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REAL-WORLD IN-USE PORTABLE EMISSION MEASUREMENTS OF NON-ROAD MOBILE MACHINERY USED ON ACTIVE CONSTRUCTION SITES IN LONDON

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The London Atmospheric Emissions Inventory attributes 7%, 11%, and 2% to NO_x, PM_{2.5}, and CO₂, respectively, to non-road mobile machinery (NRMM) in London¹. NRMM is the 3rd largest source of PM₁₀ and the 4th largest source of NO_x, and therefore contribute significantly to NO₂ and PM_{2.5} pollution problems in London, which is a major concern for public health. Excavators, dumpers, forklifts, generators, cranes, and telehandlers are some of the most common types of NRMM used at construction sites and constitute over 75% of the registered fleet².

Emission factors of 23 different NRMM were measured using UN-ECE R-49 & Commission Regulation (EU) No. 582/2011 compliant portable emissions measurement system (PEMS). The engines used by the NRMM varied in age (MY 2011 to 2015), engine size (48kW to 400kW), operational hours (10 to 18,708 hours), and emission standards (Stage III-A to Stage IV).

Measured emission factors showed that Stage IV engines emit the least amount of NO_x (g/h units) when compared with the earlier Stage III-A and Stage III-B engines, indicating a working SCR exhaust gas after-treatment system on all machines tested. Machines tested at active construction sites in London, showed similar NO_x emissions to those tested on site with an original engine manufacturer. Most NRMM had a conformity factor of 2.1 for NO_x emissions. A similar conformity factor of 2.1 for NO_x is used as an indicator for light-duty on-road vehicles' real driving emission standards. The NO_x conformity factors from this study were compared with a previous study³, to provide an indicative reference.

The measured emission factors from the 23 NRMM tested, were coupled with activity data from the register of construction machinery in London, to develop a spatially and fleet disaggregated emissions inventory. This approach was used to test two realistic policy scenarios, to develop future policy for NRMM in London, which could be applied on a global scale.

¹ London Data Store (<https://data.london.gov.uk/>)

² Register of construction machinery for London (<https://www.nrmm.london>)

³ T. Cao et al. / Atmospheric Environment 147 (2016) 234-245. Evaluations of in-use emission factors from off-road construction equipment. Atmospheric Environment. 147. 10.1016/j.atmosenv.2016.09.042.