

Stochastic fate analysis of engineered nanoparticles during release processes, e.g. in an incineration plant

Tobias Walser, Fadri Gottschalk

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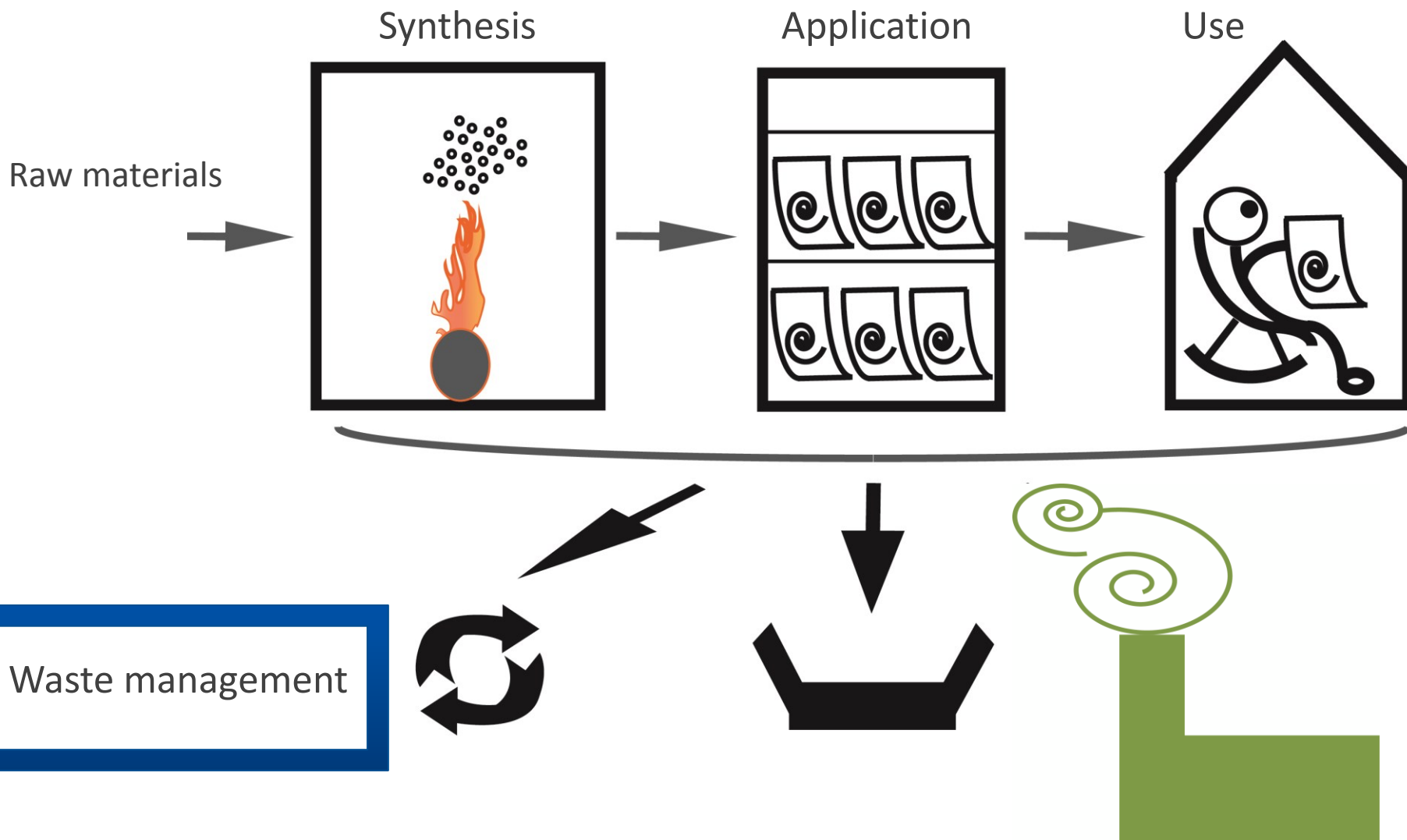


Institute of Environmental Engineering, ETH Zurich

ETH

Institute for Environmental Decisions, Natural and Social Science Interface, ETH Zurich

