g}/\text{m}^3$	SO2 year average	Benzene year average	City Index
2003	2.28	1.15	1.15	-	0.8	1.52	1.53
2004	2.13	1.03	1.03	-	0.55	1.26	1.39
2005	2.6	1.05	2.6	-	0.35	1	2.08
2006	2.5	1.05	2.66	-	0.25	0.8	2.07
2007	2.6	1.25	4.26	-	0.2	0.6	2.7
2008	2.63	1.15	3.57	-	0.15	0.6	2.45
2009	2.83	1.25	3.77	-	0.1	0.6	2.62
2010	2.85	1.23	4.46	-	0.1	0.6	2.84
2011	2.78	1.25	4.11	-	0.05	0.66	2.71
2012	2.7	1.23	3.86	-	0.05	0.6	2.59

## Legend:

Air Quality	Index Value
EU Standards are exceeded by one pollutant or more	■ > 1
EU Standards are fulfilled on average	■ 1
The situation is better than the norms requirements on average	■ < 1

# PARIS YEARLY AIR QUALITY INDEX

Source: [https://www.airqualitynow.eu/comparing\\_city\\_annual.php?paris](https://www.airqualitynow.eu/comparing_city_annual.php?paris)

# MAJOR POLLUTION EPISODES

- **March 18, 2015**
  - Paris pollution levels reached **125** according to Plume Labs, which monitors air quality through an index
    - This was worse than any other city in the world at that time
    - >150 - Critical
    - >100 - Harmful
- **Week of December 5, 2016**
  - Worst pollution levels in over a decade
  - More pictures on next slides

Sources: <http://www.france24.com/en/20150320-paris-city-smog-pollution-plume-labs-hidalgo-public-transport-diesel>  
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<https://www.forbes.com/sites/ceciliarodriguez/2016/12/12/paris-cant-breath-worst-pollution-in-a-decade-has-city-scrambling-for-solutions/#446ec02f1c2f>

# LES INVALIDES



Source: <https://www.forbes.com/sites/ceciliarodriguez/2016/12/12/paris-cant-breath-worst-pollution-in-a-decade-has-city-scrambling-for-solutions/#446ec02f1c2f>



# NOTRE DAME CATHEDRAL



Source: <https://www.forbes.com/sites/ceciliarodriguez/2016/12/12/paris-cant-breath-worst-pollution-in-a-decade-has-city-scrambling-for-solutions/#446ec02f1c2f>

# QUOTE

**StopPollution (A campaign that alerts the public about pollution dangers):**

**“Living in Paris during this peak of pollution is equivalent to breathing the smoke of eight cigarettes a day in a room of 20 square meters.”**

*Source: <https://www.forbes.com/sites/ceciliarodriguez/2016/12/12/paris-cant-breath-worst-pollution-in-a-decade-has-city-scrambling-for-solutions/#446ec02f1c2f>*

# EFFECTS OF POLLUTION

- Government measures that limit amount of fuel-powered vehicles on the road and encourage the use of public transportation
- Air pollution is the cause of 48,000 deaths per year (9% of deaths per year)
  - 3<sup>rd</sup> highest leading cause of death in France
  - PM2.5 particles cause respiratory and cardiovascular illnesses
- The World Health Organization (WHO) estimates that 47 million French people are exposed to unsafe level of particles
- For those 30 years old and up, living in a city with more than 100,000 people can reduce life expectancy by 15 months
  - For those living in cities with 2,000-100,000, life expectancy is reduced by, on average, 10 months

# ABATEMENT EFFORTS

- Banned vehicles built before 1997
- During peak pollution levels...
  - Only allowed vehicles with even or odd license plates to be driven in the city on certain days
    - Ineffective because many drivers ignored these rules
    - Rule was lifted after just one day
  - Made public transportation free
    - Velib (city shared bicycle service) made free
    - Autolib (city shared electric car service) made free
    - To encourage citizens to avoid private vehicle use

Sources: <https://www.forbes.com/sites/ceciliarodriguez/2016/12/12/paris-cant-breath-worst-pollution-in-a-decade-has-city-scrambling-for-solutions/#446ec02f1c2f>

