



Laboratoire de Chimie de l'Environnement

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PhD-Thesis Offer

Ship emissions and impacts on Urban Air Quality

Context. Shipping accounts for over 90% of the world's goods and transports millions of people every year, contributing significantly to the contamination of atmospheres with high emissions of nitrogen oxides (NO_x), sulfur dioxides (SO₂), particles with a diameter of less than 2.5 μm (PM_{2.5}) and metals. In 2018, for the first time in the Marseille, "NO_x emissions from maritime transport were comparable to road emissions" (Atmosud). Air pollution from ships is a significant threat to human health, environment and global climate. The impact of these pollutants on health, and more particularly of fine particles, is now clearly recognized and is reflected in an increase in cardiovascular and respiratory diseases, hospitalizations and premature deaths. The European Commission estimates that annually 50,000 people in Europe die prematurely because of ship air pollution. In view of the seriousness of these environmental and health damage, more restrictive standards have been introduced. In January 2020 new regulations on sulfur fuel content for ships have been introduced. The research work will take advantage from the international project AER NOSTRUM (MARITTIMO) in collaboration with several French and Italian institutions. Concomitant measurement campaigns will be carry out in Genova, Livorno, Cagliari, Ajaccio, Bastia, Nice and Toulon to assess the impact of ship emissions in the Mediterranean cities.

Topic: the thesis aims to investigate emissions from ships in the Toulon harbor. The tackled primary pollutants include NO_x, SO₂, ozone, soot, particle number and size distribution, particle chemical composition (PAHs, metals, nitrates, sulfates). The impact of ship emissions will be further investigate using fast reactors (type PAM chamber) to simulate the photochemical aging of primary emissions. State-of-the art instrumentation (high temporal resolution and high sensitivity) will be deployed during the campaigns and laboratory studies. Instrumentation will include high resolution mass spectrometers for VOCs and particles (HR-ToF-AMS, Charon-PTR-ToF-MS), filter samples will be collected for detailed analysis of particle composition (metals, PAHs and organic tracers). The ultimate goal will be to contribute to a better representation of maritime emissions in urban and regional air quality models. This will be accomplished in collaboration with Atmosud and the modeling partners of the AER NOSTRUM project.

Applications: Candidates will hold a Master degree with a strong component in Chemistry, Physical-Chemistry, Physics and/or Environmental Sciences. Application includes CV, motivation letter, contacts of one (or two at most) senior scientists who can recommend the candidate, marks from previous 3 years. All documents must be sent to barbara.danna@univ-amu.fr before the end of **May 2021**. LCE webpage: <https://lce.univ-amu.fr>