Air Pollution from cruise ships

Air quality measurements in port cities and on board of cruise ships

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Cruise terminals are mostly located near or in the middle of city centres with its lively streets and places frequented by thousands of citizens and tourists every day. While at berth cruise ships keep their engines running in order to supply the massive energy demand for all hotel, leisure and entertainment facilities on board which is comparable the energy demand of a small town. As a matter of fact ships burn fuel that is up to 3,500 times dirtier than road diesel for cars whereas they have no exhaust gas abatement technology installed. Therefore, cruise ships contribute significantly to local air pollution levels which cause severe health problems like cardio-vascular diseases or cancer and damage climate as well as the environment. In Europe alone 50,000 people die prematurely because of air pollution from ships. At the same time cruise tourism became more and more popular and records enormous growth rates which lead to the order of bigger ships and larger fleets every year.

In 2011 NABU (German Nature and Biodiversity Conservation Union), Germanys biggest environmental NGO, launched the campaign "This stinks! Clean up Cruise ships!" Since then NABU conducted numerous test measurements at cruise terminals in European port cities. The results are alarmingly. The concentration of ultra fine particles (UFP) is up to 400 times higher compared to remote areas and still 50-80 times higher than next to main roads with dense traffic. UFPs and its component soot or black carbon are most relevant for human health problems. In 2012 the World Health Organisation (WHO) declared diesel soot to be as carcinogenic as Asbestos whiles the German Lung Foundation dissuades people with weak health constitution or respiratory problems to go on a cruise at all. In 2016 and 2017 there were measurement conducted on board of cruise
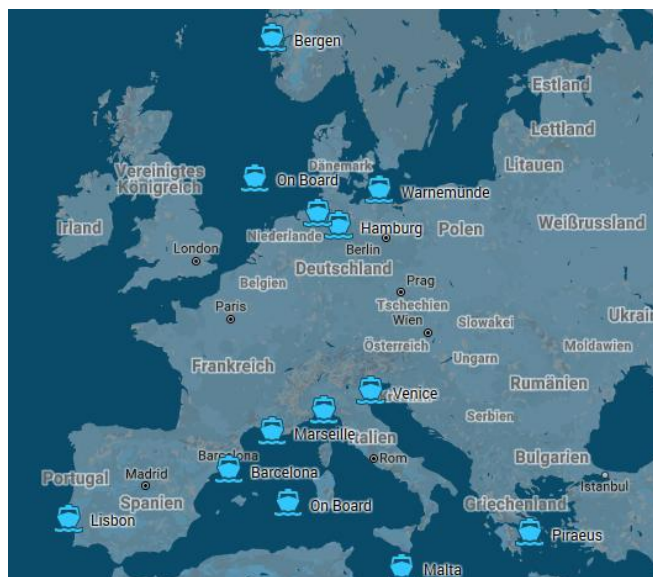

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Figure 1: Sites of NABU air quality measurements

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ships in Mediterranean Sea and North Sea both showed very high concentrations of harmful Ultra Fine Particles on deck of the cruise liners.

Unfortunately, there is no legally binding threshold for black carbon or particle number emissions from ship engines aimed at limiting emissions at the source. Same is for the requirements due to the European ambient air quality directive: It only prescribes limit values for PM10 and PM2.5 which refers to particle mass but is useless in order to limit particle number concentrations which are a much better indicator for human health threats. Therefore, NABU conducted air pollution measurements with special attention to ultra fine particles in various ports. The devise used is a TSI P-Trak 8525 that is able to detect fine and ultrafine particles with a diameter size between 20 and 1000 nanometer (which is 1 micrometer). Particle number (PN) is measured as part per cubic centimetre (pt/cc).

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

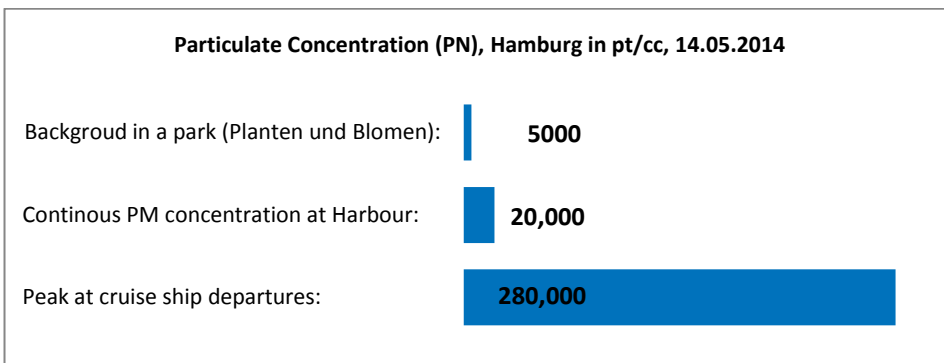|	
Backgroud in a park (Planten und Blomen):	**5000**
Continous PM concentration at Harbour:	**20,000**
Peak at cruise ship departures:	**280,000**

Figure 2: Exemplary air pollution levels in mayor German port city Hamburg

Particulate number in remote areas with good air quality varies is way below 2000pt/cc. The background level in big cities varies from 3000 to 5000pt/cc. Next to highly frequented streets the levels sometimes raise up to 10,000 pt/cc. Our measurements in cruise harbours have shown peak concentrations of more than 400,000 pt/cc. The only way to limit air pollution effectively is a change to cleaner fuels and the installation of exhaust gas abatement technology consisting of a diesel particulate filter and a SCR catalyst.
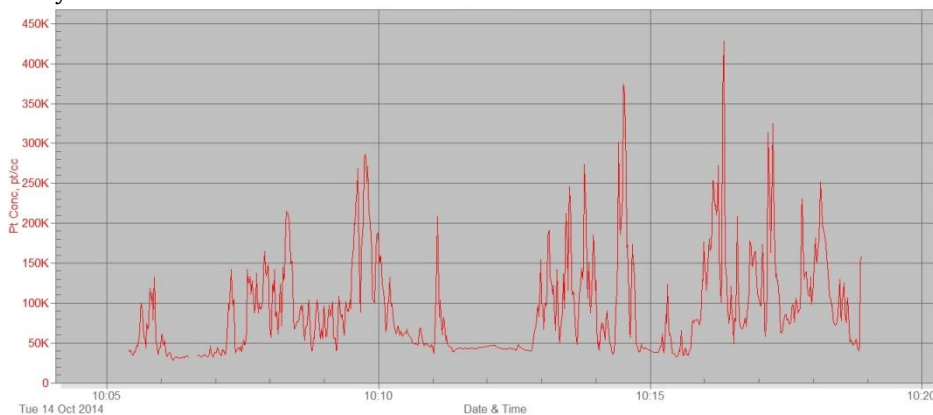
Figure 3: Air pollution level of a departing cruise chip in Barcelona.

More information is available here: www.NABU.de/ships