

## **Summary of Report on Premature Mortality from Global Shipping**

This study estimated premature deaths worldwide resulting from air emissions of fine particulate matter (PM) from international shipping. The study found that these international shipping emissions caused some 62,000 to 64,000 premature deaths annually. Due to projected increases in shipping traffic, this death toll is expected to increase by about 40% by 2012. The study was conducted by a team of eminent world researchers, led by James Corbett of Univ. of Delaware, USA. It was funded in part by CATF and the Oak Foundation.

### **Methodology**

Shipping PM emissions were based the two best traffic-based, geospatial, global shipping emissions inventories. Ambient air PM concentrations were then modeled using these two inventories and two different geospatial global aerosol models. Premature cardiopulmonary and lung cancer mortality were estimated by applying the ambient PM concentration increases due to shipping to well-accepted concentration-response functions (also used by USEPA) and to population models.

PM is made up of a number of constituents—primarily sulfates, organic and elemental carbon, nitrates, ammonium and a variety of heavy metals. Several of the model runs evaluated only the sulfate and carbon/organic fraction of PM – PM pollutants most reduced by fuel switching. Other runs included a complete set of PM constituents, including nitrates and ammonia. In all, five separate runs were analyzed. As a result, the study is quite robust.

The results of the various runs may be summarized as follows—

- Runs analyzing partial PM constituents—best estimates were 19,000 to 40,000 premature deaths in 2002;
- Runs analyzing complete PM constituents—best estimates were 62,000 to 64,000 premature deaths in 2002).
- This range represents about 3% to 8% of all deaths from global outdoor fine PM pollution, estimated at between 740,000 and 880,000 a year.
- Annual mortalities are expected to increase by 40% due to expected growth in shipping activity.

The study also modeled shipping ambient air impacts and premature mortality for separate regions of the world. While the global total is nearly the same, impacts vary by region when alternate global inventories are selected.

- The European/Mediterranean region is a major impact region of global shipping deaths—between 27% and 42% of global shipping impacts.
- East Asia and South Asia were also heavily impacted, each representing about one-quarter of the global impact.
- About one-tenth of global shipping deaths occurred in the North American region.
- Some 60% of the ship emissions mortality due to shipping may be attributed to PM constituents associated with high-sulfur residual fuels.

This study is the first to estimate human health impacts from oceangoing ships on a global scale. While the aerosol models used in this ground-breaking study were of necessity fairly coarse, the study has demonstrated for the first time that global shipping is causing premature death across the world.