WHO *air quality guidelines* e la proposta di direttiva della commissione europea sulla qualità dell' aria.

Francesco Forastiere

CNR, Palermo
Environmental Research Group, Imperial College, UK

Aims

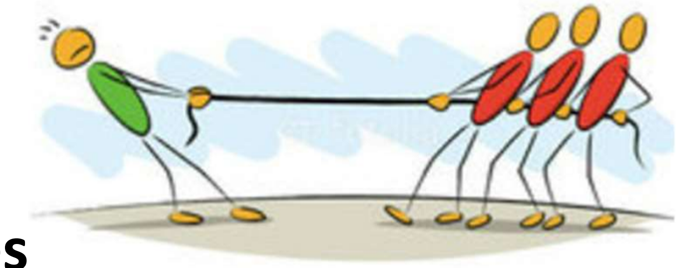
1. To provide a background for the AAQD

2. To illustrate air pollution data and main emission sectors for the Po Valley

3. To provide a health impact assessment for Lombardia and the Po Valley

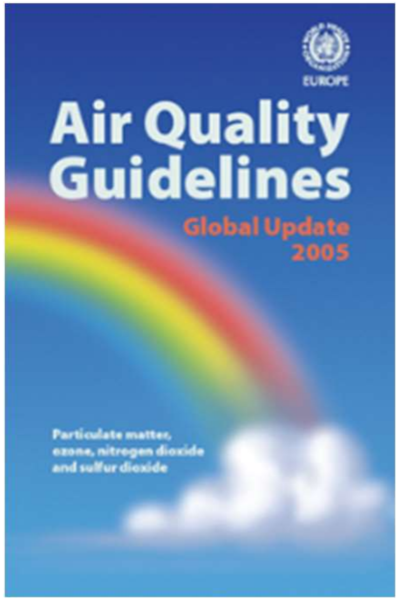
A busy period of science-policy interaction

- September 2021: Publication of WHO Air Quality Guidelines, with support of the Medical Societies
- January 2022: Publication of ELAPSE results, administrative cohorts (Stafoggia et al, 2022)
- June 2022: Publication of the HEI Traffic review
- August 2022: Proposed analyses of the mortality impacts of PM2.5 and NO2 (Hoffmann et al, 2022)
- October 2022. Proposal of the new EU Ambient Air Quality Directive
- January 2023: Clean Air in Europe for All: A Call for More Ambitious Action (Boogaard et al, 2023)
- June 2023: the text of the AAQD approved by the ENVI Committee
- 13 September: the AAQD approved by the EU Parlament

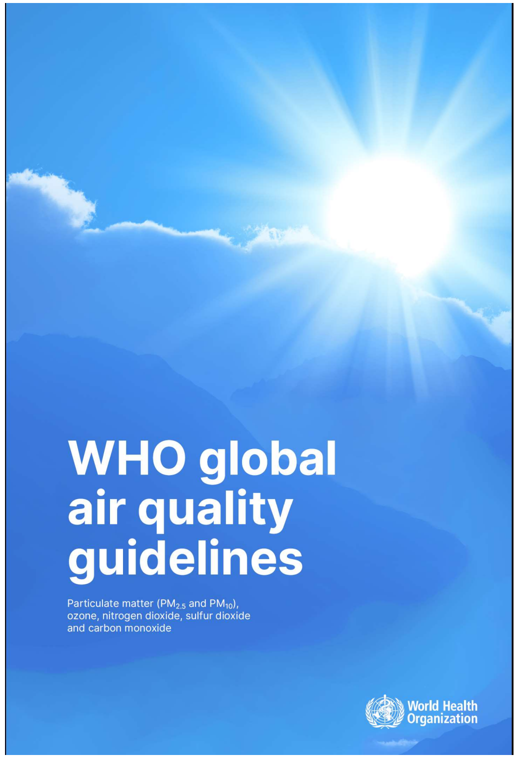


- **The update of the WHO Global Air Quality Guidelines**
  - Approach to assessing the certainty of evidence from systematic reviews informing WHO global air quality guidelines
  - **Systematic reviews published on Env Int in 2020**
  - **Report published in September 2021**

AQG – Global update 2005



WHO global AQGs 2021



International Journal of Public Health
doi: 10.3389/ijph.2021.1604465

ERS

IJPH | SSPH+

International Journal of Public Health
COMMENTARY
published: 23 September 2021
doi: 10.3389/ijph.2021.1604465

ERS EUROPEAN RESPIRATORY SOCIETY
every breath counts

ISEE

WHO Air Quality Guidelines 2021 – Aiming for healthier air for all

A joint statement by medical, public health, scientific societies and patient representative organisations

> 100 endorsements!

American Heart Association. | ESC European Society of Cardiology | european cancer ORGANISATION | ELF EUROPEAN LUNG FOUNDATION

WORLD HEART FEDERATION | ATS American Thoracic Society | American Cancer Society®

WHO Air Quality Guidelines 2021–Aiming for Healthier Air for all: A Joint Statement by Medical, Public Health, Scientific Societies and Patient Representative Organisations

Barbara Hoffmann[1*], Hanna Boogaard[2], Audrey de Nazelle[3], Zorana J. Andersen[4], Michael Abramson[5], Michael Brauer[6], Bert Brunekreef[7], Francesco Forastiere[3], Wei Huang[8], Haidong Kan[9], Joel D. Kaufman[10], Klea Katsouyanni[3,11], Michal Krzyzanowski[3], Nino Kuenzli[12], Francine Laden[13], Mark Nieuwenhuijsen[14], Adetoun Mustapha[3,15], Pippa Powell[16], Mary Rice[13], Aina Roca-Barceló[3], Charlotte J. Roscoe[13], Agnes Soares[17], Kurt Straif[18] and George Thurston[19]

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OPEN ACCESS

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Olaf von dem Knesebeck, University Medical Center Hamburg-Eppendorf, Germany

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Keywords: air pollution, WHO Air Quality Guidelines, health effects, policy implications, average population exposure

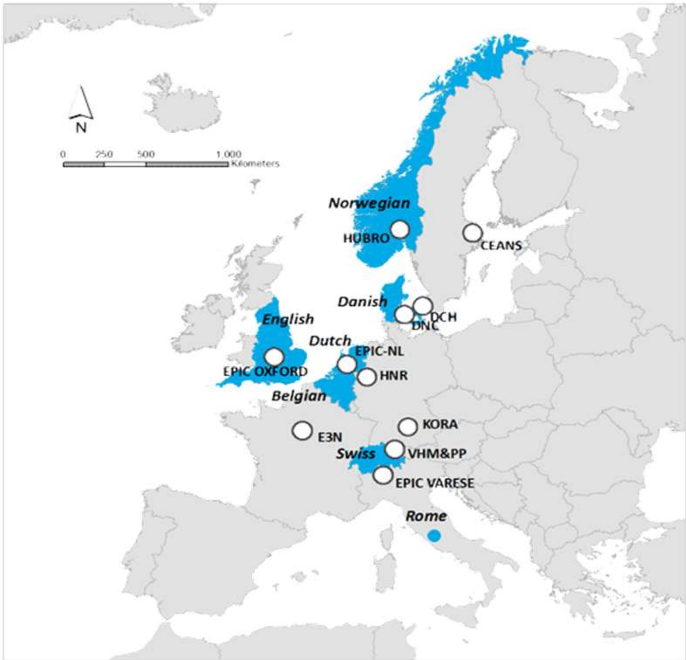
ERS Website: https://www.ersnet.org/news-and-features/news/urge-implement-air-pollution-policies-who-aqgs/

ELAPSE: Effects of Low-Level Air Pollution: a Study in Europe

- Mortality, lung cancer incidence, CVD events, respiratory disease
- Advanced exposure modeling combining LUR, CTM, AIRBASE, satellite observations
- Modeling for PM2.5, NO2, BC, and O3 with high resolution

