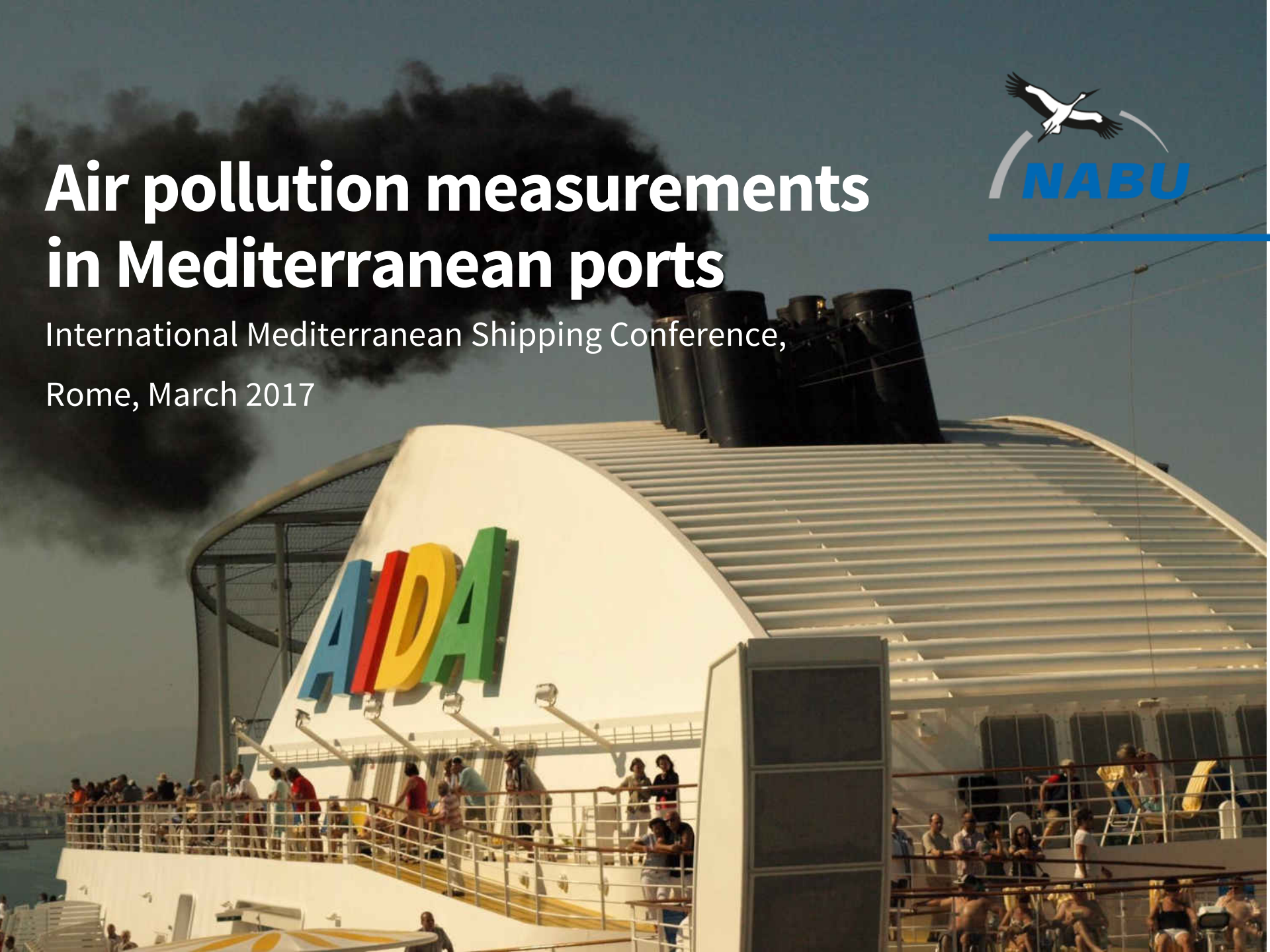


# Air pollution measurements in Mediterranean ports

International Mediterranean Shipping Conference,  
Rome, March 2017



# Who we are

- German Nature and Biodiversity Conservation Union
- member of Birdlife International
- 620,000 members and supporters
- 2,500 local groups and chapters



# Ultrafine particles - Health Effects

- EU COM: 50,000 people die prematurely every year due to shipping emissions in the EU (CEEH 2011)
- diesel exhaust is as carcinogenic as asbestos (WHO /IARC 2012)
- Exhaust gases from ships (HFO and MGO) and in particular BC are even worse for human lung cells than previously thought (Helmholtz Virtual Institute of Complex Molecular Systems in Environmental Health , HICE 2015)
- the smaller the worse. Ultrafine particles affect human health much more than PM2.5 and PM10 (Franck et al. 2011)
- German Lung and Pneumologists Associations recommends not to sit on aft deck when going on a cruise

