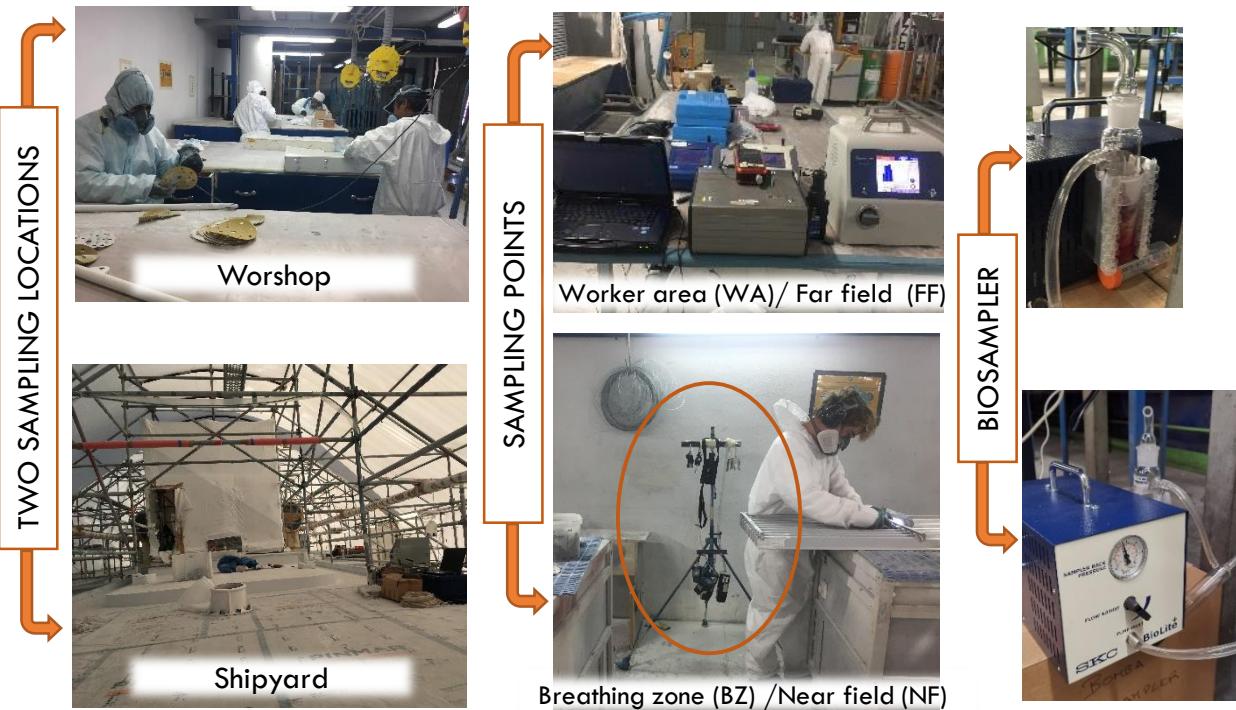


# Nanoparticles Emitted During Maintenance Operations in Shipyards: Chemical Composition and Toxicity

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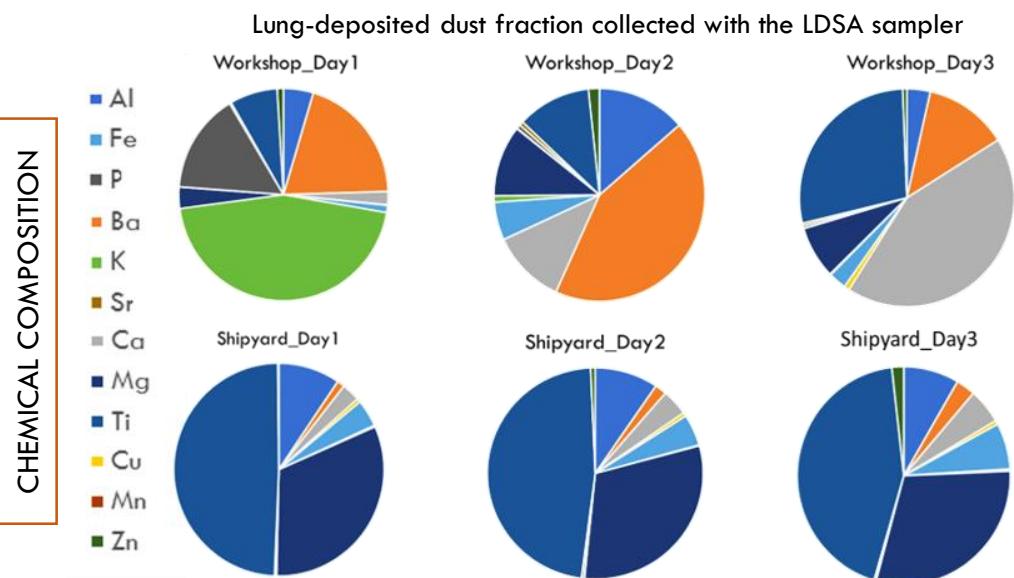
Nanoparticle research in harbour areas typically focuses on ship (stack) or vehicular exhaust emissions, while high particle emissions and impacts on exposure also occur during harbour operations, specifically from vessel refurbishment activities. The literature regarding these activities is scarce, especially in terms of particle chemical composition and toxicity. The aim of this work was to evaluate the chemical composition and toxicity of lung-deposited aerosols released during vessel rehabilitation activities.

## METHODS

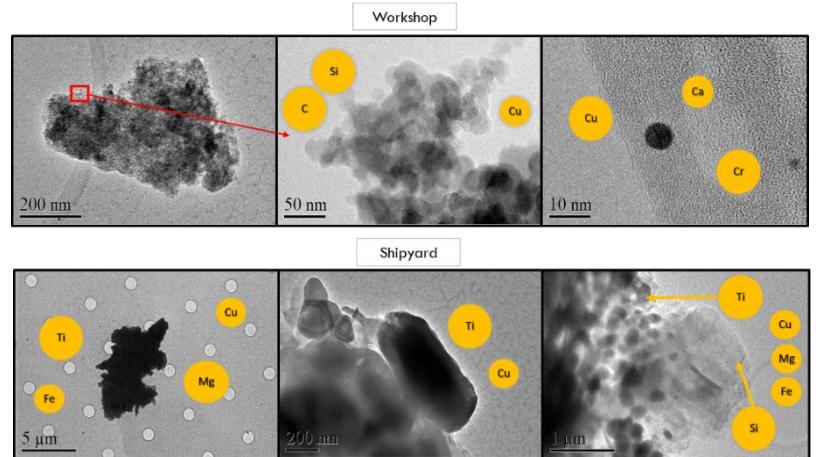


- Airborne particle samples were collected in the shipyard and in a workshop area during abrasion of primer and top-coat paints with a mechanical abrador connected to a local exhaust ventilation system.
- Mass concentration and particle number was determined using online instruments (Grimm Mini-LAS, TSI Dusttrak DRX) in the WA and BZ in the workshop and in the FF and NF in the shipyard.
- Lung-deposited surface area (LDSA) particle chemical composition was determined on foams in the BZ/NF. Samples were collected using an LDSA sampler (Koehler et al., 2009), acid digested and analysed by ICP-MS and ICP-OES.
- Particle cytotoxicity (for particles <math>< 2 \mu\text{m}</math>) was assessed by the MTT in vitro assay after collection using a Biosampler.
- Particle morphology was characterised by Transmission Electron Microscopy (TEM)

## RESULTS



### PARTICLE MORPHOLOGY



## CONCLUSIONS

- Nanoparticle emissions (up to 500.000 particles/cm<sup>3</sup>) were detected during all of the activities monitored, in the workshop and the shipyard.
- The chemical composition of particles <math>< 4 \mu\text{m}</math> was mostly stable across different days in the shipyard, and very variable in the workshop (due to short-term activities). It reflected the chemical composition of the paints being abraded, with major components Ti, Al and Zn.
- Toxicity assessments of the size fraction <math>< 2 \mu\text{m}</math> evidenced a moderate potential for cytotoxic effects.