- Two arms of the study:
  - Pooling of several well-examined European cohorts (ESCAPE)
  - ~ 380,000 subjects

  - Seven large administrative/national cohorts in UK, NO, DK, IT, NL, CH, B
  - ~ 28,000,000 subjects, no pooling



HEI

ELAPSE Administrative cohorts (Stafoggia et al, 2022)

	Increment	Hazard ratio (95% CI)			
		Non-accidental mortality	Cardiovascular mortality	Non-malignant respiratory mortality	Lung cancer mortality
$PM_{2.5}$	5 μg/m³	1·053 (1·021–1·085)	1·041 (1·010–1·072)	1·064 (1·013–1·118)	1·102 (1·036–1·172)
NO_2	10 μg/m³	1·044 (1·019–1·069)	1·025 (1·006–1·044)	1·058 (1·024–1·093)	1·093 (1·053–1·134)
Black carbon	0·5 × 10^{-5}/m*	1·039 (1·018–1·059)	1·022 (1·004–1·040)	1·053 (1·021–1·085)	1·078 (1·038–1·118)
O_3	10 μg/m³	0·953 (0·929–0·979)	0·976 (0·954–0·998)	0·948 (0·910–0·988)	0·924 (0·887–0·963)

After indirect adjustment for smoking and BMI

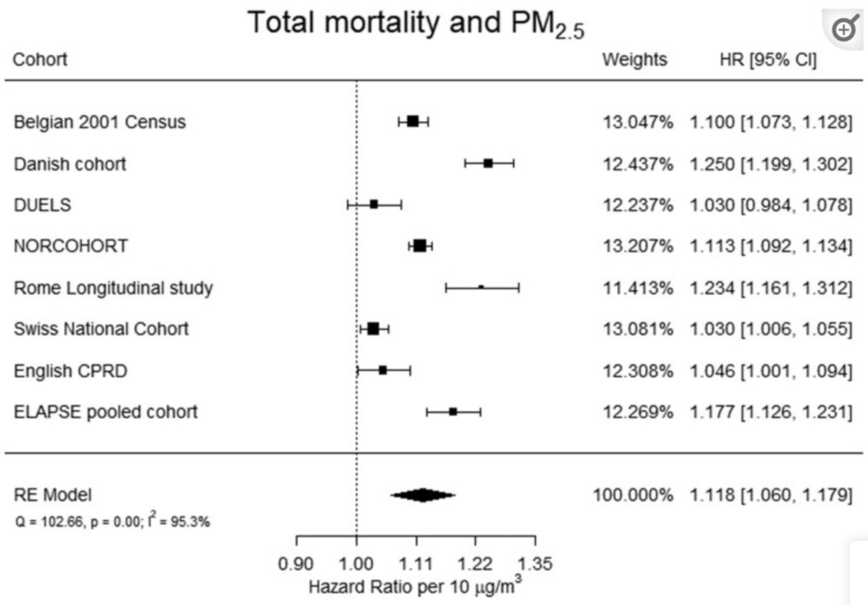
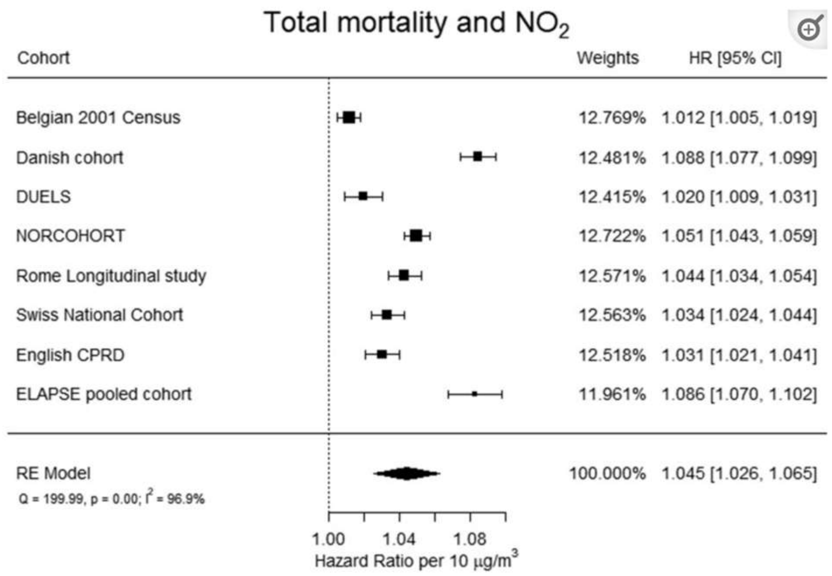


Figure 2.



Commentary

ENVIRONMENTAL EPIDEMIOLOGY

OPEN

Benefits of future clean air policies in Europe

Proposed analyses of the mortality impacts of $PM_{2.5}$ and NO_2

Barbara Hoffmann[a], Bert Brunekreef[b], Zorana J. Andersen[c], Francesco Forastiere[d], Hanna Boogaard[e*]

PM2.5 and total mortality

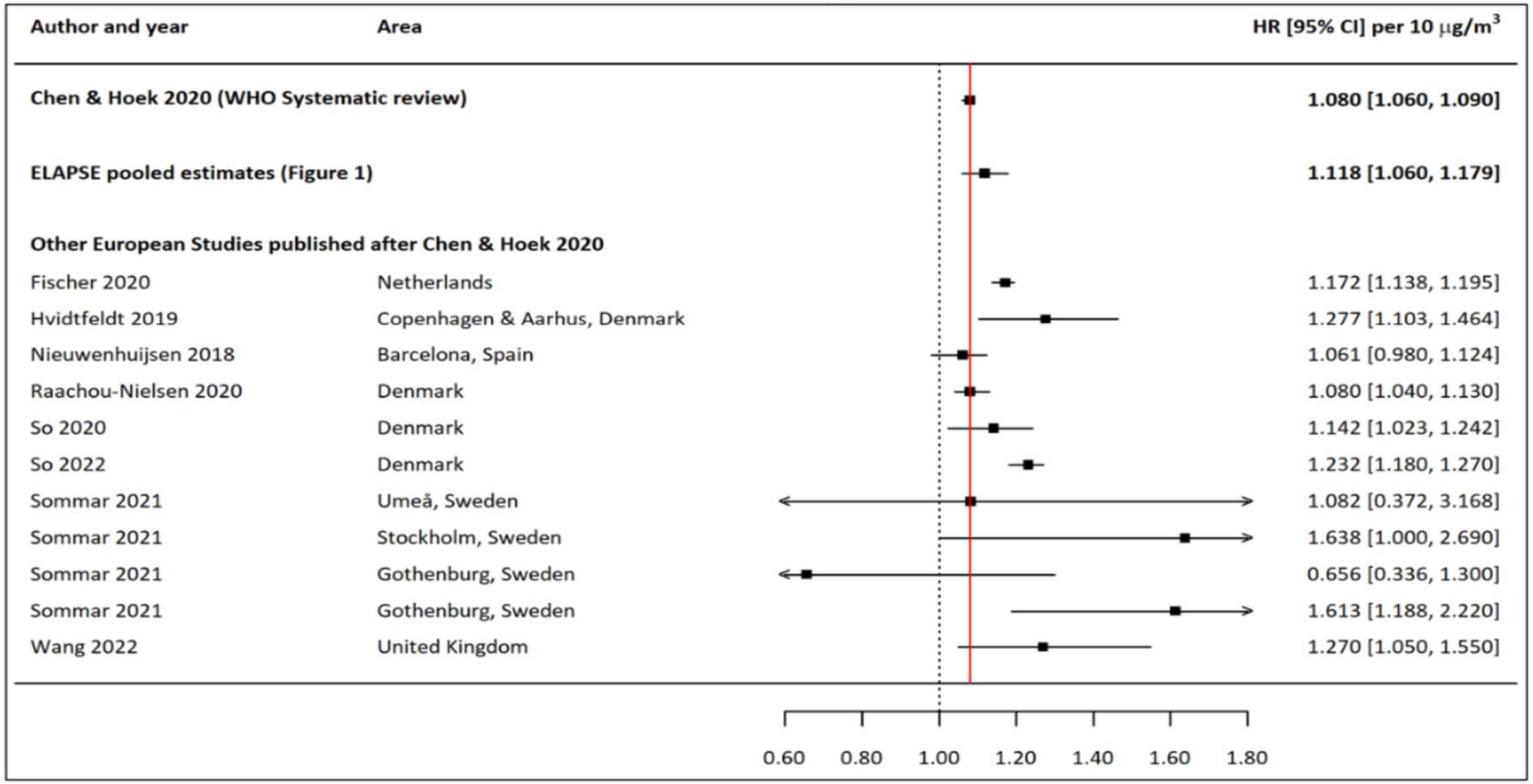


Figure 3. Total mortality and long-term $PM_{2.5}$ from other European studies published since the WHO systematic review by Chen & Hoek (2020).*

