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Background

- Small engines, i.e. moped and lawnmowers, are still at the tail of emissions regulations and emissions reduction efforts Particle emissions can be very high
- (+ the operator, approx. 1 m away, is inhaling this)

 Traditional type-approval PEMS approach does not work due to exhaust pulsations and flow reversals • Alternatives are explored in this work

Goal: To measure emissions of small engines during











- flow dilution tunnel, fuel consumption meter) Different motorcycles and mopeds used

Discussion & Conclusions

- Exhaust flow is the #1 source of uncertainty
- Exhaust flow meters used in type-approval PEMS not readily usable (bulky and not designed for pulsating flow). Both speed-density method and close-coupled high-speed Pitot tube useful when calibrated during chassis dyno tests.
- Light-weight, low-cost inspection-grade "garage-grade" five-gas (HC, CO, CO_2 , NO, O_2) and PN (non-volatile particle number) can be used.

Cumulative fuel consumption (from $HC+CO+CO_2$ emissions) over WMTC cycle "direct:/:raw: - directly measured exhaust flow x undiluted concentrations diluted - dilution tunnel flow x diluted exhaust concentrations



PECHOUT, Martin, et al. Atmospheric Environment: X, 2022, 14: 100170.