DEP Lazio
Dipartimento di Epidemiologia
Servizio Sanitario Regionale
Regione Lazio

SISTEMA SANITARIO REGIONALE
ASL ROMA 1

REGIONE LAZIO

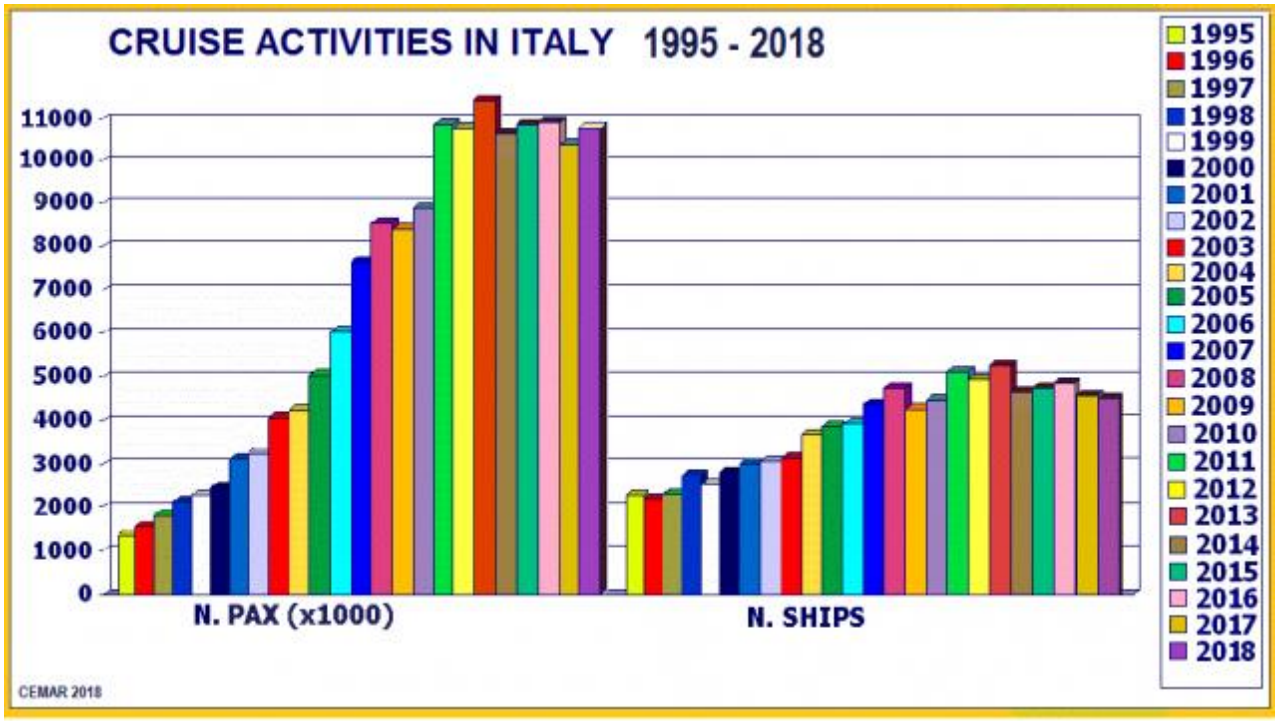
Air pollution from ships and its impact on health

Carla Ancona

Mediterranean Shipping Conference
Paris, May, 15th 2018

Italy is the first European market for cruise traffic, with 10.4 million passengers in 2017 and an average annual growth rate of 8% between 2005 and 2017.

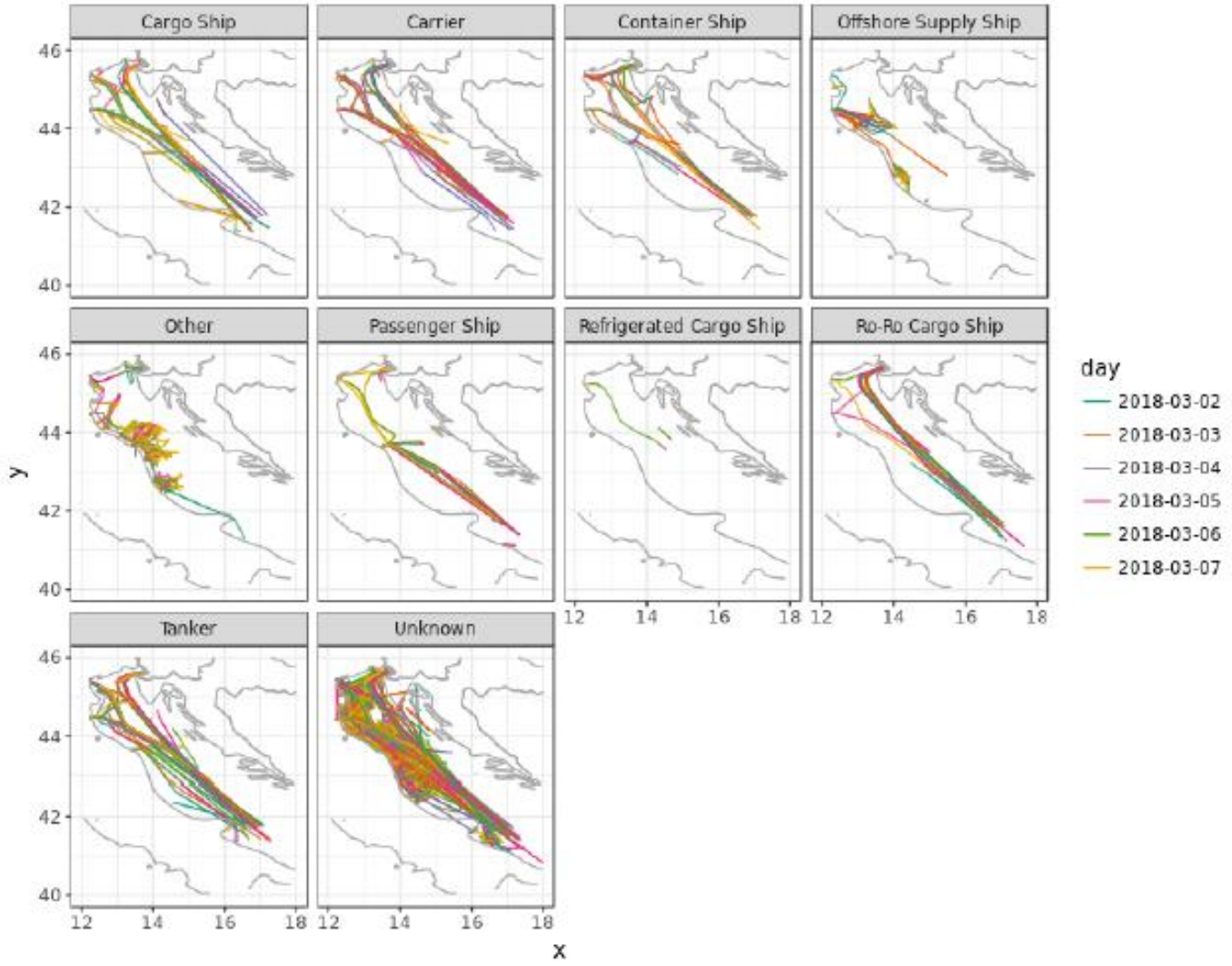
The first seven ports (Civitavecchia, Venice, Naples, Savona, Genoa, Livorno and Bari) handle almost 80% of passengers,