# What's missing?

- Today's regulation only addresses particulate matter with a larger diameter of 2.5 and 10 micrometer (EU Ambient Air Quality Directive; NEC Directive)
- The much more important ultrafine which are referred to as particle number (PN) however are almost not addressed at all (only Euro 6/VI standards for cars, busses and trucks)
- accordingly, official measurement stations do not gather PN data as there is no legal demand

=> However, human health is massively affected by the ultrafine particles which therefore need to be tackled immediately

**...so in the absence of official data we conducted our own air pollution measurements with the help of Dr. Axel Friedrich...**





05.04.2017

Source: Iryna Lu

# Air pollution measurements in ports and at (cruise) terminals

- NABU measured concentrations of ultrafine particles next to cruise and container ships as well as at ferry terminals, in ports and on deck
- We found particle concentrations well above 500,000 ppt/ccm of air (maximum of the device)
- while cities' background concentrations are around 5,000 ppt/ccm
- clean air would be 1,000 -2,000. In coastal areas even lower
- note well: we are referring to particle number, not mass! As this is a much better indicator for health risks
- measurement device TSI P-Trak 8525 particle counter
- particle diameter between 20 nm and 1 micro meter

# Comparison background levels <> air pollution from ships in Hamburg

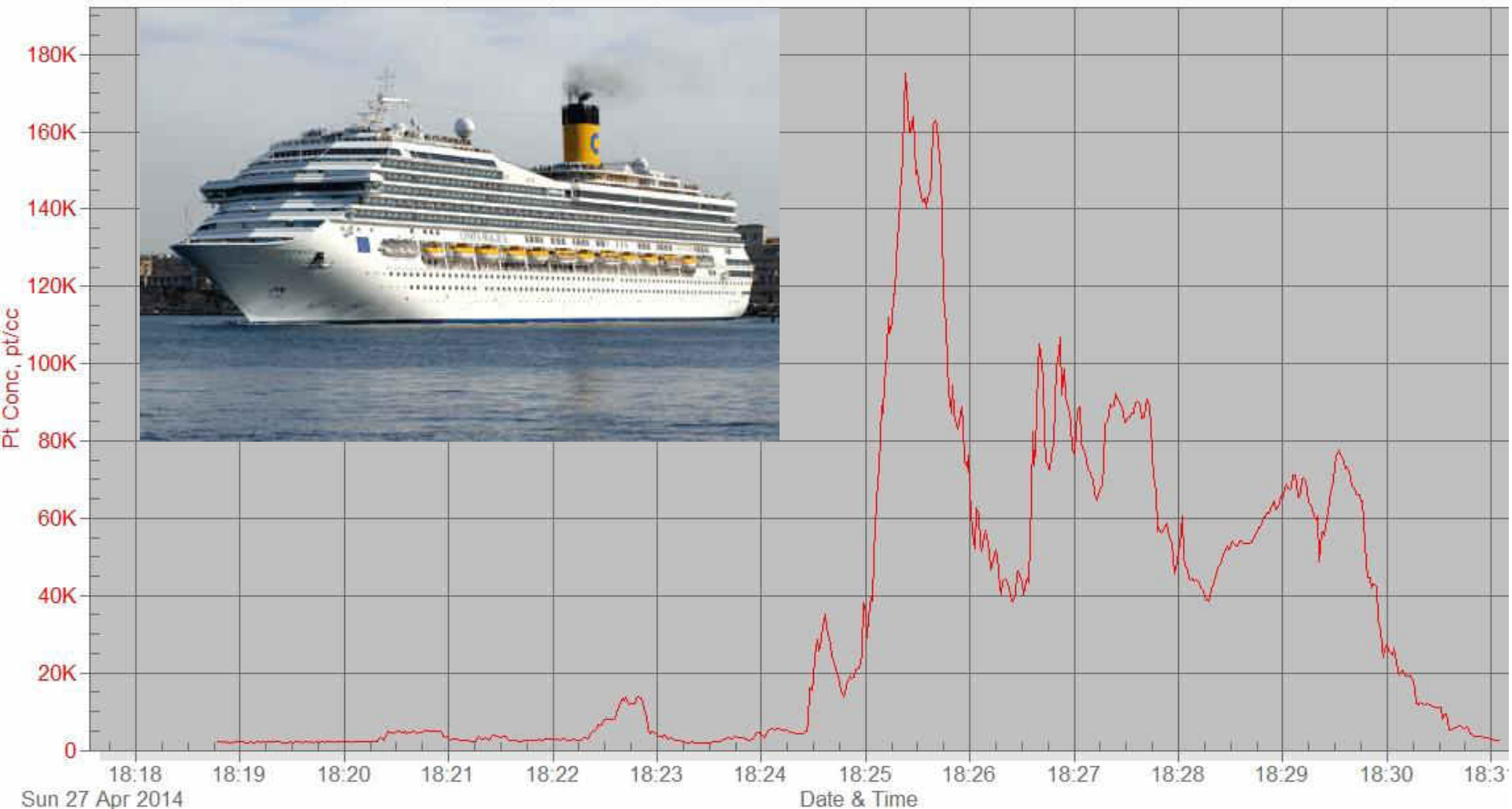
Particulate Concentration (PN), Hamburg in pt/cc, 14.05.2014