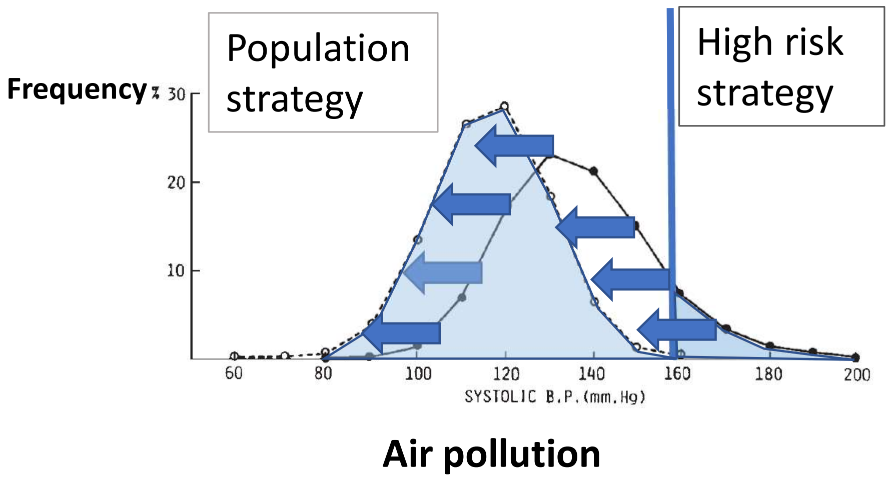
*Red line indicates the summary estimate from the systematic review by Chen & Hoek (2020). Range of mean $PM_{2.5}$ exposure in European studies from 5.8 to 20.5 μg/m³.

International Journal of Epidemiology 2001;**30**:427–432

REITERATION

Sick individuals and sick populations

Geoffrey Rose



- **„Shifting the curve"** yields much larger health benefits than only treating the high risk population
- Air pollution: **Combination** of fixed limit values with **binding** reduction of average population exposure

GENERAL PUBLICATIONS

Proposal for a revision of the Ambient Air Quality Directives

Details

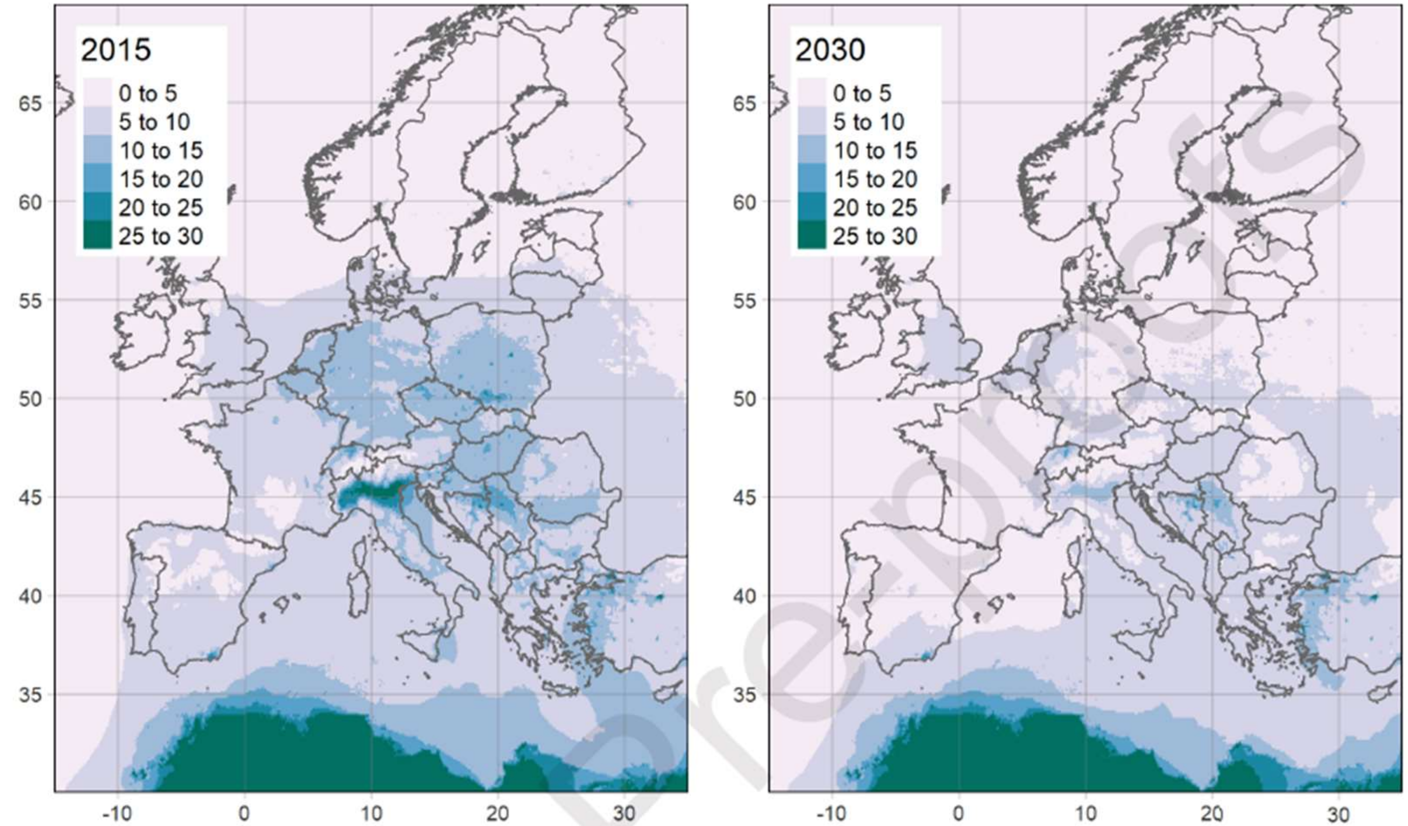
Publication date	26 October 2022
Author	Directorate-General for Environment

European Commission

Study to support the impact assessment for a revision of the EU Ambient Air Quality Directives

Specific Contract under Framework Contract ENV/F1/

PM2.5 concentrations in 2015 and 2030 projections



igure 1: PM2.5 yearly average concentrations (μg/m³), for 2015 (left) and 2030 scenario (right).

Pisoni et al, 2023

Immediate (same day) reaction!

WEBINARS

"The newly proposed annual limit values will ensure important health benefits, and are much stricter than the 2008 limit values in particular for PM2.5 and NO2. However, greater collective efforts are ultimately needed for a continued improvement in air quality down to, or below, the latest WHO health-based Air Quality Guidelines."