Cemar Agency Network

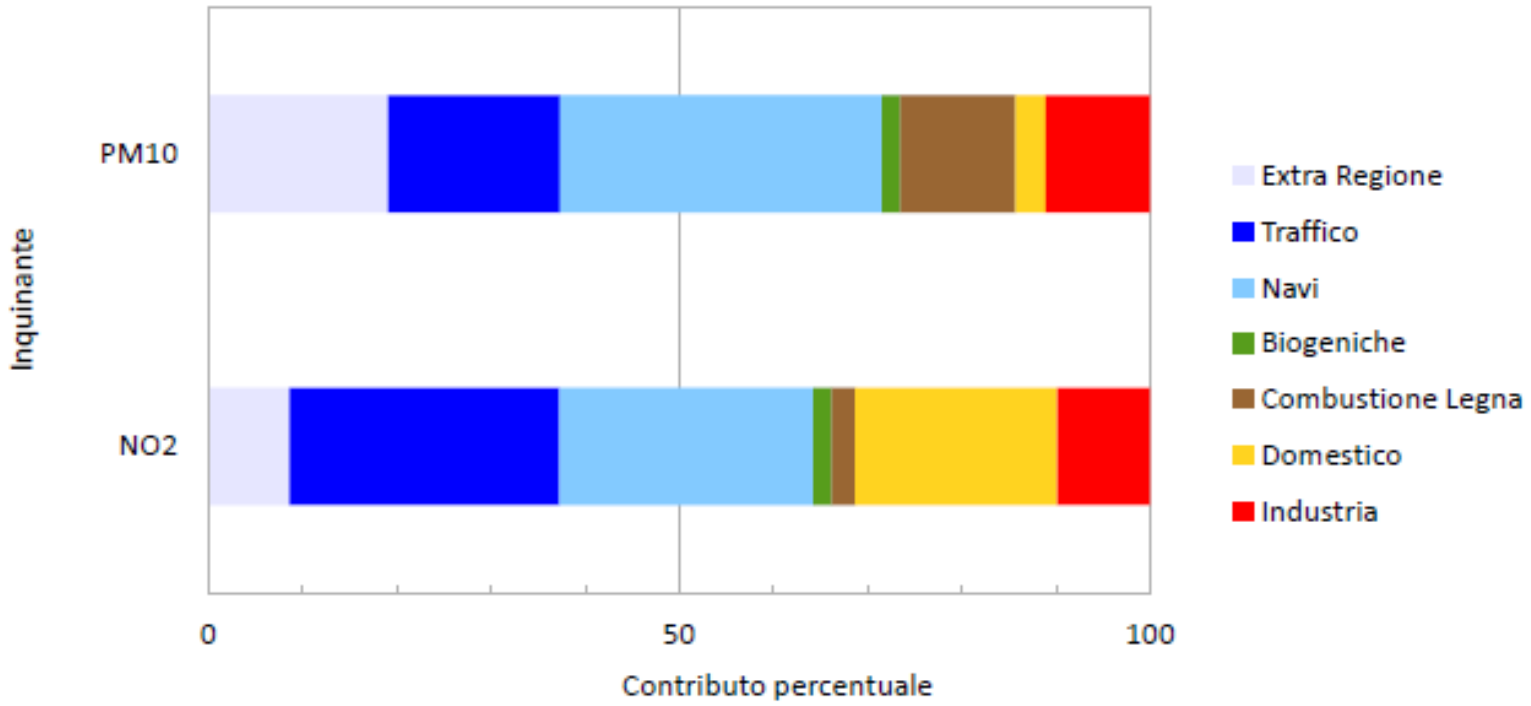
Real-time monitoring of ships in the Adriatic (SHAPe project - IPA Adriatic). Naval routes 2-7 March 2018

Source: Marchesi Environmental Agency FVG



Air quality in Trieste (north east Italy)

Source: Marchesi Environmental Agency FVG




CIVITAVECCHIA
MOBY

Location	
Country	Italy
Location	Civitavecchia, Metropolitan City of Rome
Details	
Wharfs	26
Statistics	
Annual container volume	64,387 TEU's (2014)[1]
Value of cargo	15,587,776 (2014)[1]
Passenger traffic	1,473,269 (2014)[1] 2,141,195 (2014)[1]
Website	
http://www.port-of-rome.org	

more than 500 cruises a year; half a dozen ferry lines carry passengers, cars, and freight to Sardinia, Sicily, and other points in the Mediterranean; economic effect of the cruise activities equal to 401.9 million euros

