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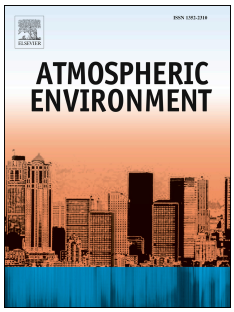

Impact Assessment of Biomass-based District Heating Systems in Densely Populated Communities. Part I: Dynamic Intake Fraction Methodology

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Impact Assessment of Biomass-based District Heating Systems in Densely Populated Communities. Part I: Dynamic Intake Fraction Methodology

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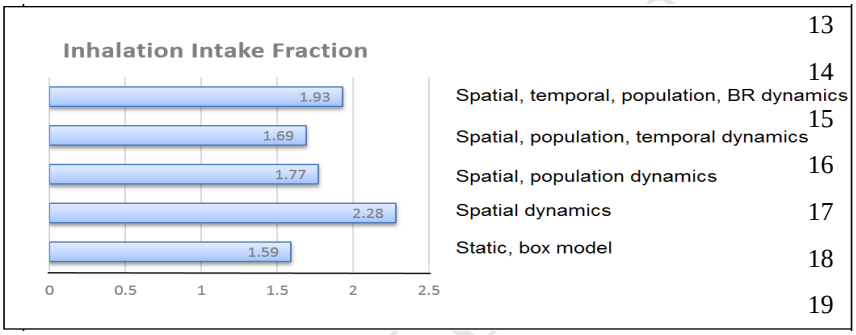
Highlights:

- An impact assessment approach for densely populated communities is proposed.
- A comprehensive dynamic inhalation intake fraction (iF) is suggested as metric.
- Microclimatic characteristics and spatial/temporal variations of parameters were accounted.
- Overall community dynamic iF is 21% higher than overall community static iF.

GRAPHICAL ABSTRACT



ABSTRACT

This study contributes to the literature by proposing a novel, state-of-the-art approach to estimate incremental air quality and health impacts of proposed or installed district energy systems (DES), such as the growing biomass-based DES, on the immediately surrounding community where population density varies significantly during day as well as the micrometeorological conditions. Spatial and temporal dynamics of pollutant concentrations at sensitive receptors obtained from modeled actual source emissions, inclusion of site-specific terrain, land use and microclimatic characteristics, population density and breathing rates are examined based on their impacts on the exposure potential expressed by the intake fraction (iF). Overall, results revealed that when those parameters are changing, the increase of iF calculated based on average ambient concentrations at each receptor for the UBC campus for the day and night hours for September 2012, ranges from 6.2% to 43.0%: introducing actual spatial receptor distribution led to 43% increase of iF, combined spatial and population dynamics led to 11.3% increase of iF, while introducing temporal dynamics and varying breathing rates resulted in 6.2% and 21.4% increase in iF respectively, compared to the base case box model where receptors and