

Study finds cleaner ship fuels will reduce childhood asthma by 3.6 percent globally

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Oil tanker near Delaware City, DE. Credit: University of Delaware

Marine shipping fuels will get a whole lot cleaner in 2020 when a

regulation by the International Maritime Organization (IMO) requires fuels to contain 80-86 percent less sulphur.

This is the most significant improvement in global [fuel](#) standards for the shipping industry in 100 years, intended to achieve significant [health benefits](#) on a global scale.

Now, a new study in *Nature Communications* quantifies these [health](#) benefits and finds cleaner shipping fuels will result in a 3.6 percent reduction of [childhood asthma](#) globally.

The study was led by University of Delaware's James Corbett, and included an international team of researchers from the Finnish Meteorological Institute (FMI), Rochester Institute of Technology (RIT) in New York and Energy and Environmental Research Associates.

The team studied the impacts of sulphur emitted by [ships](#) using current marine fuels, which produce air pollution particles that are small enough to be breathed deeply into the lungs and are considered harmful to human health.

Ship air pollution effects are greatest in areas where heavily travelled ship routes exist in, and next to, densely populated communities. Some key regions include China, Singapore, Panama, Brazil and coastlines of Asia, Africa and South America.

"Essentially, we document how much health benefit to expect from the 2020 adoption of cleaner ship fuels," said Corbett, professor of marine science and policy in UD's College of Earth, Ocean, and Environment, and the paper's corresponding author.

Roughly 14 million annual cases of childhood asthma are estimated to be related to global ship pollution using current fuels. The change to cleaner

ship fuels will reduce the ship-related childhood asthma cases by half.

Additionally, shipping pollution is estimated to contribute to 400,000 premature deaths from lung cancer and cardiovascular disease annually. This is about 7-8 percent of the global health burden caused by air pollution. Reducing ship sulphur emissions cuts these other global health related impacts, too, avoiding about one-third of the annual cardiovascular disease and lung cancer deaths from shipping air pollution.

Quantifying the effect of low-sulphur shipping fuels

Researchers used a state-of-the-art model of ship traffic based on satellite records to determine where ship activity was producing emissions, and adjusted to account for expected vessel emission growth rates by the year 2020. They used another high-resolution model to see how ship emissions would mix and chemically transform in the atmosphere, how they disperse and how they contribute to air quality where people live.

To compute how additional pollution from ships increases risk of disease for exposed populations, especially those living in coastal communities or along major shipping lanes and far inland in some nations like India, the team incorporated important underlying health information from the World Health Organization and Global Asthma Network.

"Our results show that these regulations are beneficial, but also that more [air pollution](#) health benefits remain possible with less-polluting ships," said James Winebrake, professor and dean at RIT, an authority on the environmental impacts of transportation, including health risk assessments.

The new IMO rule will decrease the allowable amount of sulphur in fuel

oil from 3.5 percent to 0.5 percent, a reduction from 35,000 parts per million (ppm) to 5,000 ppm. Refining industries will invest in the necessary technology to produce, and shipping will invest to adapt engine systems to use, these cleaner fuels. These costs will be borne by consumers in the prices of goods they buy. Corbett believes that improved [global health](#) is worth the investment.

"Cleaner ships fuels help people who don't have an economic role in the pollution they are suffering, some in places that aren't engaged in trade at all, as well as communities located along major shipping lanes," said Corbett, an expert on environmental policy and global shipping.

Public health benefits bring climate tradeoffs

While the health benefits are clear, the research also quantifies tradeoffs in terms of climate.

Sulphur dioxide emissions from ships create small particles. These sulphur containing particles reflect sunlight and help form brighter clouds, creating a global effect that temporarily diminishes the warming effects of carbon dioxide.

Think of this warming effect like a pot of water boiling on the stove. Adding ice cubes to the boiling water can slow how quickly the water heats up, but it does not stop the heating itself. It's the same with sulphur in the atmosphere.

So, what happens when ships emit less sulphur and warming from greenhouse gases is no longer offset?

"The use of cleaner ship fuels will increase the rate of global warming by about 3 percent," said FMI senior scientist Mikhail Sofiev, who led the climate related research. "This means more attention may be needed to

reduce greenhouse gases across all sectors of the global economy."

At the same time, shipping activity is expected to increase with global trade and continue to produce harmful air emissions and greenhouse gases. Despite the upcoming reductions, low-sulphur marine fuels will still account for approximately 250,000 deaths and 6.4 million childhood asthma cases annually, so more stringent standards beyond 2020 may be needed to provide additional health benefits.

More information: Mikhail Sofiev et al, Cleaner fuels for ships provide public health benefits with climate tradeoffs, *Nature Communications* (2018). [DOI: 10.1038/s41467-017-02774-9](https://doi.org/10.1038/s41467-017-02774-9)

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