Background

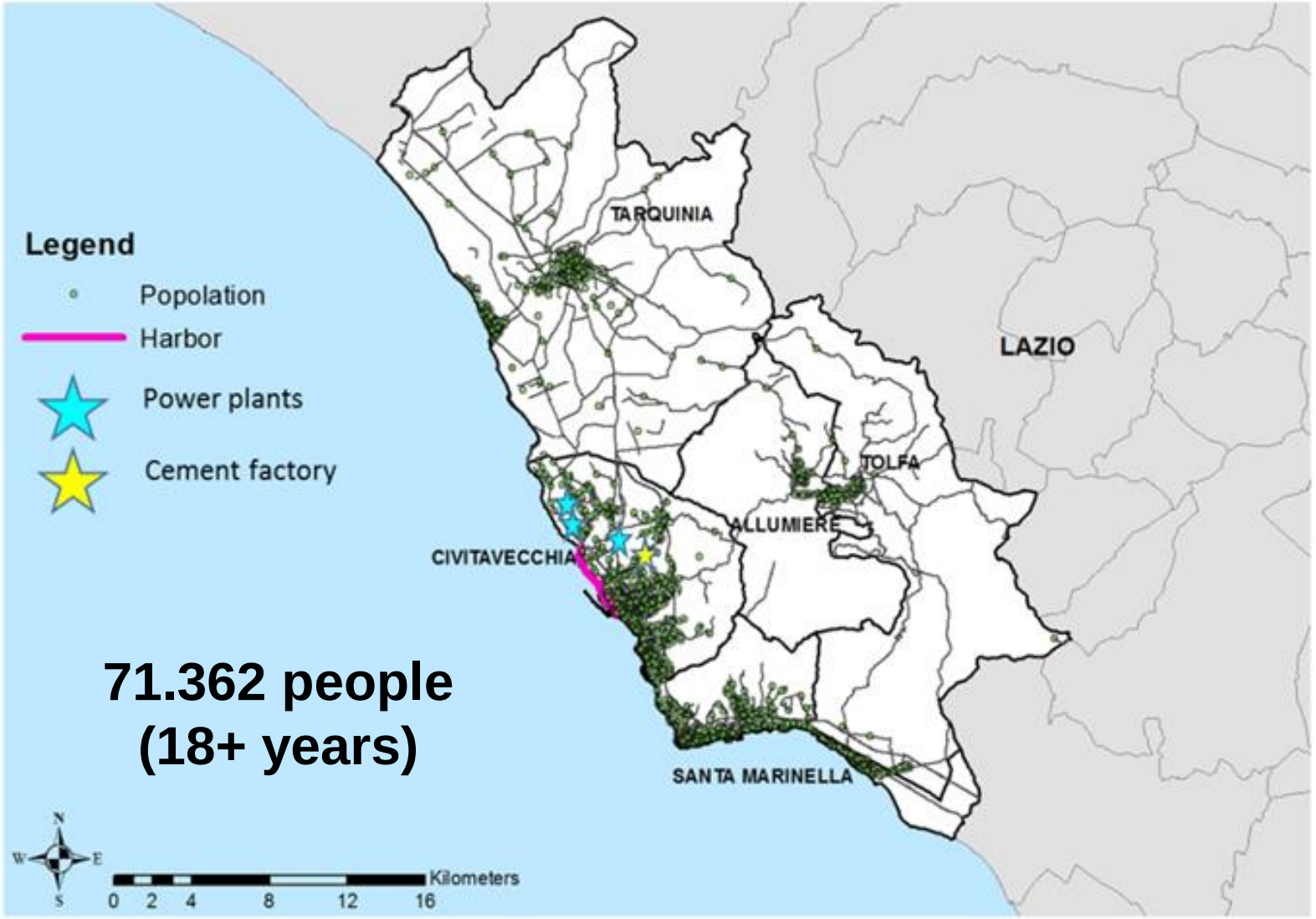
Epidemiological studies carried out in the Civitavecchia district showed high mortality and morbidity risk for lung cancer, mesothelioma and respiratory diseases both among workers and general population.

- **Harbor workers (Bonassi 1985)**
- **Electric power plant workers (Forastiere 1989)**
- **Seamen and ship workers (Rapiti 1992)**
- **Respiratory diseases in children (Forastiere 1992, 1994)**
- **Lung cancer case-control study (Fano, 2004)**

data about individual exposure to pollutants from the different sources were not available

Population

municipality registers

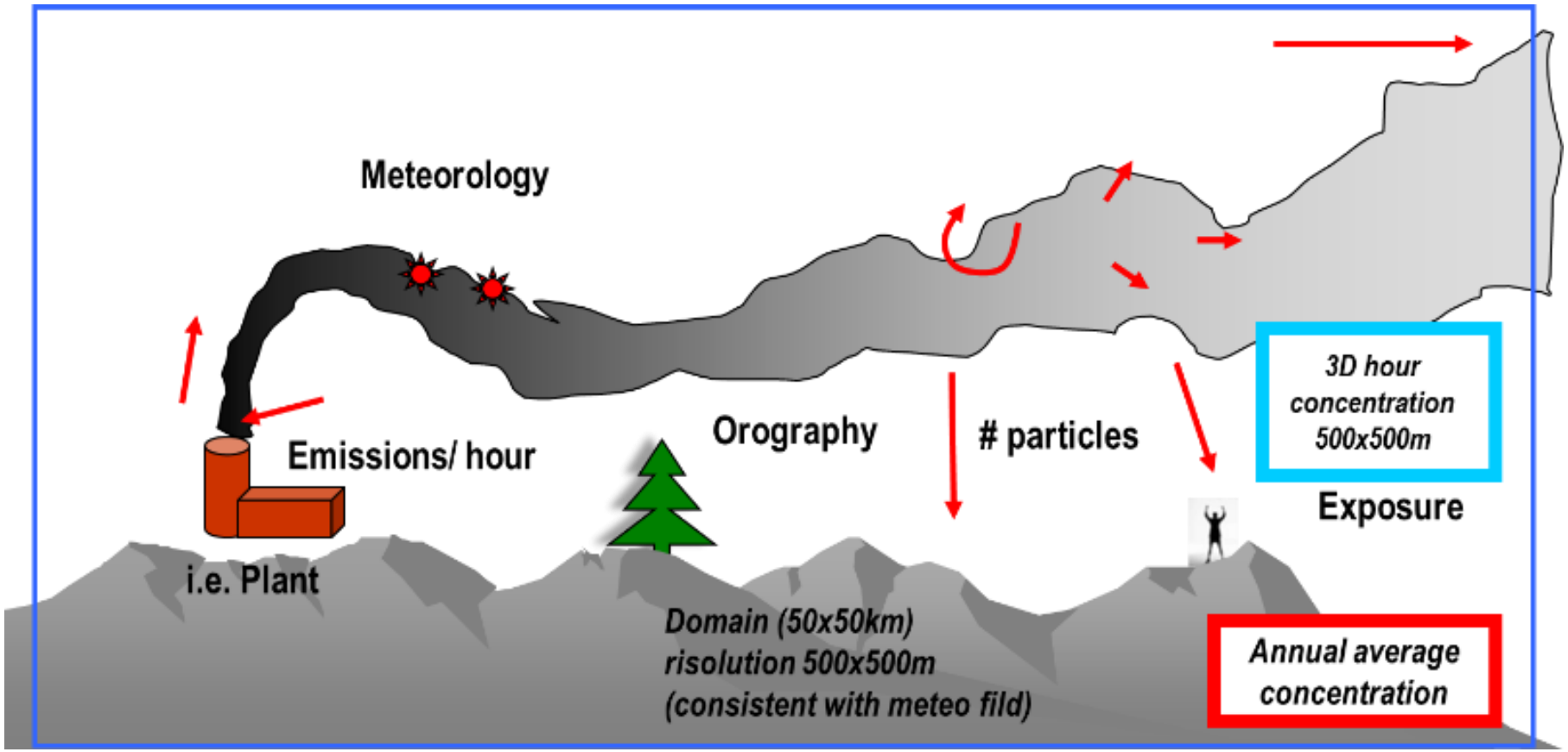


What is (and which was) the individual level of exposure of residents?