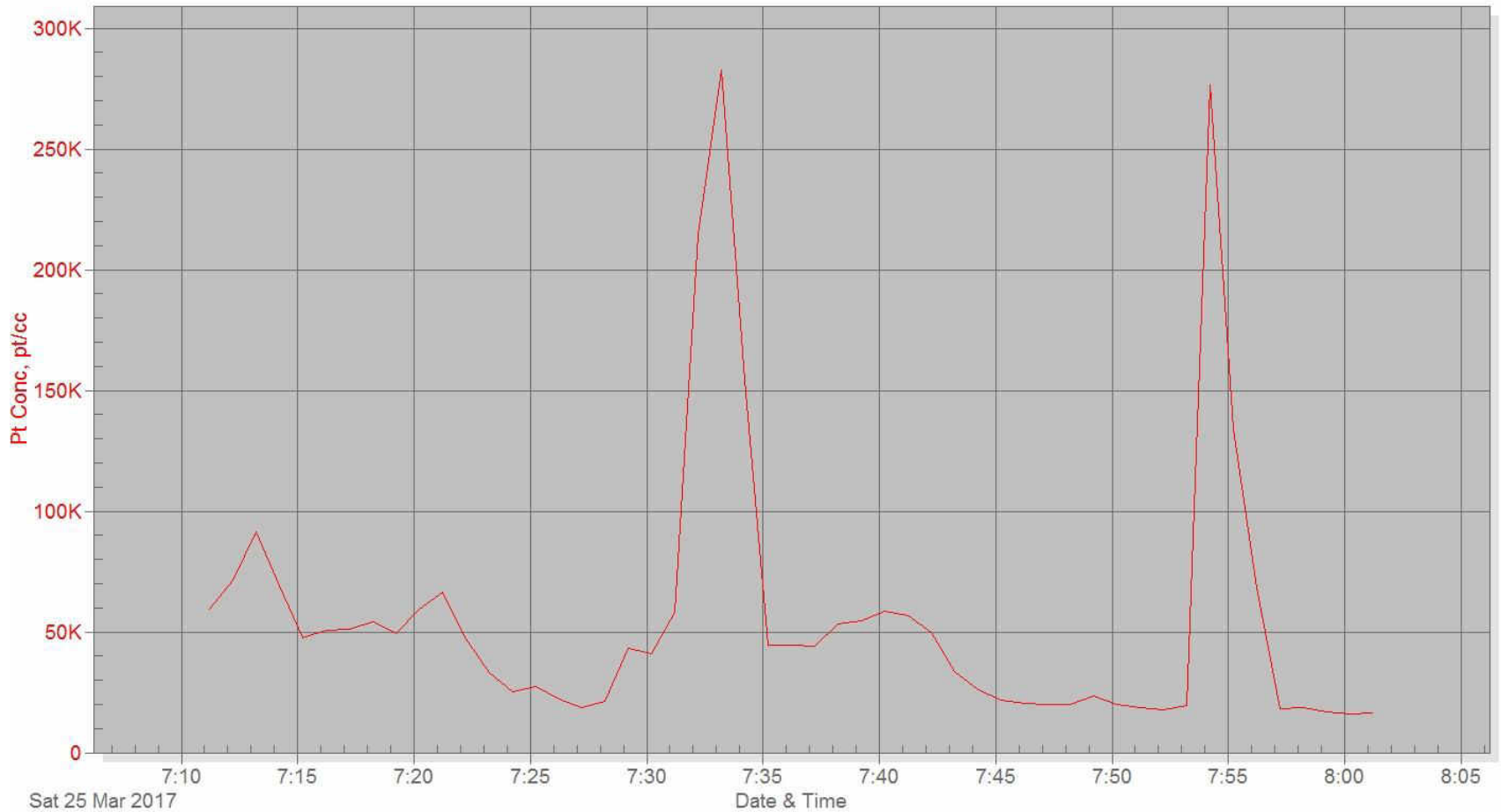
# Passing cruise ship in Venice, Sant' Elena

Costa\_Magica  
S\_Elena



# Civitavecchia

Hafenmessung\_Morgens  
Sub Title



# Air testings in major EU cruise tourism hot spots



# Why are ports affected?

- cruise ports are often located in the middle or next to the city center.
- Due to its massive energy consumption this is comparable to a small power plant without a filter
- example Hamburg: 19% of PM10 and 38% of NOx stem from port activities!
- More ships = more pollution (cruise ship industry boom)
- EU COM's infringement procedures against most MS





# Cruise ship emissions: Peanuts?



## LUFTSCHADSTOFFEMISSIONEN AIR POLLUTION

### Vergleich von Kreuzfahrtschiff und Pkw Comparison Cruise Ship and Car

EMISSIONEN PRO TAG EMISSIONS PER DAY	KREUZFARTSCHIFF CRUISE SHIP	PKW CAR	EIN KREUZFARTSCHIFF ENTSpricht ONE CRUISE SHIP EQUALS
Schwefeldioxid SO <sub>2</sub> Sulphur dioxide SO <sub>2</sub>	7 500 kg	0,00002 kg	376 030 220 Pkw Cars
Stickoxide NO <sub>x</sub> Nitrogen Oxides NO <sub>x</sub>	5 250 kg	0,0124 kg	421 153 Pkw Cars
Feinstaub Particulate matter	450 kg	0,0004 kg	1 052 885 Pkw Cars
Kohlendioxid CO <sub>2</sub> Carbon dioxide CO <sub>2</sub>	476 850 kg	5,698 kg	83 678 Pkw Cars

Die Berechnungen beruhen auf jeweiligen Durchschnittswerten für das Jahr 2012.