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# ABATEMENT EFFORTS

- The “War on Cars” has been controversial
  - Some people have no other means of getting to work
  - But the government has no other tools with which to fight against extreme smog levels
  - Government also claims the ban has been effective: In 2014, after just one day of banning even numbered license plates, pollution levels fell by 6% on average across Paris
- Other measures used to encourage people to stop using their cars:
  - Creating more bike lanes
  - Free parking for motorcycles and electric cars
- Others seek more long-term solutions

# THE ELECTRIC CAR SOLUTION

- Offer a stipend of €10,000 (\$11,852.50) to individuals that purchase an electric car
- Offer €1,000 (\$1,185.25) to those that buy an electric scooter
- For drivers of diesel-powered light trucks or taxis, €10,000 (\$11,852.50) will be given to replace them with an electric vehicle
- The Paris government announced a plan to remove all diesel vehicles from Paris by 2020

# LEGISLATION

- **The Regional Air Quality Plan (PRQA)**
  - Examines quality of air and provides solutions
- **The Atmosphere Protection Plan (PPA)**
  - Mandates measures to improve air quality and meet EU standards
- **The Ile-de-France Urban Mobility Plan (PDU)**
  - Controls transportation and parking in the Ile-de-France region
- **Paris Mobility Plan (PDP)**
  - Reduces the use of cars in Paris and institutes plans that favors public transportation

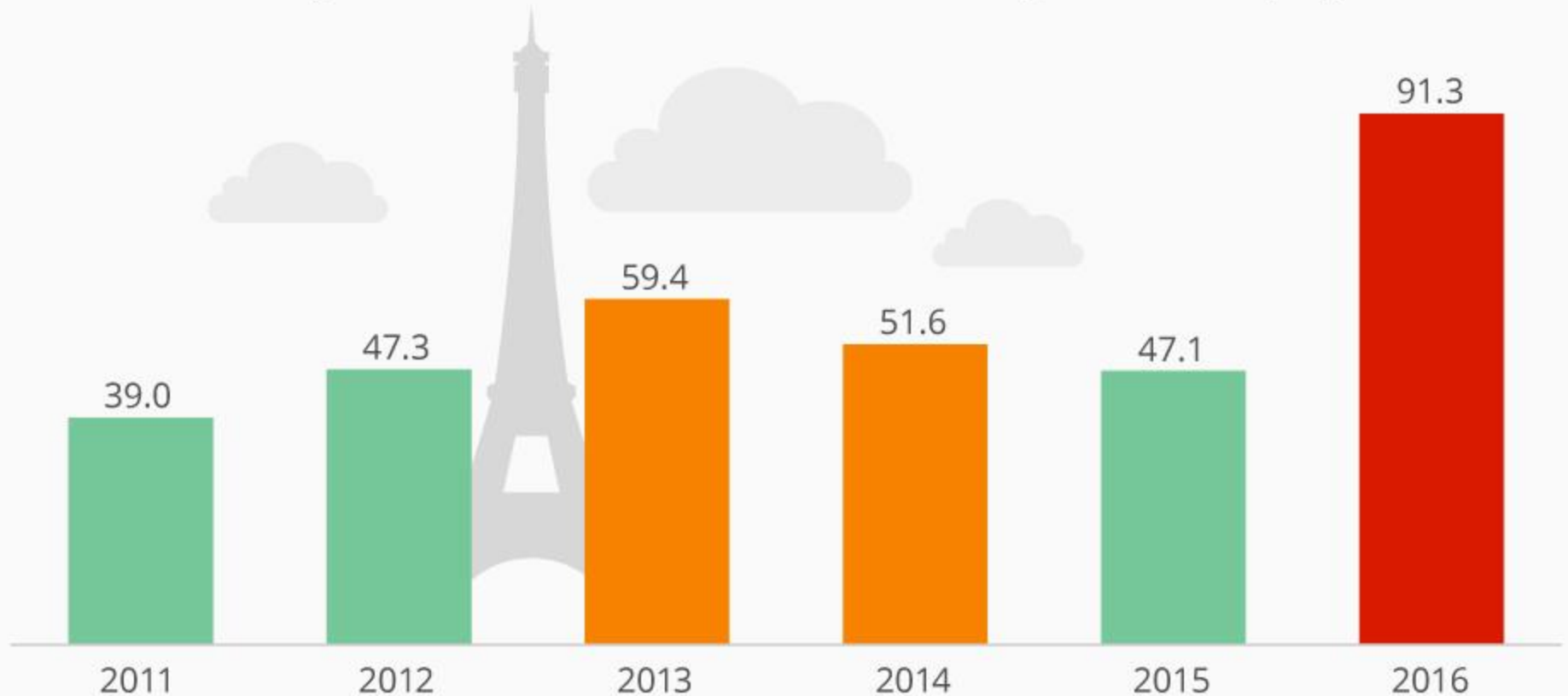
# SUCCESS ACHIEVED?