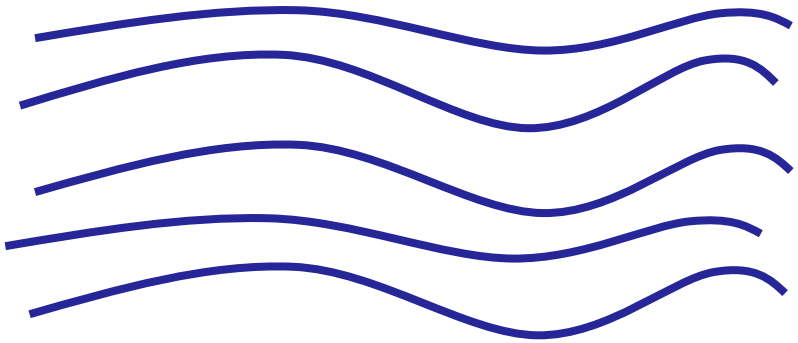
Is there an association between ships emissions and long-term effect on the health of residents?

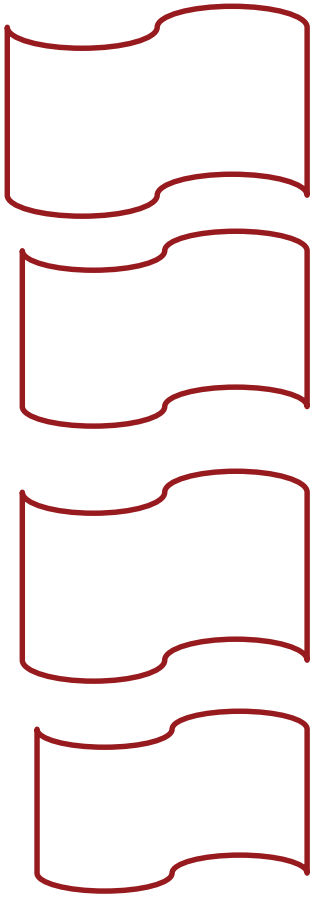
dispersion model

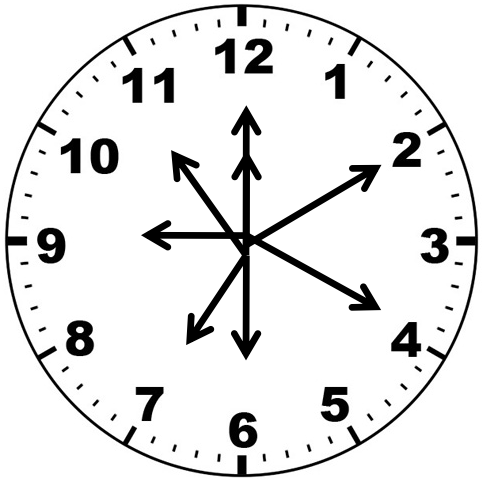
SPRAY



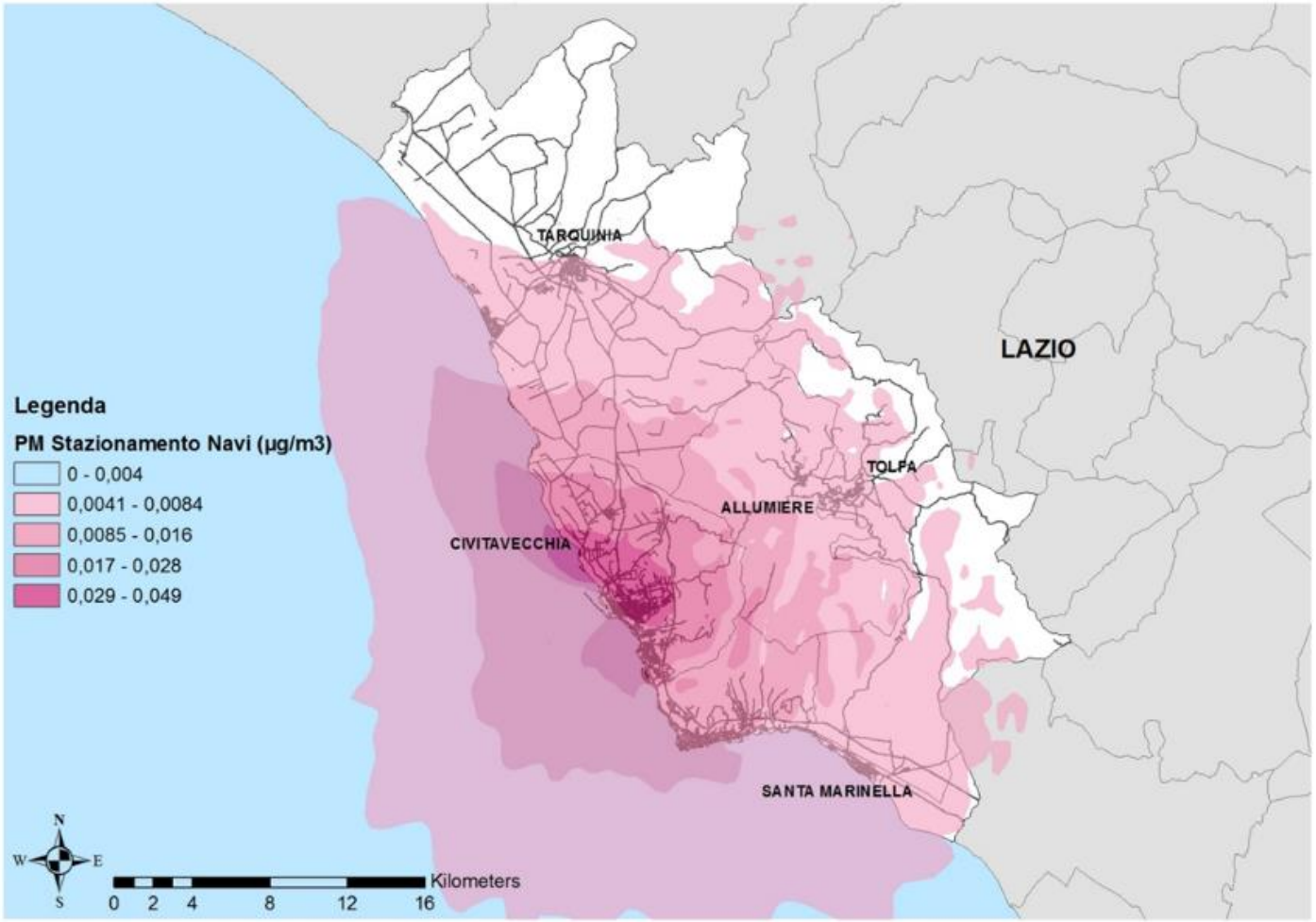
dispersion model





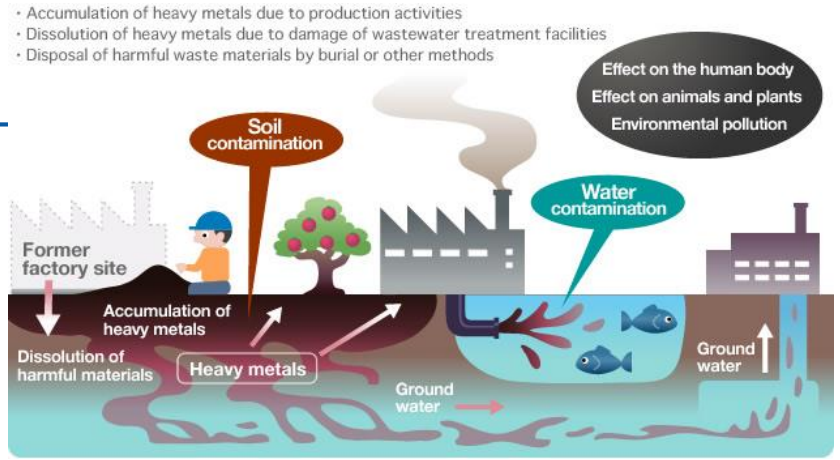


PM10 μg/m3 concentrations



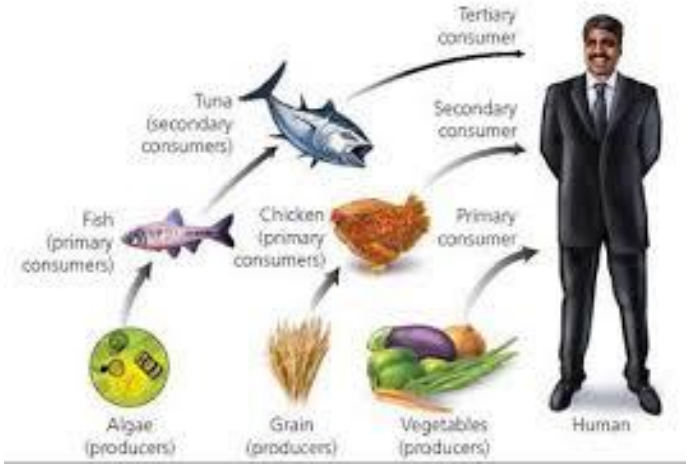
HBM

Biomonitoring the concentrations of metals in blood or in urine allows to assess the human contamination to environmental pollutants through all routes of exposure