Hotspots of nanoparticle emissions



Nanowaste

Products containing engineered nanoparticles at the end of the use phase

LETTERS

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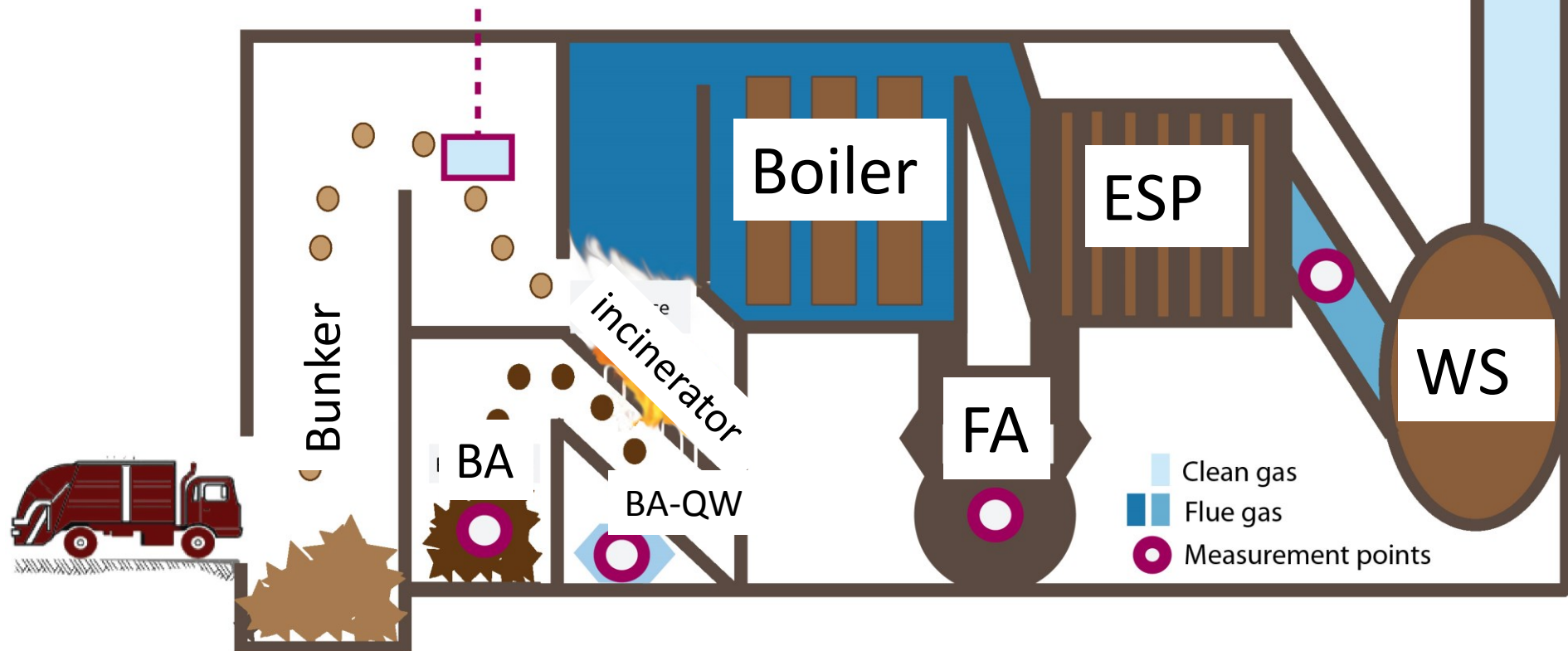
nature
nanotechnology

Persistence of engineered nanoparticles in a municipal solid-waste incineration plant

