

# THE CONTRIBUTION OF SHIPS TO MEASURED NO<sub>x</sub> AND ULTRAFINE PARTICLE CONCENTRATIONS ALONG THE WATERWAYS IN AMSTERDAM

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**Background and aim:** Emissions from ships in waterways near residential areas might contribute significantly to local air pollution. The aim of this study was to assess the contribution of passing ships to short term concentrations NO<sub>x</sub> and ultrafine particles (UFP) near homes close to waterways.

**Methods:** Continuous measurements were made in 10 second intervals at two locations in the Amsterdam area, on different predefined days in June 2010 during a 4 hour period. One of the locations (Sumatrakade) was in central Amsterdam along the river IJ, in a street with medium traffic intensity (4000 veh/24h). The other location (Diemen) was in a low traffic zone in a suburban area along the Amsterdam-Rhine Canal. Measurements were performed near homes at 21 m from the waterside at Sumatrakade and 44 m in Diemen. Local wind direction was variable at Sumatrakade and from the canal side in Diemen. Time and type (cargo vs pleasure) of passing ships and road traffic were registered.

**Results:** A significant increase in NO<sub>x</sub> concentration was observed 10-90 seconds after passage of cargoships at Sumatrakade and 30-100 seconds in Diemen. Linear regression analysis showed that during those time periods, a cargo ship increased NO and NO<sub>2</sub> concentrations with on average 2,4 and 5,7 µg/m<sup>3</sup> at Sumatrakade and 20 and 11 µg/m<sup>3</sup> in Diemen. The effect on UFP was less clear at Sumatrakade and absent in Diemen. Mean NO<sub>2</sub> and NO concentration was respectively 42 and 9 µg/m<sup>3</sup> at Sumatrakade and 10 and 10 µg/m<sup>3</sup> in Diemen. Taking the number of passing ships into account, cargo ships contributed 2 µg/m<sup>3</sup> to the NO<sub>2</sub> concentration at Sumatrakade and 5 µg/m<sup>3</sup> in Diemen. The contribution to the NO concentration was 1 µg/m<sup>3</sup> at Sumatrakade and 8 µg/m<sup>3</sup> in Diemen.

**Conclusion:** Ship emissions contributed significantly to NO<sub>2</sub> and NO concentrations in Amsterdam.