Contamination of soil, plants and animals

Disease or not disease



Food chain

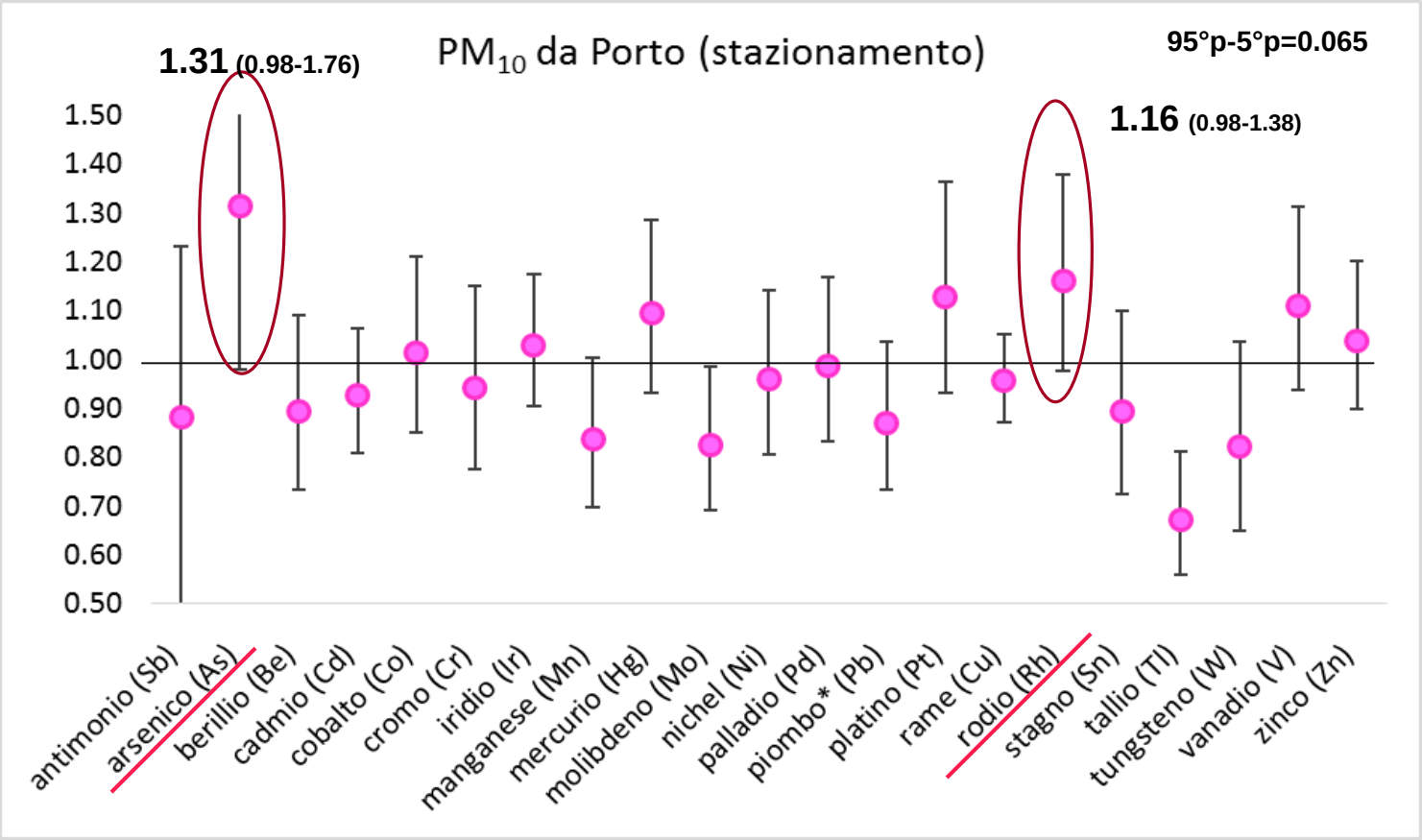
Human biomonitoring Study

Biomarcatore	NHANES* - USA	Revisione letteratura
Antimonio (Sb)	centrale a carbone	dieta; acqua
Arsenico (As)		centrale a carbone; porto; dieta; acqua
Berillio (Be)	combustione olio e carbone; fumo	fumo; dieta; acqua; rifiuti pericolosi
Cadmio (Cd)	combustione carbone e petrolio; fumo	centrale a carbone; porto; fumo
Cobalto (Co)	combustione carbone e petrolio; traffico	dieta (integratori)
Cromo (Cr)		centrali a carbone; porto; traffico; industria galvanica; fumo; dieta
Iridio (Ir)		traffico
Manganese (Mn)		porto; combustione; dieta
Mercurio (Hg)	combustione carbone; dieta	centrale a carbone; dieta
Molibdeno (Mo)		centrale a carbone; acqua; dieta