- Dr. Hanna Boogaard
Co-Chair
International Society for Environmental Epidemiology (ISEE) Europe Chapter

"We are faced with a public health emergency from air pollution - tackling it requires political will, for immediate and long-lasting health benefits.

Where the Commission shied away from proposing what's needed, the European Parliament and Member States now have to step up, to save lives and prevent disease. This is done by fully aligning with the updated WHO guidelines by 2030 at the latest and with a strong enabling framework, including limit values and enforcement mechanisms."

- Anne Stauffer
Deputy Director
at the Health and Environment Alliance (HEAL)

"The burden of disease from air pollution remains unacceptably high in Europe. We need greater efforts to reduce air pollution exposure with a more ambitious path to achieving full alignment with WHO Air Quality Guidelines everywhere in Europe."

- Prof. Zorana Jovanovic Andersen
Chair of the Environment and Health Committee
European Respiratory Society (ERS)

ANNEX

Table 1 – Limit values for the protection of human health to be attained by 1 January 2030

Averaging period	Limit value	
$PM_{2.5}$		
1 day	25 µg/m³	not to be exceeded more than 18 times per calendar year
Calendar year	10 µg/m³	
PM_{10}		
1 day	45 µg/m³	not to be exceeded more than 18 times per calendar year
Calendar year	20 µg/m³	

15

3

5

3

15

Nitrogen dioxide (NO_2)

1 hour	200 µg/m^3	not to be exceeded more than once per calendar year
1 day	50 µg/m^3	not to be exceeded more than 18 times per calendar year
Calendar year	20 µg/m^3	

3

15

The difference between the EU air quality standards and the WHO air quality guidelines

Firstly, the air quality reference values for a number of pollutants, defined by the WHO, are intended as policy guidance only, while the EU standards, as defined by the AAQDs, are mandatory. Secondly, the WHO guidelines are based solely on health considerations, while the EU standards reflect broader considerations, such as technical feasibility and the political, economic and social aspects of achieving these standards. This explains why, for certain pollutants, the EU co-legislators opted for weaker standards than those recommended by the WHO.

Source: EEA, report on Air quality in Europe – 2020.

European Parliament

2019-2024

Committee on the Environment, Public Health and Food Safety

2022/0347(COD)

23.2.2023

*****I**

DRAFT REPORT

on the proposal for a directive of the European Parliament and of the Council Ambient Air quality and cleaner air for Europe (recast)
(COM(2022)0542 – C9-0364/2022 – 2022/0347(COD))

Committee on the Environment, Public Health and Food Safety

Rapporteur: Javi López

(Recast – Rule 110 of the Rules of Procedure)

IL GAZZETTINO.it

Inquinamento, le nuove regole dell'Europa e le conseguenze: «In Veneto 3 fabbriche su 4 dovrebbero chiudere»

Luca Zaia: «Le Alpi fanno da barriera, bisogna considerare la morfologia del territorio»

Tra sette anni, per essere in **regola** con le **nuove norme europee** sull'inquinamento **atmosferico**, il Veneto dovrebbe bloccare il 75 per cento di tutti gli autoveicoli, sia privati che commerciali. **Dovrebbe obbligare alla chiusura il 75 per cento delle attività industriali**. **Il 60 per cento degli allevamenti** - mucche, galline, maiali - dovrebbe cessare. E anche i**l 75 per cento degli impianti di riscaldamento** dovrebbe essere spento. Chi se lo immagina un Veneto così?

Meeting on Air Quality proposal

Regione Lombardia

10th February 2023

Regione Lombardia

www.regione.lombardia.it

We are available to support the definition of amendments on the proposal

gian_luca_gurrieri@regione.lombardia.it
matteo_lazzarini@regione.lombardia.it
g.lanzani@arpalombardia.it

Improving air quality and achieving WHO suggested concentrations of pollutants is an important ambition for the protection of citizens' health by European, national, and local institutions. Anyway, **reaching near-zero limits in a limited time is extremely complex.**

For these reasons, the AIR group Regions have sent a position paper to the European Commission. The document aims to promote a careful and in-depth discussion between the Community institutions and national and regional governments. The AIR group Regions are Lombardia, Piemonte, Veneto, Emilia-Romagna, Catalunya, Comunidad de Madrid, Dutch Provinces, Steiermark. Among the Air group Regions, there are the regions of the Po Valley in Northern Italy.

FEASIBILITY

What does it mean a reduction of 80% of SOX, NOX, PM, NH3 and NMVOC emissions?

According to a study of the Environmental Protection Agency of Lombardia, in Po Valley that reduction **is not possible with only technical measures, but it is also necessary a drastic reduction of activities**, such as:

- Removing 75% of vehicles and replacing the remaining 25% vehicles with zero emissions vehicles
- PLUS Removing 75% of methane domestic heating systems and 100% of biomass domestic heating systems
- PLUS Removing 60% of pigs and cattle and applying BAT on the remaining 40% (livestock stabling, coverage of manure storages and management of manure spreading)
- PLUS Removing 75% of industrial activities

Air Pollution in Italy, 2019

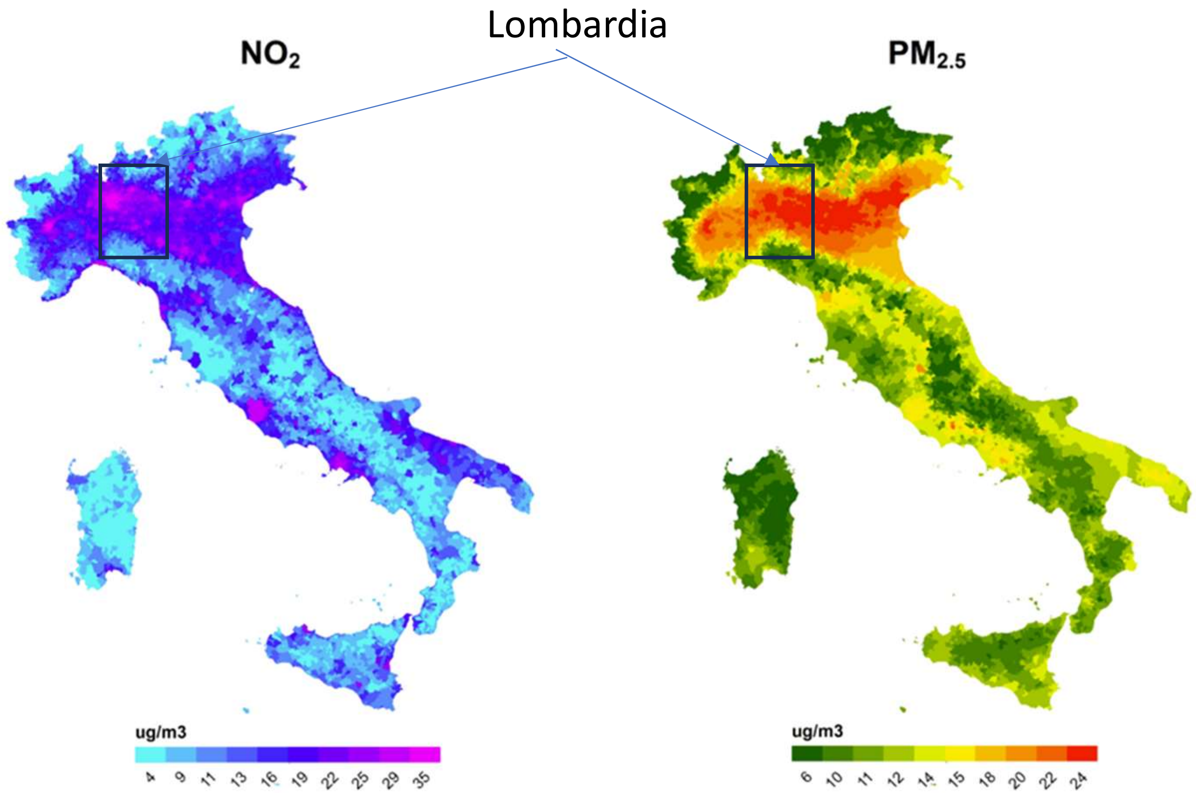
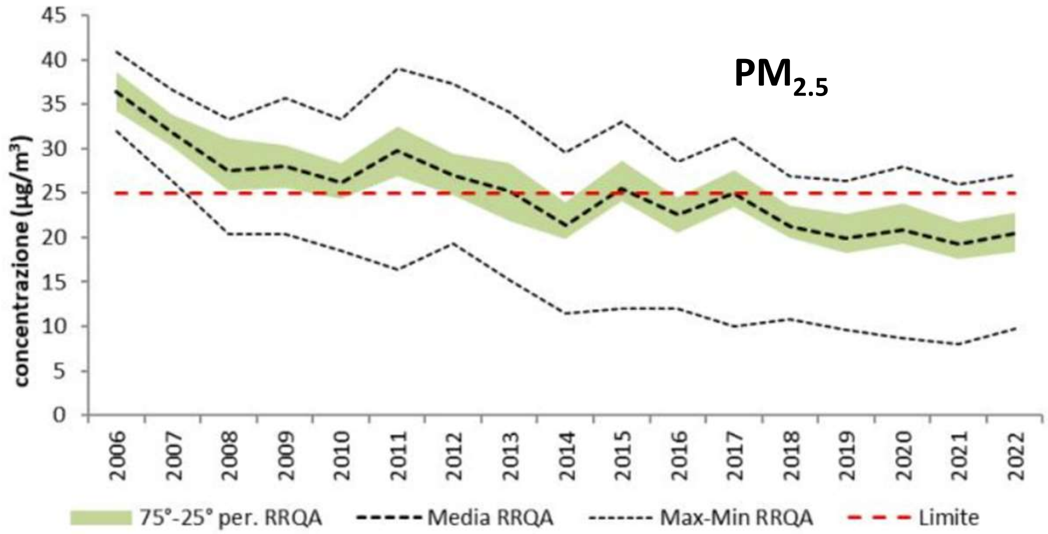