Zu Grunde gelegt wurden: Ein Kreuzfahrtschiff mit 250 m Länge und 36 000 kW, Schiffskraftstoff mit 2,7% Schwefelgehalt sowie ein Pkw der EU Schadstoffklasse Euro 4.

Die verwendeten Emissionsfaktoren sind dem Standardwerk „Handbuch Emissionsfaktoren“ entnommen.

Diese sind für ein Kreuzfahrtschiff: NO<sub>x</sub> > 35 kg/t, Partikel > 3 kg/t, CO<sub>2</sub> > 3 179 kg/kg

und für einen Pkw: NO<sub>x</sub> > 0,35 g/km, Partikel > 0,012 g/km, CO<sub>2</sub> > 160 g/km

Calculations are based on average data for the year 2012 which are:

A cruise ship with 250 m length and 36 000 kW, marine fuel with a sulphur content of 2.7% as well as a Euro 4 passenger car.

All emission factors were taken from the official "Handbook Emission Factors".

These are: for a cruise ship: NO<sub>x</sub> > 35 kg/t, particle > 3 kg/t, CO<sub>2</sub> > 3 179 kg/kg.

For a car: NO<sub>x</sub> > 0.35 g/km, particle > 0.012 g/km, CO<sub>2</sub> > 160 g/km.

# Climate change, air pollution and damage of sensitive eco-systems due to heavy fuel oil

- Soot 2<sup>nd</sup> main climate forcer after CO<sub>2</sub>
- SO<sub>x</sub> > acidification of soils and waters
- NO<sub>x</sub> > eutrophication of soils and waters
- Oil spills after accidents (e.g. Erika, Prestige)



# Air pollution on deck of cruise ships



# Sun deck: 380,000 ppt/cm<sup>3</sup>

Source: France 3/Thalassa and ARD Plusminus

# The AIDAprima case: The allegedly most eco friendly cruise ship of all times

68.000 ppt/cm<sup>3</sup>

average value for +30 minutes next to ice skating lane on deck

Source: ARD Plusminus.

# Greenwashing vs. real measures

Voluntary schemes vs. mandatory legal requirements

## „Blue Flag“ initiative Venice

Less sulphur = less health damage?

Ultrafine particles need to be eliminated by a filter, NO<sub>2</sub> by SCR catalyst  
...or alternative fuels

# Control & Enforcement – Prepared for 2020?

What happens at open sea?

Do all ships comply when there is a massive economic benefit for cheating but no effective control?

Now that IMO agreed on the introduction of 0.5% sulphur cap in 2020, (how) do countries prepare to enforce this standard?

Are sanctions/levels of fines adequate?

Problem of flag states: Formal notice for violation: What follows?

A proper system for control and enforcement has to be set up in 2.5 years time!