- Airparif, an independent organization that monitors air quality in Paris, claims that air quality is actually improving
- Days of very high air pollution:
  - 2012: 44
  - 2013: 36
  - 2014: 16
  - 2015: 16
  - 2016: 15
- But would our interpretation change if we measured air quality in another way?
- More data from Airparif on next slides



# Paris Air Pollution Has Reached A Critical Level

Mean air pollution levels over the first seven days of December in Paris\* 2011-2016



# TREND IN PM<sub>2.5</sub> CONCENTRATION

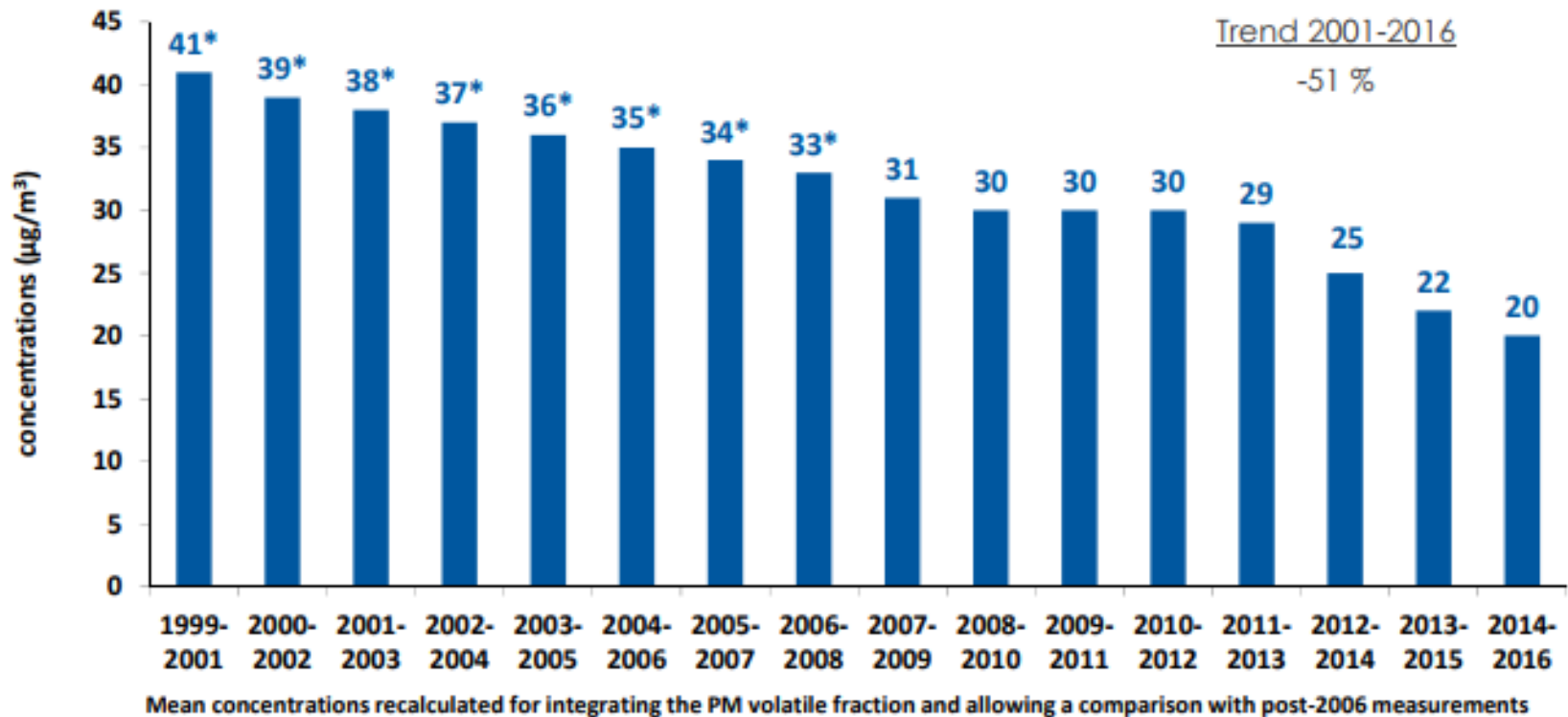
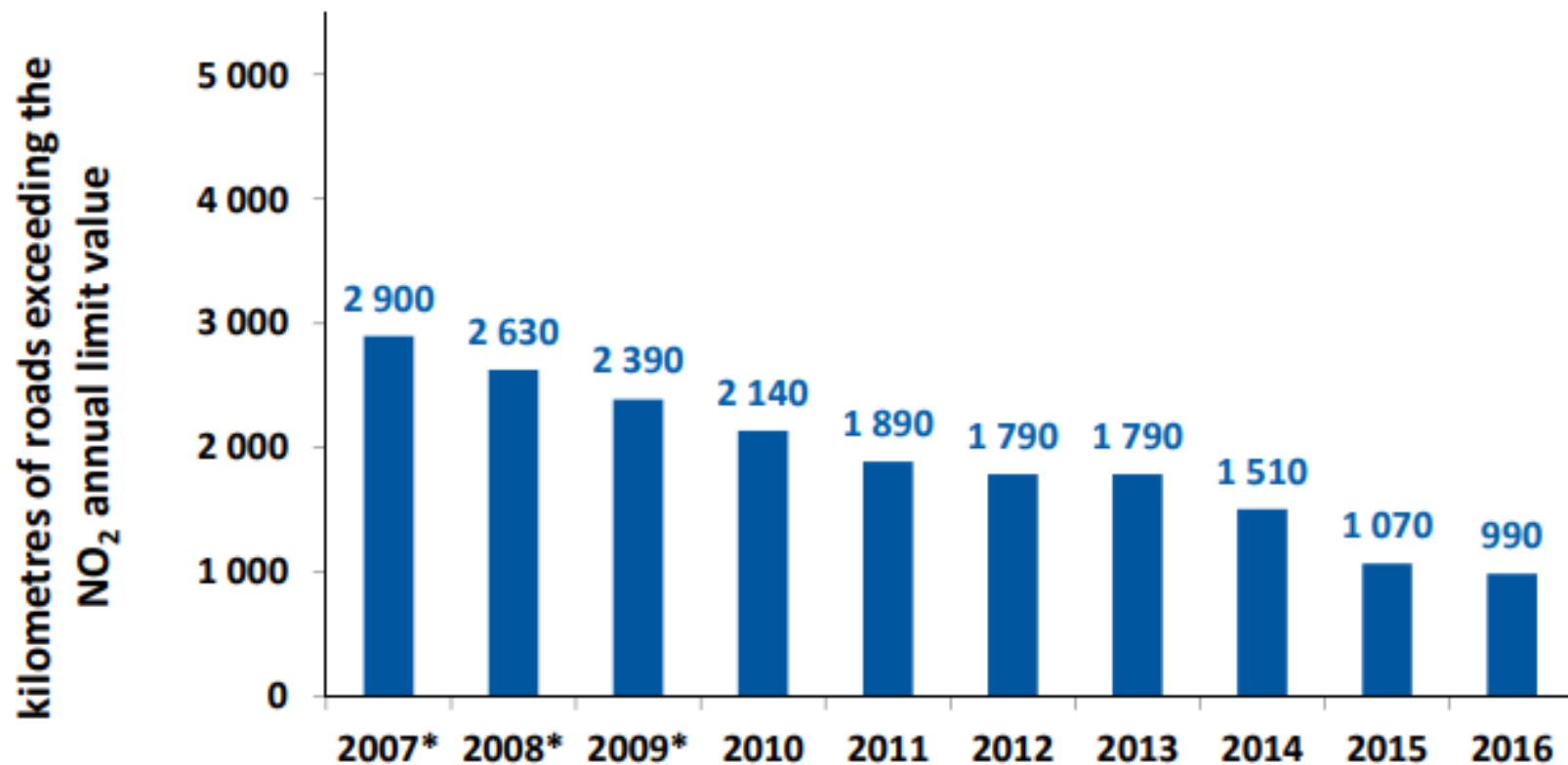


Figure 17 : trend in the PM<sub>2.5</sub> tri-annual mean concentration for the traffic monitoring station Ring road BP Porte d'Auteuil from 1999-2001 to 2014-2016