Figure 1. Annual average concentrations of PM$_{2.5}$ and NO$_2$. Italy, 2016-2019.
Figura 1. Media annuale delle concentrazioni di PM$_{2.5}$ e NO$_2$. Italia, 2016-2019.

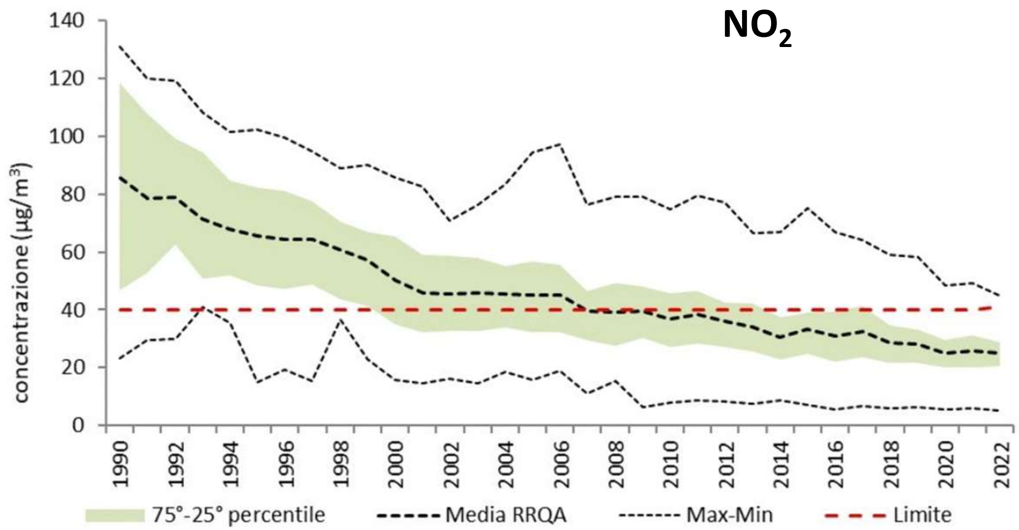
Stafoggia et al. Health impact of air pollution and air temperature in Italy: evidence for policy actions. Epidemiologia & Prevenzione, 2023

Model data using
- 500 monitoring stations
- Satellite-based data on Aerosol Optical Depth (AOD)
- Spatio-temporal data on land use

Time trends of PM2.5 and NO2 in the Lombardia Region



PM2.5- Trend delle medie annue in Regione Lombardia



NO2- Trend delle medie annue in Regione Lombardia

Ara Lombardia: Bilancio Qualità dell'Aria, 2022

Annual means for 2022, PrepAir

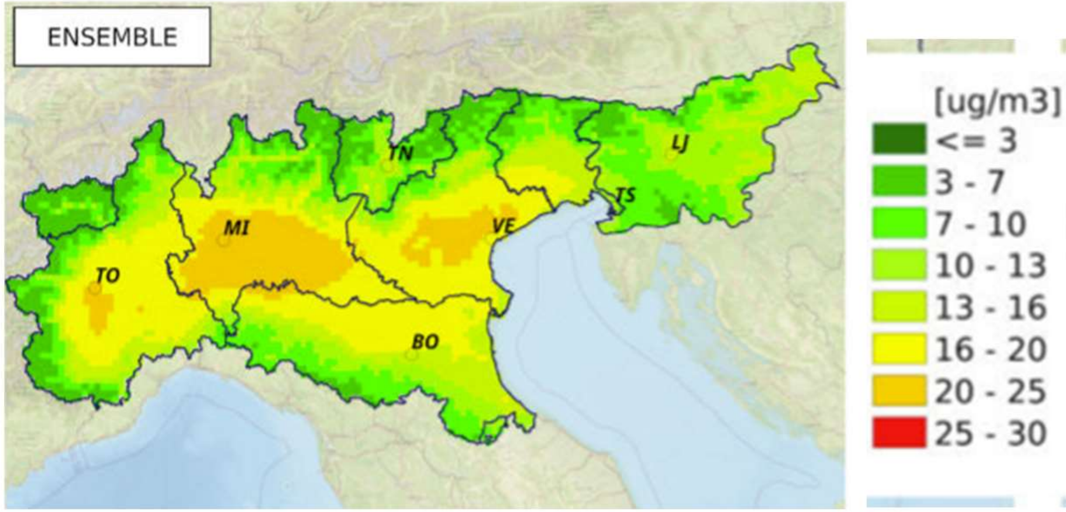
With the contribution of the LIFE Programme of the European Union

LIFE 15 IPE IT 013

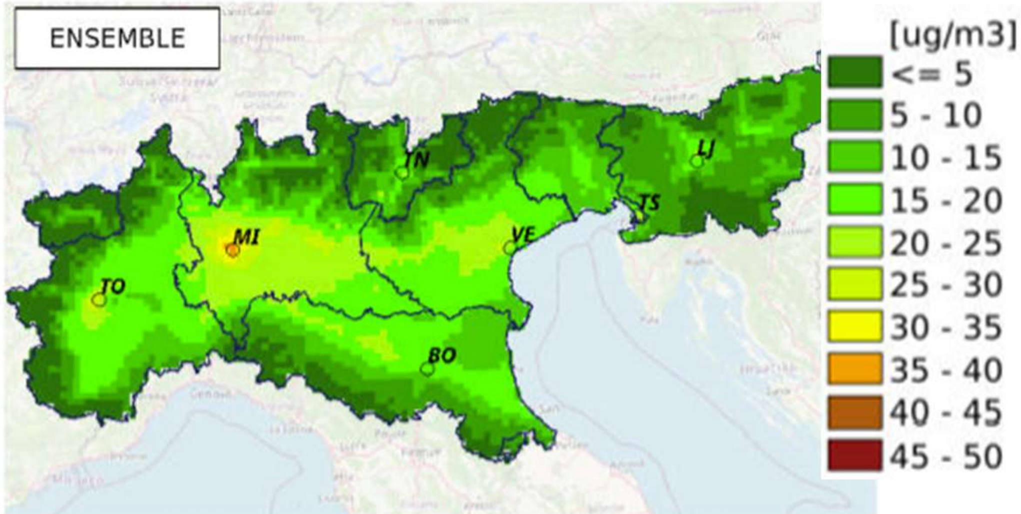
prepAIR

Po Regions Engaged to Policies of Air

AIR QUALITY ASSESSMENT 2022



PM25, 2022 annual mean



NO2, 2022 annual mean

The main reasons for air pollution in the Po Valley

- Recent studies conducted as part of the Life-Prepair project confirm that three factors are responsible for fine particle pollution in the Po Valley:
- - the combustion of fossil fuels for heating (especially wood and pellets),
- - road transport (with emissions of NOx, precursors of particulate matter),
- - agriculture and intensive livestock farming (emissions of ammonia, precursors of particulate matter).