# Myth: Massive revenue from cruise tourism

Study Venice (external costs):  
3,300 EUR per capita/year

Study Bergen: No one spends so little  
money in a city as cruise tourists

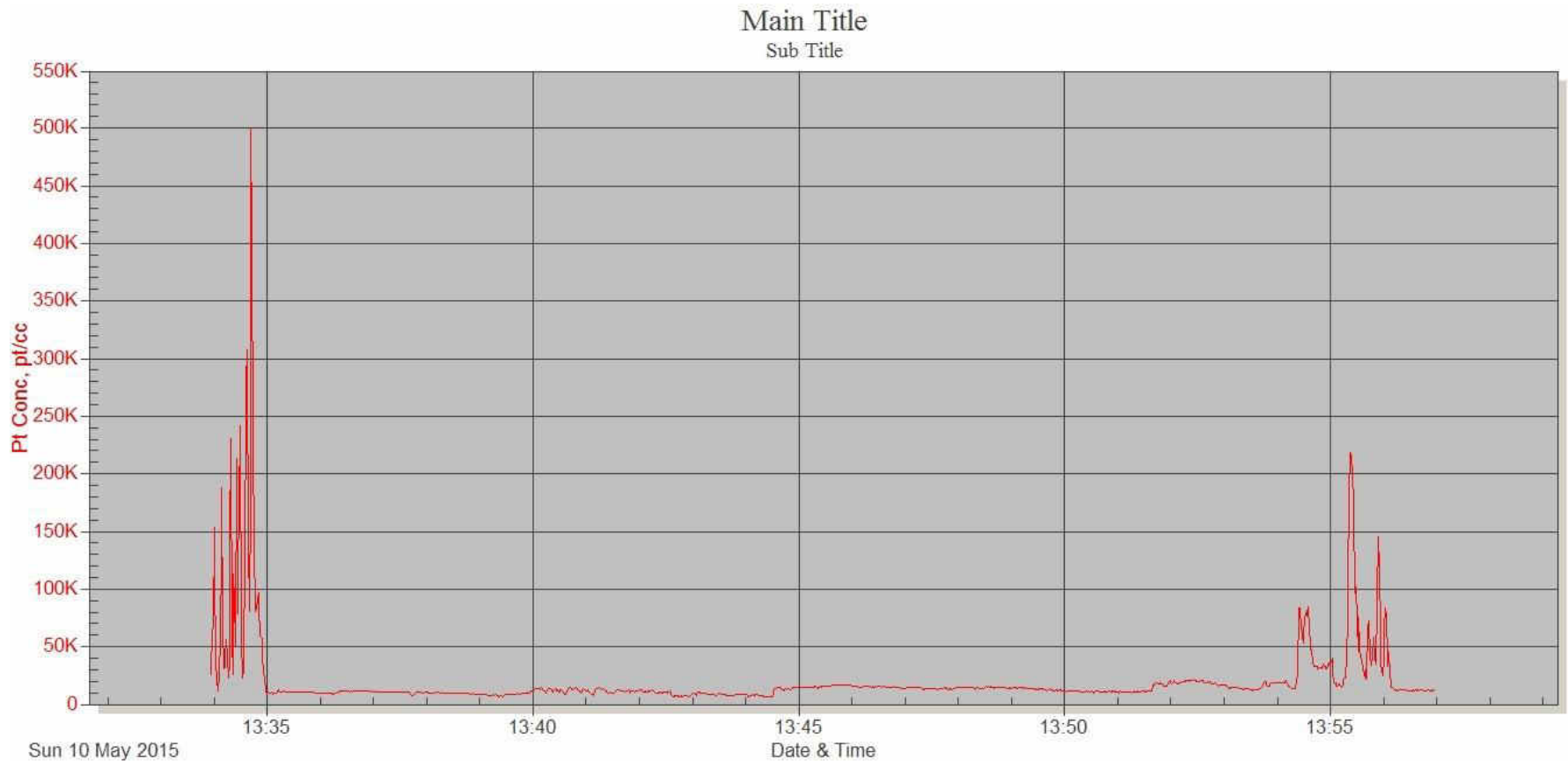
Who pays for infrastructure? 12 mio  
EUR of tax payers money for OPS  
in Hamburg used by 1 cruise ship!?





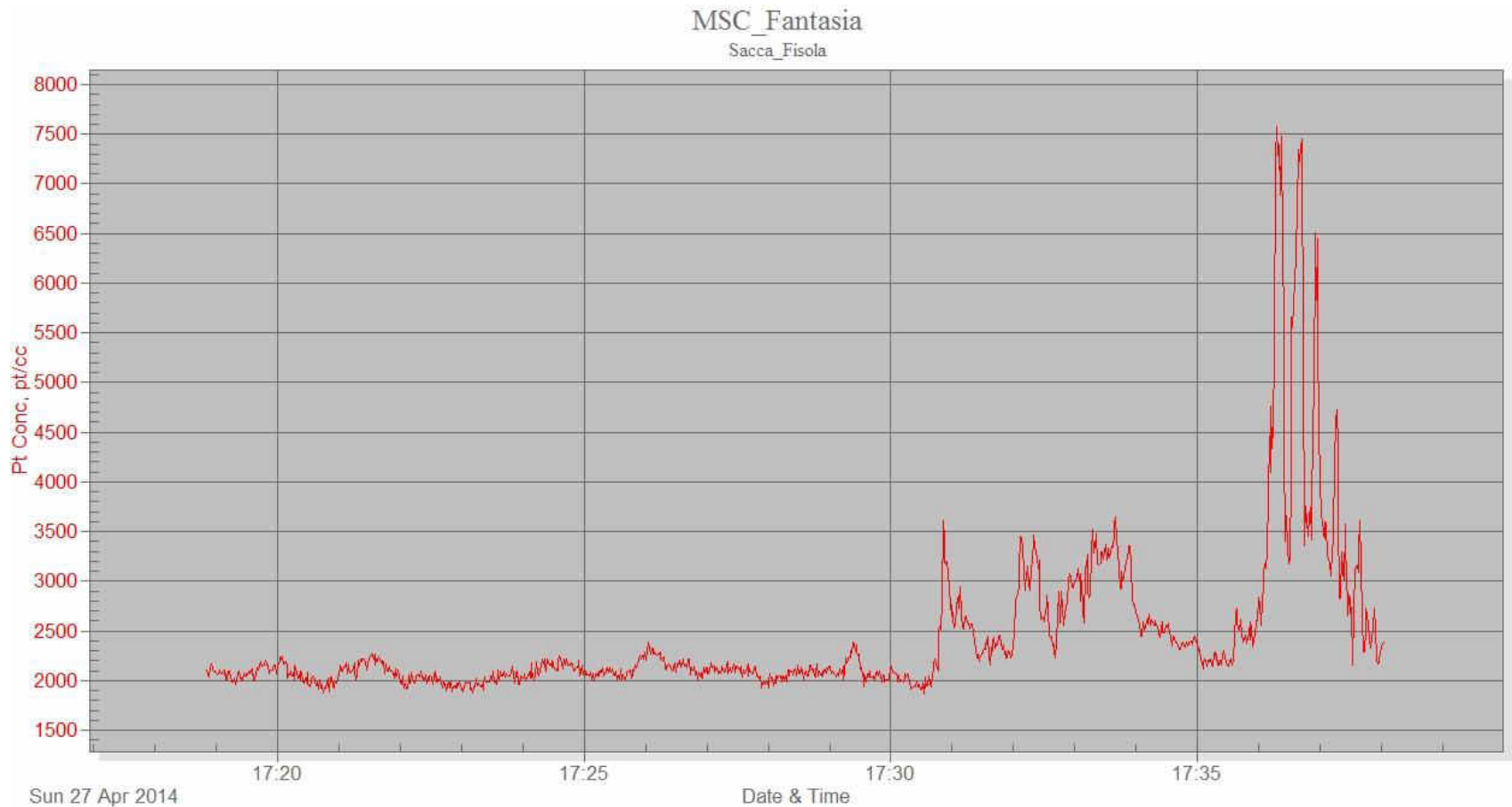
# Public transport: ferry passage in Lisbon