# KILOMETERS OF ROADS EXCEEDING EU NO<sub>2</sub> LIMITS



\* exceedances calculated with included threshold

Figure 20 : kilometres of roads exceeding the nitrogen dioxide (NO<sub>2</sub>) EU annual limit value in the Paris region from 2007 to 2016

# SO2 LEVELS

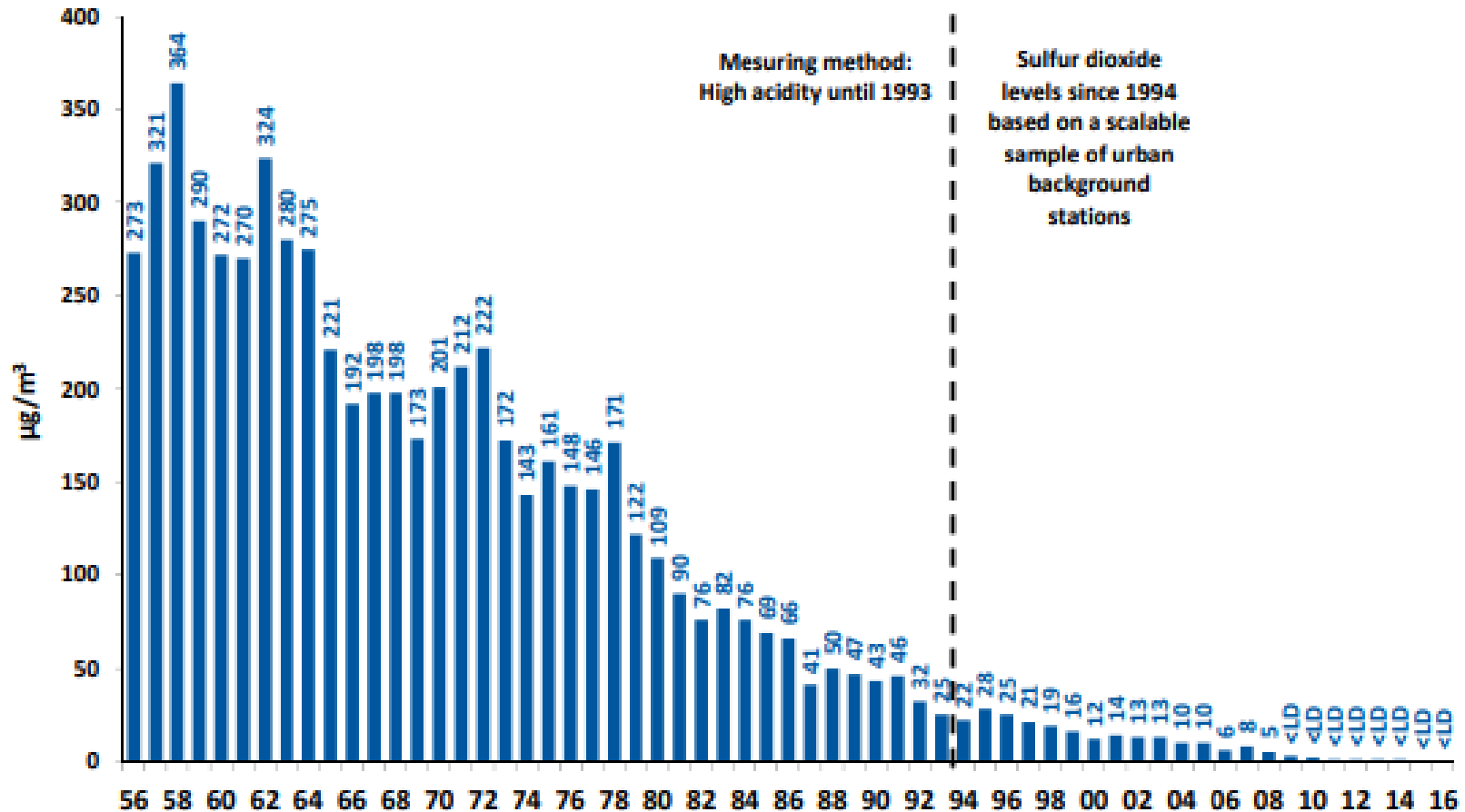


Figure 50 : trend in the sulfur dioxide (SO<sub>2</sub>) winter mean concentrations in Paris since the end of 1950's