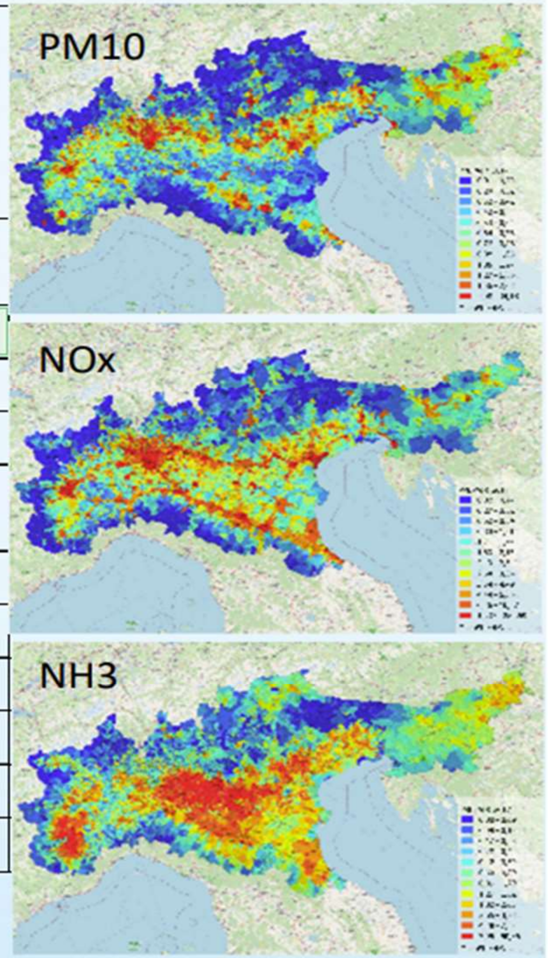
Atmospheric Emission Sources in the Po-Basin from the LIFE-IP PREPAIR Project

Alessandro Marongiu*, Elisabetta Angelino, Marco Moretti, Giulia Malvestiti, Giuseppe Fossati

Environmental Protection Agency of Lombardia Region, Air Quality Modeling and Inventory Unit, Monitoring Sector ARPA, Milano, Italy
Email: *a.marongiu@arpalombardia.it

Emissions share on year 2017 for Po-Basin

Macrosectors	NH3	NMVOC	NMVOC without mac 10 and 11	NOx	PM10
1-Combustion in energy and transformation industries	0%	0%	0%	7%	1%
2-Non-industrial combustion plants	1%	5%	11%	11%	56%
3-Combustion in manufacturing industry	0%	1%	2%	15%	4%
4-Production processes	0%	4%	10%	3%	3%
5-Extraction and distribution of fossil fuels and geothermal energy	0%	3%	6%	0%	0%
6-Solvent and other product use	0%	23%	55%	0%	3%
7-Road transport	1%	6%	13%	48%	19%
8-Other mobile sources and machinery	0%	1%	2%	14%	3%
9-Waste treatment and disposal	1%	0%	0%	1%	0%
10-Agriculture	97%	24%		1%	5%
11-Other sources and sinks	0%	34%		0%	5%