Health impact for daily commuters!?

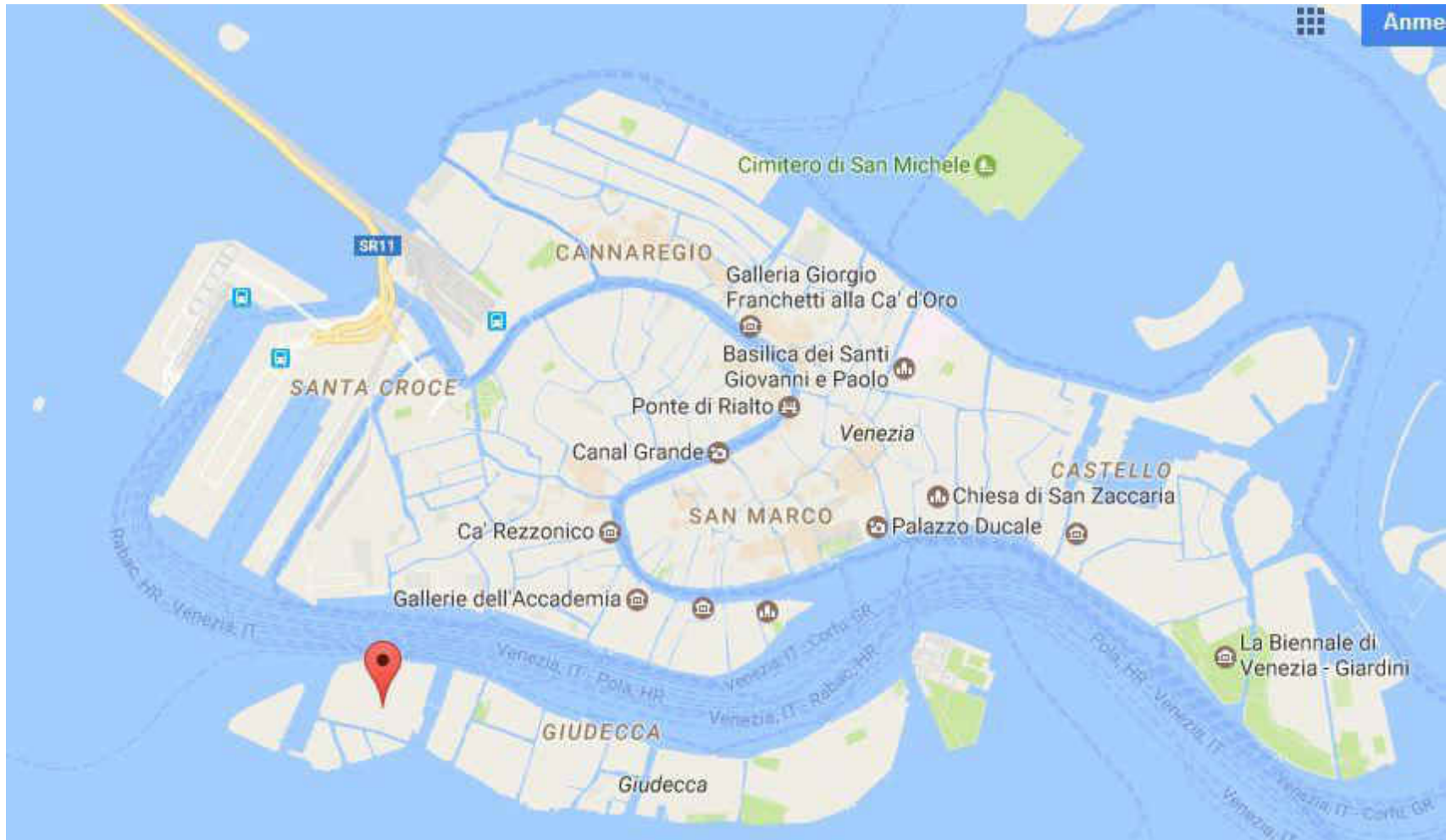


# Where are the official in-situ stations located?

## Example Venice

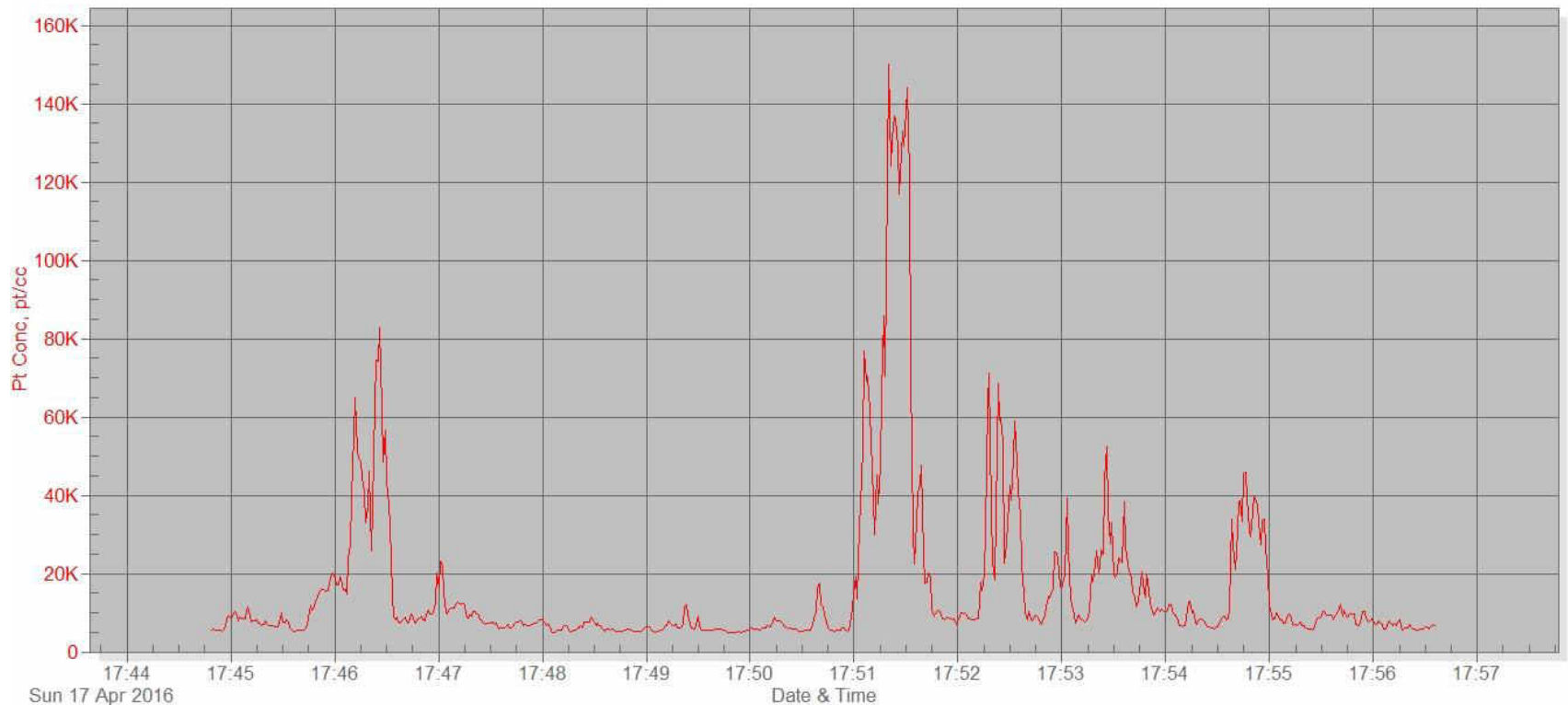


# Monitoring station Sacca Fisola/Venice



Source: google maps

# At the same time : Cruise ship MSC Musica passing San Marco Venice



# NABU's demands to tackle shipping emissions most effectively

- HFO ban, switch to low sulphur fuels
- install DPF & SCR (new build cheaper than retrofit)
- Designation of the Mediterranean as ECA (SECA; NECA and beyond)
- All ships owned by public authorities have to use cleaner fuels and operate with DPFs and SCRs
- Include exhaust gas aftertreatment in tenders for public transport etc.
- Eco port fee system/incentives