Nichel (Ni)		combustione carbone; porto; traffico; combustione; fumo; dieta; bigiotteria; detergenti
Palladio (Pd)	traffico	traffico
Piombo (Pb)	centrale a carbone	porto; dieta; acqua; bottiglie in pet ad alte temperature
Platino (Pt)		traffico
Rame (Cu)		centrale a carbone; porto; traffico
Rodio (Rh)		Traffico
Stagno (Sn)		combustione carbone e petrolio; consumo di prodotti in scatola
Tallio (Tl)	combustione del carbone	combustione carbone
Tungsteno (W)		combustione; cementificio; acqua
Vanadio (V)		porto; carburanti di origine fossile; dieta
Zinco (Zn)		combustione; traffico; dieta

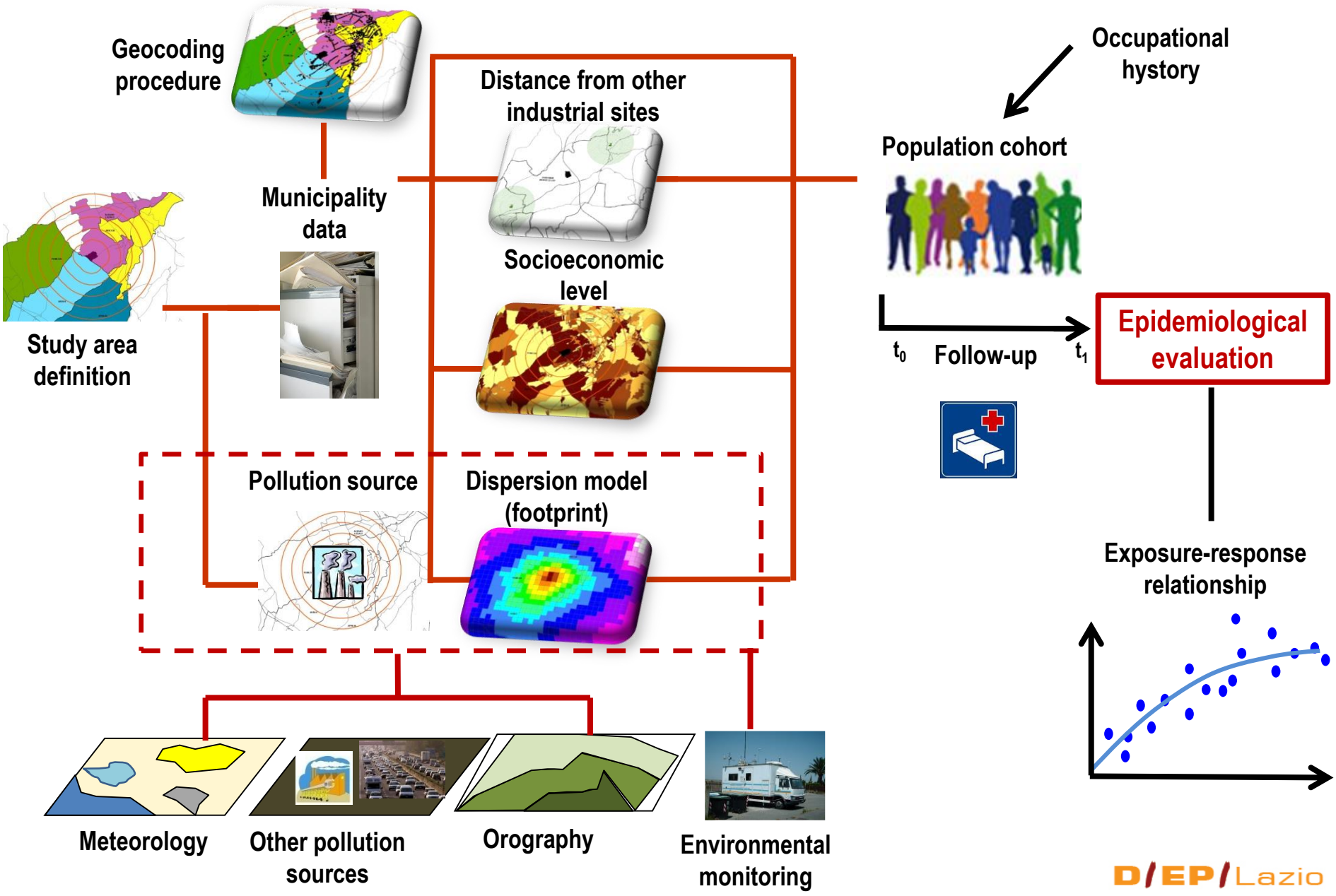
AMBIENTE
BIOMONITORAGGIO
CIVITAVECCHIA

A sample of 1200 residents (age 35-69) was randomly selected from the Municipal Register's data and their residence addresses were geocoded.