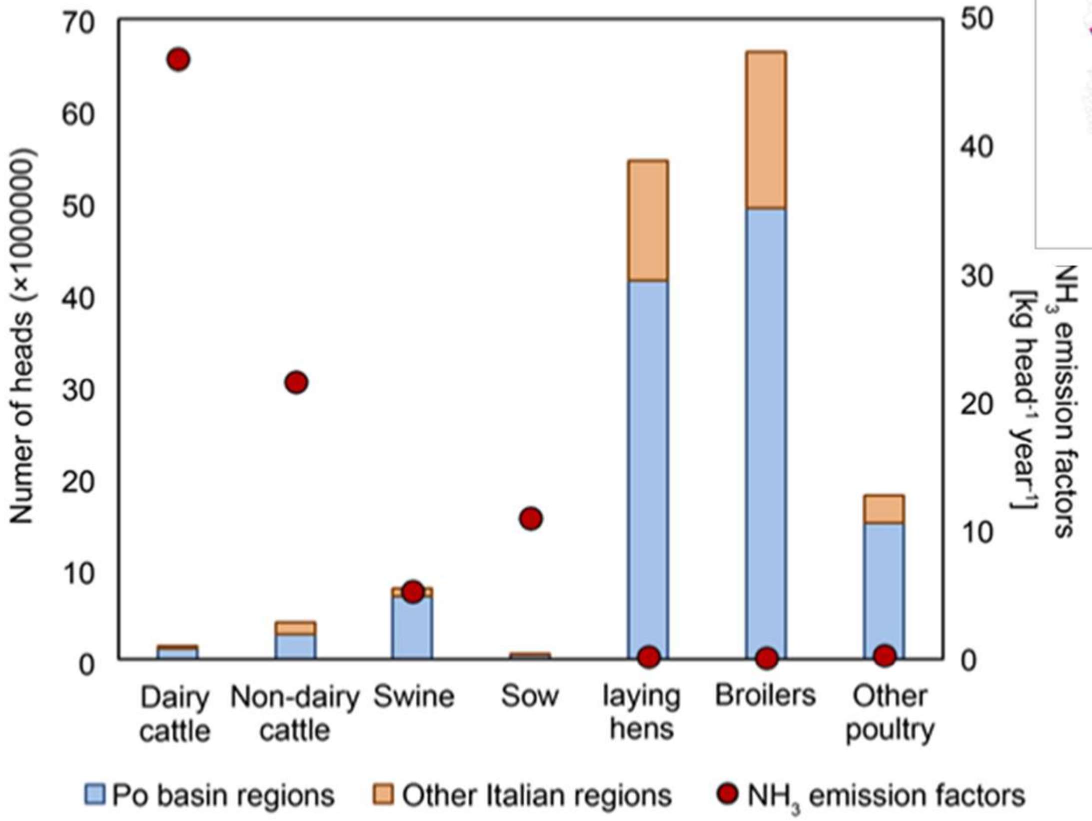
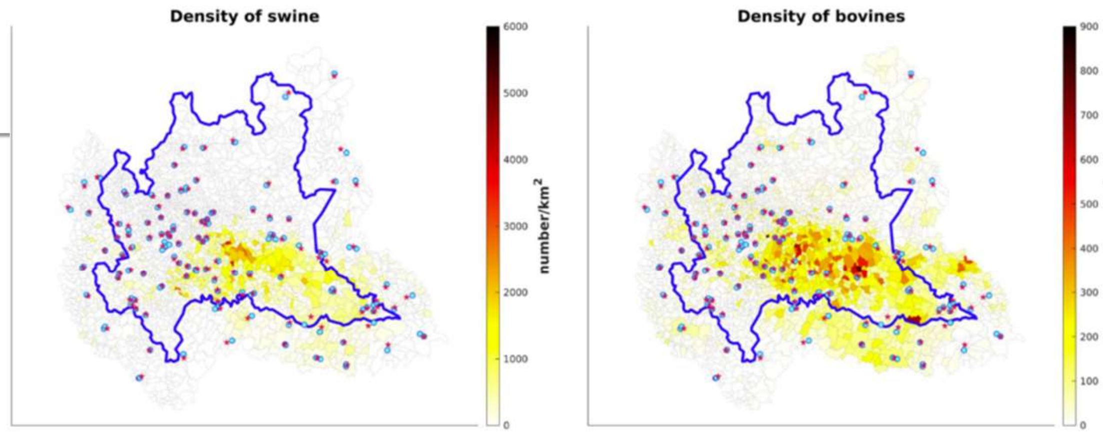
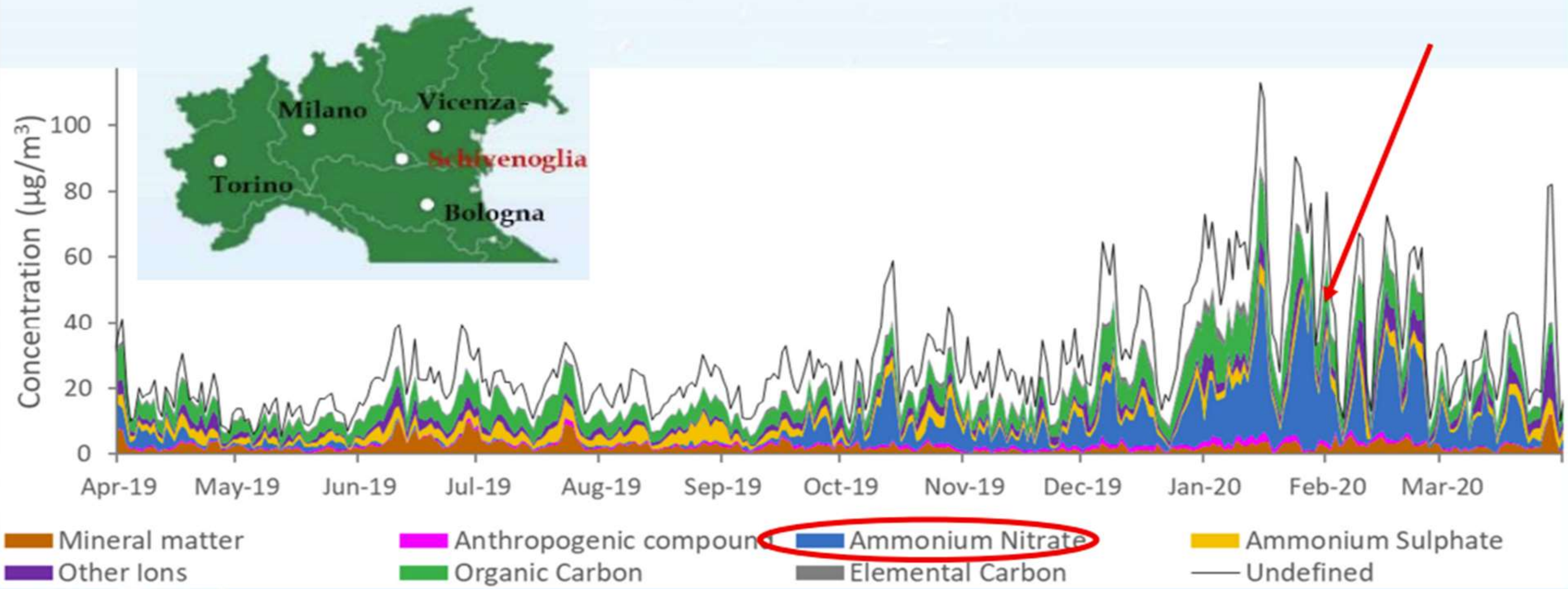


Figure 3. Number of heads for the main animal categories present in the Po basin regions and in other Italian regions and relative emission factor.



INHALE (Impact on humaN Health of Agriculture and Livestock Emissions),

PM10 composition - average for Po-Basin



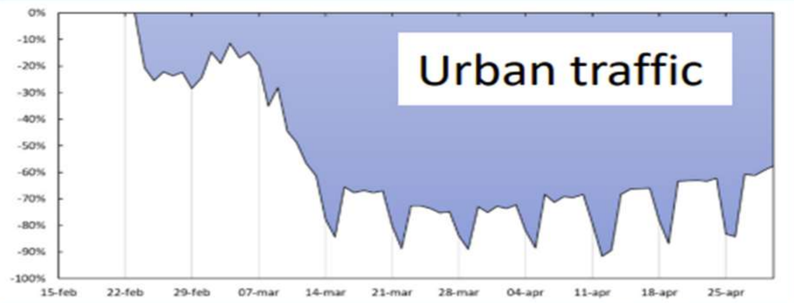
During high pollution episodes, secondary inorganic aerosol can represent 40% - 50% of the total PM10 concentration (average on the basin) and even more of PM2.5

Report Life Prepair : ACTION D6: Monitoring the environmental effects of pollutants reduction measures implemented by air quality improvement plans

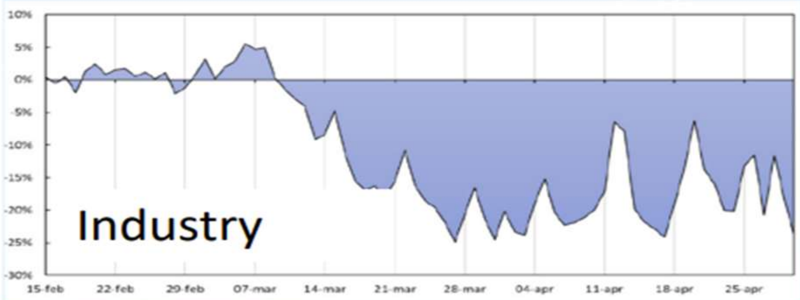
The effects of «lockdown» - emissions
The lesson learned

LIFE 15 IPE IT 013

prepAIR



TRAFFIC:
Urban: -80 – 90%
Highways:-60%
Flights: > -90%



INDUSTRY: -20 -30 %

(from Energy Consumption: Terna https://www.terna.it/it/sistema elettrico/transparency-report/total-load
Natural gas in industry: SNAM https://www.snam.it/it/trasporto/dati-operativibusiness/2_Andamento_dal_2005/?formindex=1&archive_year=2020

HEATING:
Domestic: +3% +6%
Commercial: -70% -80%

AGRICULTURE
-1%

Report VALUTAZIONE EMISSIVA E MODELLISTICA DI IMPATTO SULLA QUALITÀ DELL'ARIA DURANTE L'EMERGENZA COVID-19 periodo febbraio-maggio

The effects of «lockdown» - emissions
The lesson learned

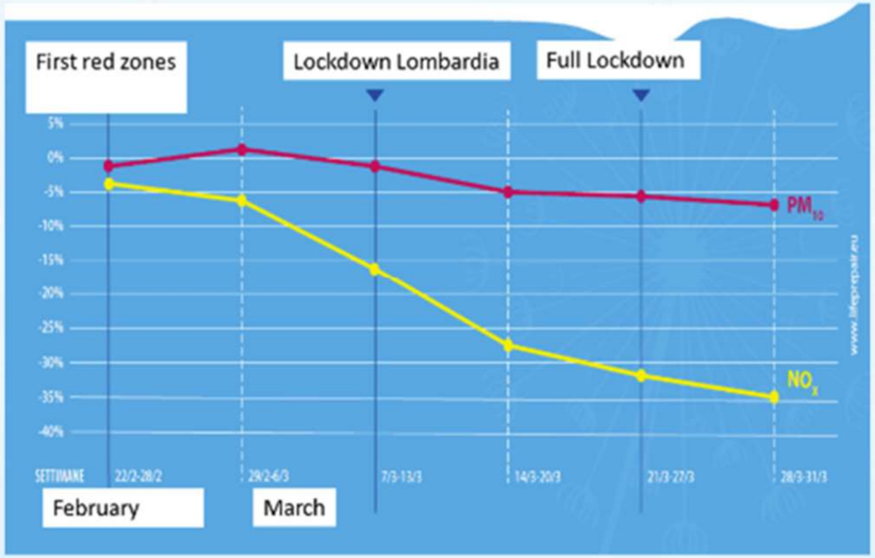
LIFE 15 IPE IT 013

The reduction **<u>of emissions</u>** in the stricter lockdown phase was estimated in:

