

Science for Environment Policy

Health effects of cruise ship air emissions in Greek ports

Over 2500 tons of the air pollutants nitrogen oxides (NO_x), sulphur dioxide (SO₂) and particulate matter with a diameter of less than 2.5 micrometers (PM_{2.5}) were released by cruise ships across the five busiest Greek cruise ports during 2013, a new study found. The researchers also examined the costs of the potential health impacts of this pollution, finding they could be as high as €24.3 million.

Cruise tourism has experienced rapid growth in recent years. Between 2003 and 2013 worldwide demand increased from 12 million to 21.3 million passengers. Cruise ships are one of the most energy-intensive tourism activities because they often act as luxury hotels, including amenities such as swimming pools, casinos, gyms and restaurants. Cruise tourism can also contribute significant amounts of revenue. In Greece, the direct annual expenditure from the cruise industry was €574 million in 2013.

Harbour cities are typically densely populated areas, and [air pollution](#) from cruise ships can be an important factor in deteriorating air quality. This research estimated cruise ship emissions — and their associated [health](#) effects — across five of the busiest Greek cruise ports, Corfu, Katakolo, Mykonos, Piraeus and Santorini, throughout 2013.

The study focused on emissions of NO_x, SO₂ and PM_{2.5}, all linked to increased rates of diseases such as lung cancers, heart disease and asthma and cardiovascular and cardiorespiratory mortality.

Emissions were estimated based on individual ship 'activity profiles'. These included data on the ships' different modes of operation in ports, including movements (i.e. manoeuvring or berthing), hotelling (i.e. maintaining power for amenities and heating in dock), the time spent in each mode, and information on engine types, engine loads and types of fuels used.

The studied ports received 2565 visits from 134 cruise ships, which stayed in port for more than 26 000 hours in total, and transported over 4 million passengers. The busiest phase for cruise ships extended from April to October, and emissions peaked during summer months, producing 58.5% of total annual emissions.

Emissions across all ports totalled 2742.7 tons. NO_x emissions were the highest (1887.5 tons), followed by SO₂ (760.9 tons) and PM_{2.5} (94.3 tons).

'Hotelling' accounted for 88.5% of total emissions, significantly more than those produced during manoeuvring activities (11.5%). Extended hotelling time requires constant operation of the auxiliary engines throughout the vessels' stay in port. Emissions are higher during this time compared to while the ship is at sea because additional energy is required to provide electrical facilities while at berth, as the main engines do not function.

To estimate the potential costs of adverse health effects arising from the air pollution to residents of these ports, the authors used two different valuation methods: Clean Air For Europe (CAFE) and New Energy Externalities Development for Sustainability (NEEDS). These valuation methods have slightly different methodologies in the assessment of air pollution exposure, sensitive groups and concentration response functions as well as in the valuation of the health impacts, thus giving a factor of two range of valuations.

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In total the NEEDS method produced a valued health cost of €24.25 million while the CAFE method valued the costs at €12.42 million. This equates to health costs per cruise passenger of between €2.5 (CAFE) and €5.3 (NEEDS).

However, the authors highlight that these numbers are likely to be underestimates of the health costs from cruise ships in ports because neither CAFE nor NEEDS include daily visitors or workers passing through these areas, instead basing their calculations only on permanent port area inhabitants.

These results show the importance of controlling emissions from ships in port cities, say the study's authors.