Association between PM_{10} frm the harbor and urinary concentration of heay metals



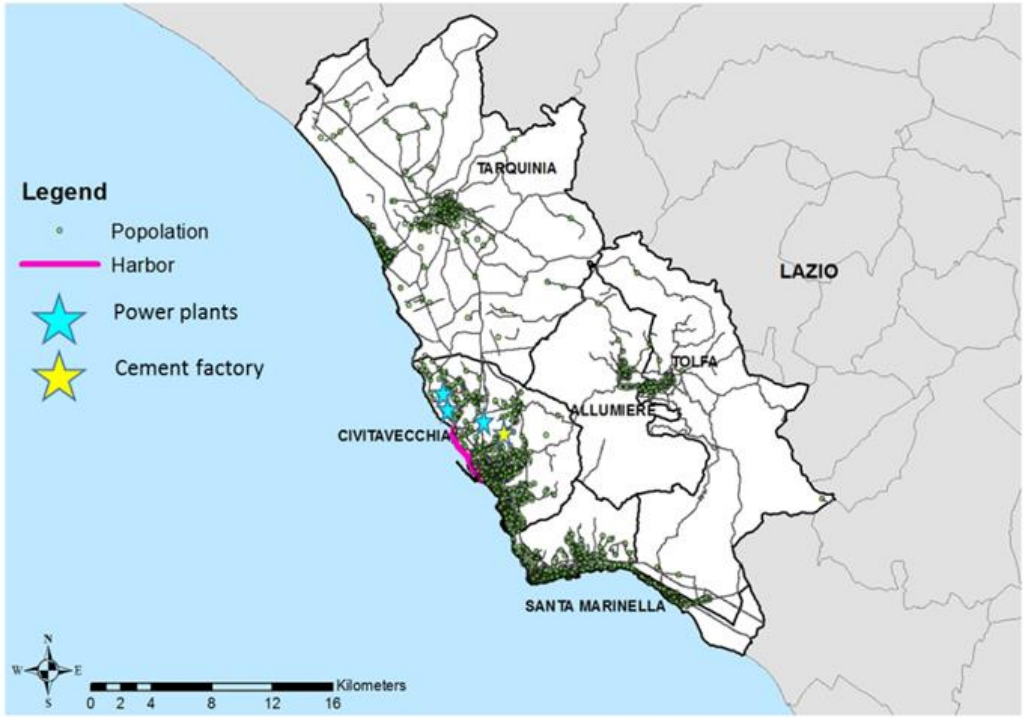
Study design – Long term effect



cohort approach

Residents at 01-01-1996
follow-up 31-12-2013

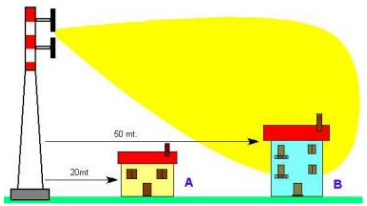
71.362 people
(18+ years)



OUTCOME

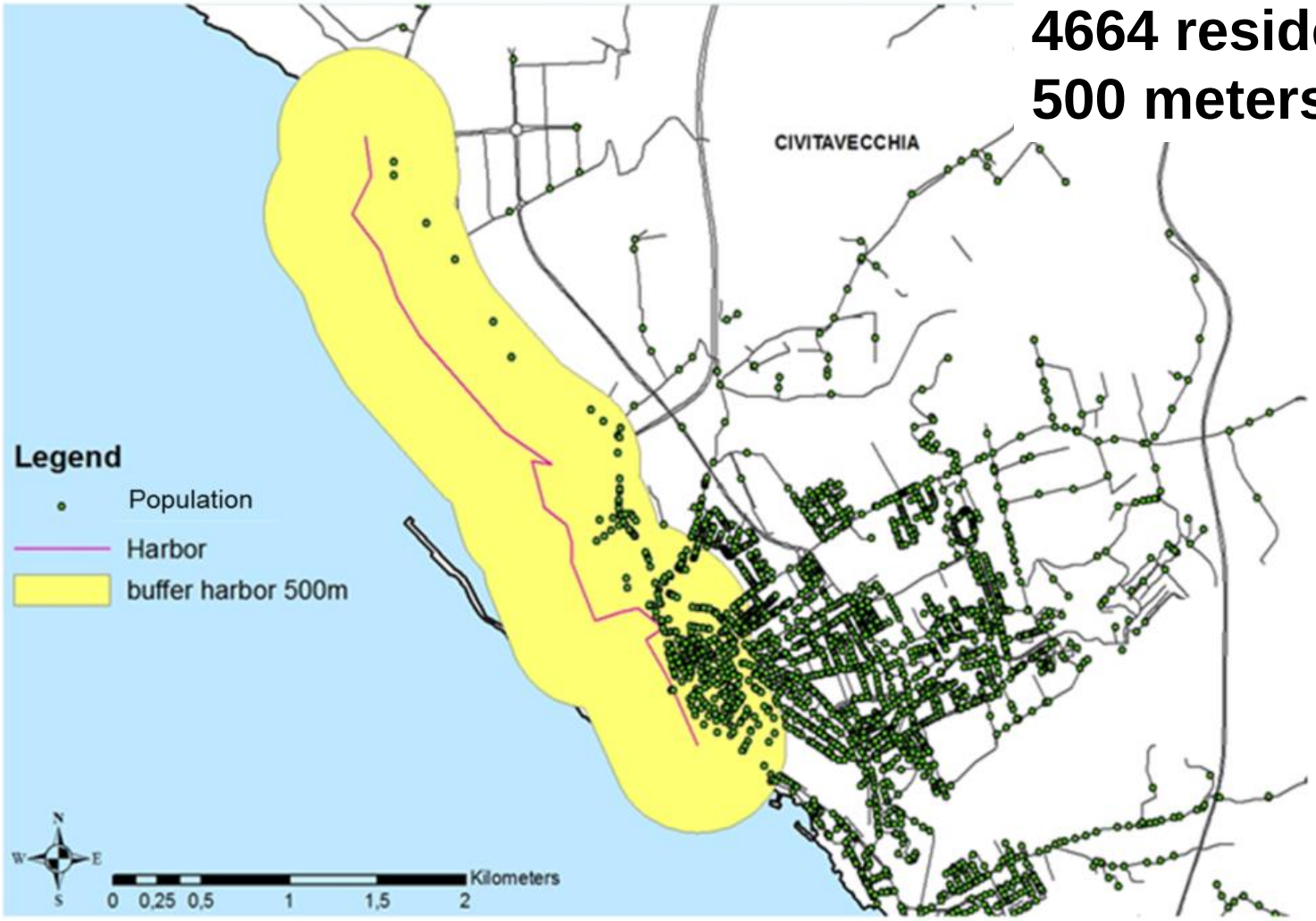
Mortality (1996-2013)