# More information is available here

[www.NABU.de/ships](http://www.NABU.de/ships)

air pollution measurements: <https://en.nabu.de/issues/traffic/air-testing.html>

air pollution from container ships <https://en.nabu.de/issues/traffic/container.html>

Retrofitted German science ship „Heincke“

[https://www.nabu.de/imperia/md/content/nabude/verkehr/1602-info\\_heincke\\_measurements\\_en.pdf](https://www.nabu.de/imperia/md/content/nabude/verkehr/1602-info_heincke_measurements_en.pdf)

Clean air in ports <https://en.nabu.de/issues/traffic/ports/>

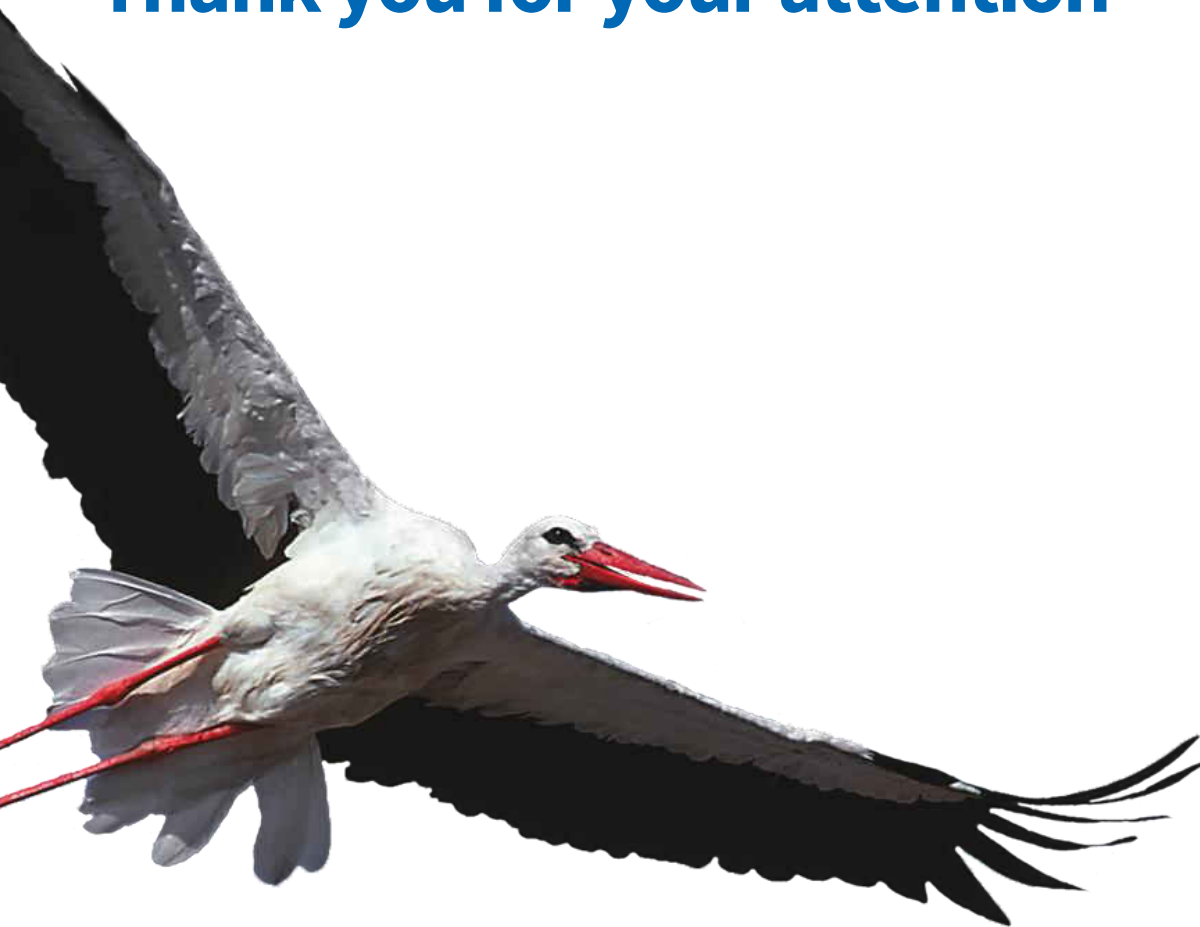
SECA compliance & enforcement <https://en.nabu.de/issues/traffic/19832.html>

SECA assessment <https://www.nabu.de/imperia/md/content/nabude/verkehr/nabu-seca-studie2016.pdf>

Study on scrubbers <https://www.nabu.de/downloads/150312-Scrubbers.pdf>



# Thank you for your attention



NABU Headquarters

Daniel Rieger

Charitéstraße 3

10117 Berlin

Tel. +49 (0)30.28 49 84-1927

Fax +49 (0)30.28 49 84-3927

Daniel.Rieger@NABU.de

[www.NABU.de/ships](http://www.NABU.de/ships)

[www.NABU.de/ports](http://www.NABU.de/ports)

[www.sootfreeclimate.org](http://www.sootfreeclimate.org)