Around 30% – 40% for NOx

Around -7% - 14% for primary PM10

Ammonia emissions are not substantially reduced



Report Life Prepair Covid-19 -Studio preliminare degli effetti delle misure Covid-19 sulle emissioni in atmosfera e sulla qualità dell'aria nel bacino padano – giugno 2020 Action D1, A3, C1

Measures to be taken

- Reducing emissions of these pollutants is possible immediately through the following radical measures:
  1. **Modification of transport modes** through intensification of public transport, radical changes in urban layouts, sustainable transport (walking, cycling, pedestrian home-school and home-work routes, restricted traffic zones, school roads, etc.), rapid transition to less polluting means of transport for people and goods;
- 2. **Replacement of wood and gas heating** systems with sustainable methods;
- 3. Technological solutions for **reducing ammonia emissions** in agriculture and livestock farming, reducing the protein component of animal diets, reducing meat consumption

Quantifying the mortality due to polluted air

Health impact of air pollution and air temperature in Italy: evidence for policy actions

Impatto sanitario dell'inquinamento atmosferico e della temperatura dell'aria in evidenze per azioni concrete

Massimo Stafoggia,[1] Francesca de' Donato,[1] Carla Ancona,[1] Andrea Ranzi,[2] Paola Michelozzi[1]
[1] Department of Epidemiology, Lazio Region Health Service, ASL Roma 1, Rome (Italy)
[2] Environmental Health Reference Centre, Regional Agency for Environmental Preven-tion of Emilia-Romagna, Modena (Italy)
Corresponding author: Francesca de' Donato; f.dedonato@deplazio.it

Cause-specific mortality	ICD-9 code	ICD-10 code	Age (years)	$PM_{2.5}$ RR	(95%CI)	NO_2 RR	(95%CI)
Natural	001-629; 677-799		30+	1.12	(1.06-1.18)	1.04	(1.03-1.06)
Cardiovascular	390-459	I	30+	1.11	(1.09-1.14)	–	–
Respiratory	460-519	J	30+	1.10	(1.03-1.18)	1.03	(1.01-1.05)

Table 1. Association between exposure to $PM_{2.5}$ and NO_2 and mortality from existing literature:* relative risk and 95%CI for increments of 10 μg/m³.

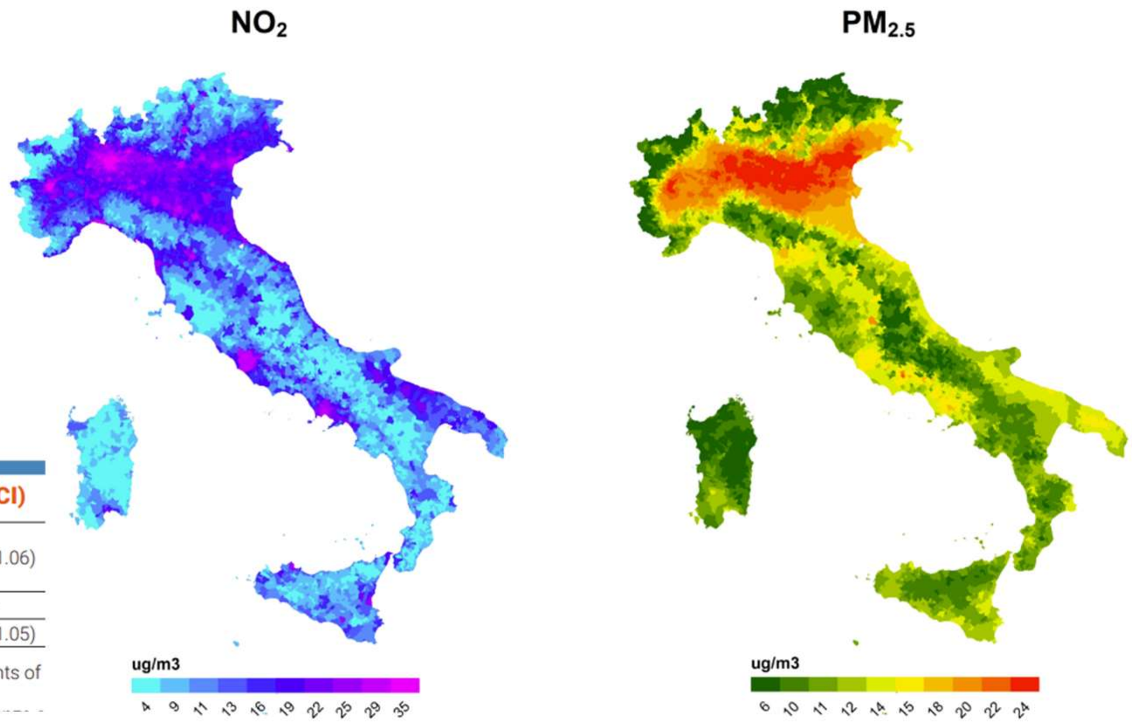


Figure 1. Annual average concentrations of $PM_{2.5}$ and NO_2. Italy, 2016-2019.
Figura 1. Media annuale delle concentrazioni di $PM_{2.5}$ e NO_2. Italia, 2016-2019.

The $PM_{2.5}$ burden of mortality in Italy in 2019 (annual data)

Area	Population 30+ years	Weighted Exposure	Threshold: 5 µg/m³		
	No.	µg/m³	AD	(95%CI)	AF (%)
Natural causes					
Italy	42,952,673	16.5	72,083	(38,974-102,888)	11.7
North	20,095,926	20.2	43,931	(23,932-62,247)	15.2
Central	8,664,082	14.2	12,137	(6,501-17,482)	9.6
South	14,192,665	12.6	16,014	(8,542-23,159)	8.0
Po Valley	17,204,657	21.2	39,628	(21,626-56,052)	16.3
6 largest cities	5,242,576	18.1	10,336	(5,388-14,752)	13.6
Cardiovascular diseases					
Italy	42,952,673	16.5	24,038	(20,079-29,680)	3.9
North	20,095,926	20.2	14,076	(11,790-17,312)	4.9
Central	8,664,082	14.2	4,139	(3,447-5,133)	3.3
South	14,192,665	12.6	5,822	(4,842-7,235)	2.9
Respiratory diseases					
Italy	42,952,673	16.5	4,638	(1,502-7,701)	0.7
North	20,095,926	20.2	2,901	(948-4,772)	1.0
Central	8,664,082	14.2	799	(256-1,344)	0.6
South	14,192,665	12.6	938	(298-1,585)	0.5

Table 3. Annual deaths (AD) and fractions (AF) attributable to long-term exposure to $PM_{2.5}$ exceeding WHO AQGs, Italy (2016-2019): results for the entire country, for geographic macroareas, and for the 6 largest metropolitan areas.

Conclusions

- Reducing pollutant emissions, and thus environmental concentrations of air pollutants, is an integral part of climate policy and has profound immediate health implications.

- The main emissions in Po Valley are traffic, fossil fuels burning and intensive livestock.

- The Po Valley has the most significant burden of air pollution attributable mortality and morbidity in Italy