EXPOSURE



Distance from the harbour

≤ 500 m or >500 m



4664 residents < 500 meters

Association between living <500 m from the harbour and mortaity

	n	HR adj	95% CI
Natural mortality (001-799)	13,687	1.03	0.96 - 1.10
Malignant cancers (140-208)	4,427	1.11	0.99 - 1.25
Stomach (151)	294	1.39	0.89 - 2.17
Colon and rectum (153-154; 159)	585	1.09	0.79 - 1.50
Liver (155-156)	291	0.99	0.63 - 1.54
Pancreas (157)	240	1.05	0.65 - 1.68
Larynx (161)	38	0.34	0.04 - 2.59
Trachea, bronchus and lung (162)	1,046	1.31	1.04 - 1.66
Pleura (163)	29	0.61	0.14 - 2.63
Bladder (188)	181	1.11	0.62 - 1.98
Kidney (189)	103	0.29	0.09 - 0.95
Brain and other parts of CNS (191-192; 225)	92	0.84	0.35 - 2.02
Lymphatic and hematopoietic tissue (200-208)	368	1.08	0.73 - 1.61
Neurological diseases (330-349)	341	1.51	1.05 - 2.18
Cardiovascular diseases (390-459)	5,354	0.97	0.88 - 1.08
Respiratory diseases (460-519)	874	0.79	0.60 - 1.04
Digestive sistem diseases (520-579)	561	1.04	0.75 - 1.43
Renal diseases (580-599)	242	0.91	0.56 - 1.50

Discussion

- Effect of **diesel engine** on **lung cancer mortality**

Vermeulen R et al. Exposure-Response Estimates for Diesel Engine Exhaust and Lung Cancer Mortality Based on Data from Three Occupational Cohorts. Env Heal Perspect. 2014.

Moolgavkar SH et al.. Diesel engine exhaust and lung cancer mortality: time-related factors in exposure and risk. Risk Anal. 2005.

- traffic-related air pollution may negatively affect the **central nervous system** and contribute to central nervous system diseases

Costa LG et al. Neurotoxicants Are in the Air: Convergence of Human, Animal, and In Vitro Studies on the Effects of Air Pollution on the Brain. Biomed Res Int. 2014

Levesque S et al. Air pollution & the brain: Subchronic diesel exhaust exposure causes neuroinflammation and elevates early markers of neurodegenerative disease. J Neuroinflammation 2011.

- case-control study in Denmark found modeled NO_2 from traffic sources associated with **risk of Parkinson's disease**

Ritz B et al. Traffic-Related Air Pollution and Parkinson's Disease in Denmark: A Case-Control Study. Environ Health Perspect 2015.

Prevention

- Ship emissions reduction (# of ships, speed, fuel)
- Verification of compliance with regulations in the use of
- fuels by all ships and boats
- Control of the fumes emitted by the chimneys of the ships and others polluting sources with LIDAR (Light Detection and Ranging),
- Replacement of trucks and cranes powered by diesel engines
- environmental control
- epidemiological surveillance

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No CoI

c.ancona@deplazio.it

www.deplazio.net


PACIFIC EXPLORER
CAPTAIN COOK CRUISES

Civitavecchia

thermoelectric power plants

Coal

Gas/Oil

Coal/Oil

Cement factory

harbor

traffic

Tarquinia

Coastal deposits oil

biomass heating

Civitavecchia

Tolfa

Allumiere

Santa Marinella

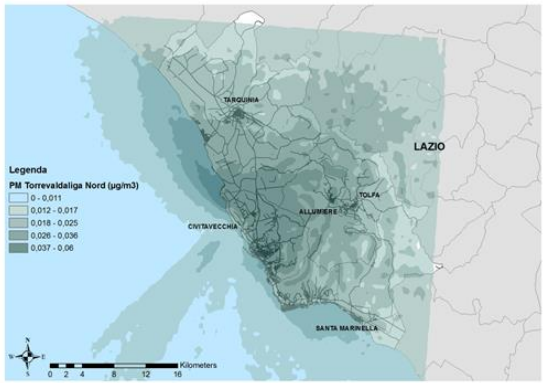
Civitavecchia

Rome

Modello di dispersione

PM_{10}

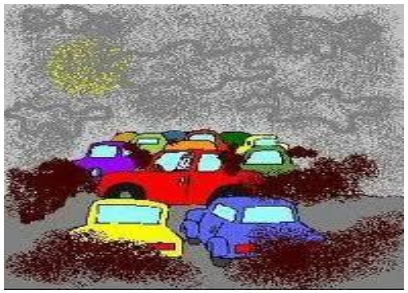
Centrale a carbone

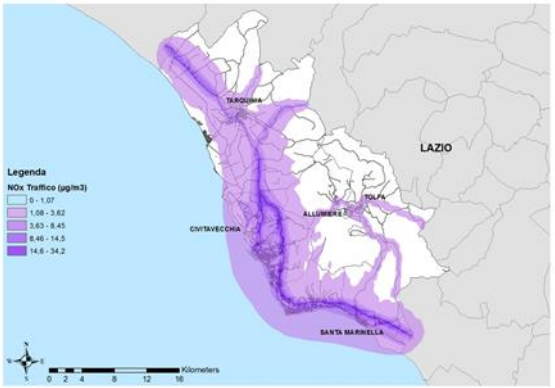


Modello di dispersione degli inquinanti – **Centrale Torrevaldaliga Nord** – PM_{10}

NO_x

Traffico (cars+trucks)

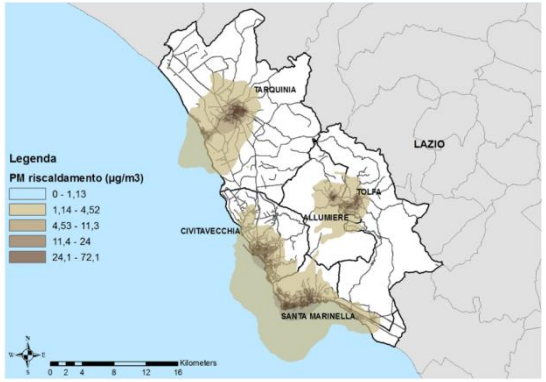




Modello di dispersione degli inquinanti – **Traffico stradale** – NOx µg/m^3

PM_{10}

Camini



Modello di dispersione degli inquinanti **Camini**: – PM_{10} µg/m^3

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