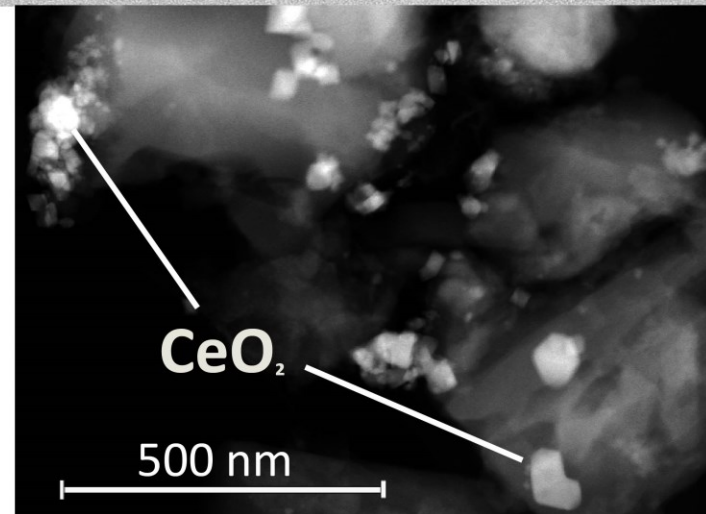
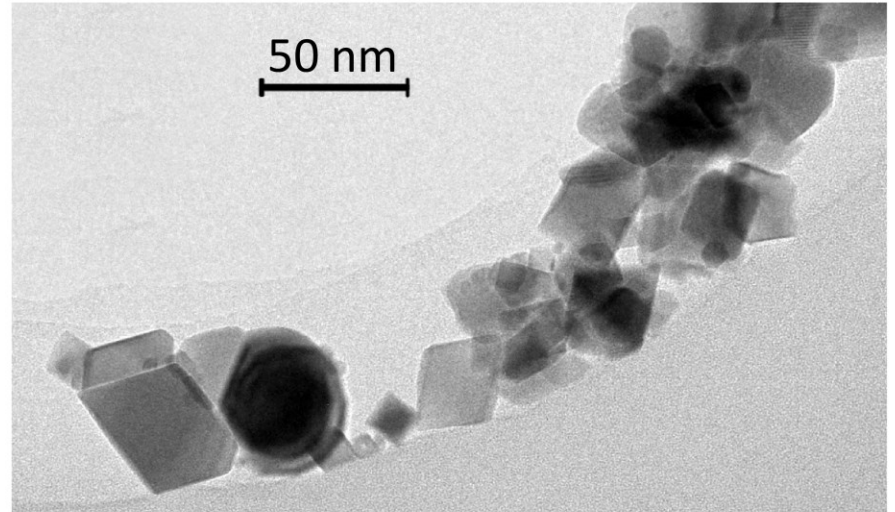
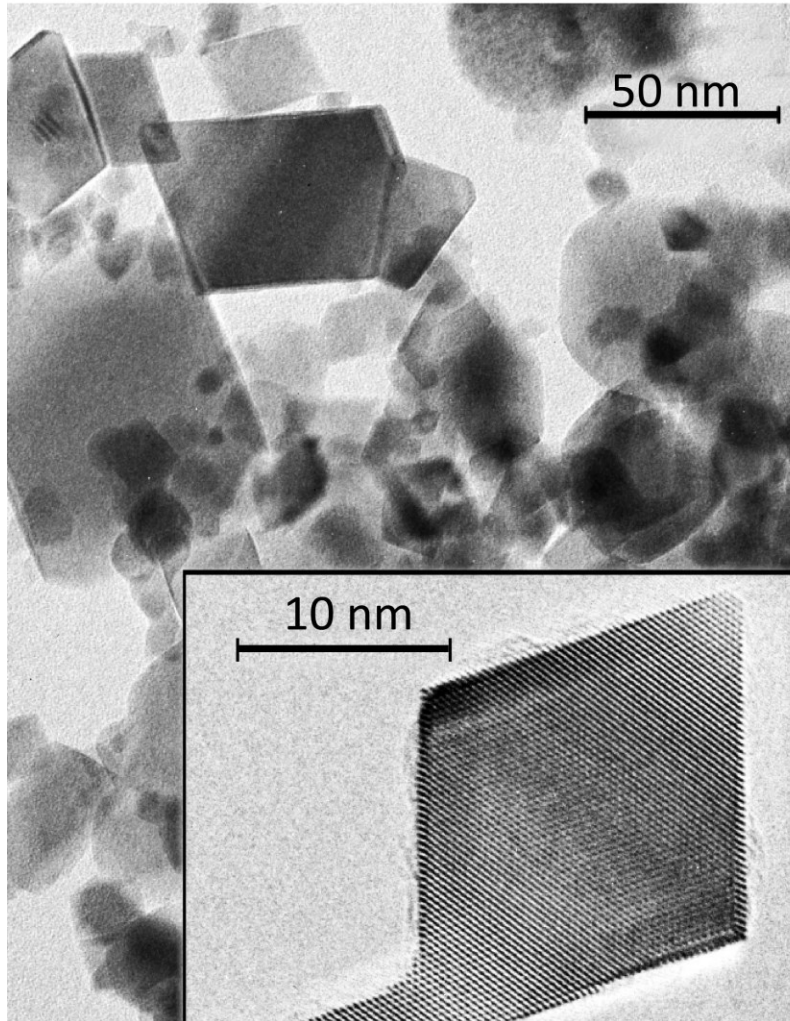
Tobias Walser¹, Ludwig K. Limbach², Robert Brogioli³, Esther Erismann⁴, Luca Flamigni³, Bodo Hattendorf³, Markus Juchli⁵, Frank Krumeich³, Christian Ludwig⁶, Karol Prikopsky⁴, Michael Rossier², Dominik Saner¹, Alfred Sigg⁴, Stefanie Hellweg¹, Detlef Günther³ and Wendelin J. Stark^{2*}

Experiment on the fate of nano-CeO₂ in incineration

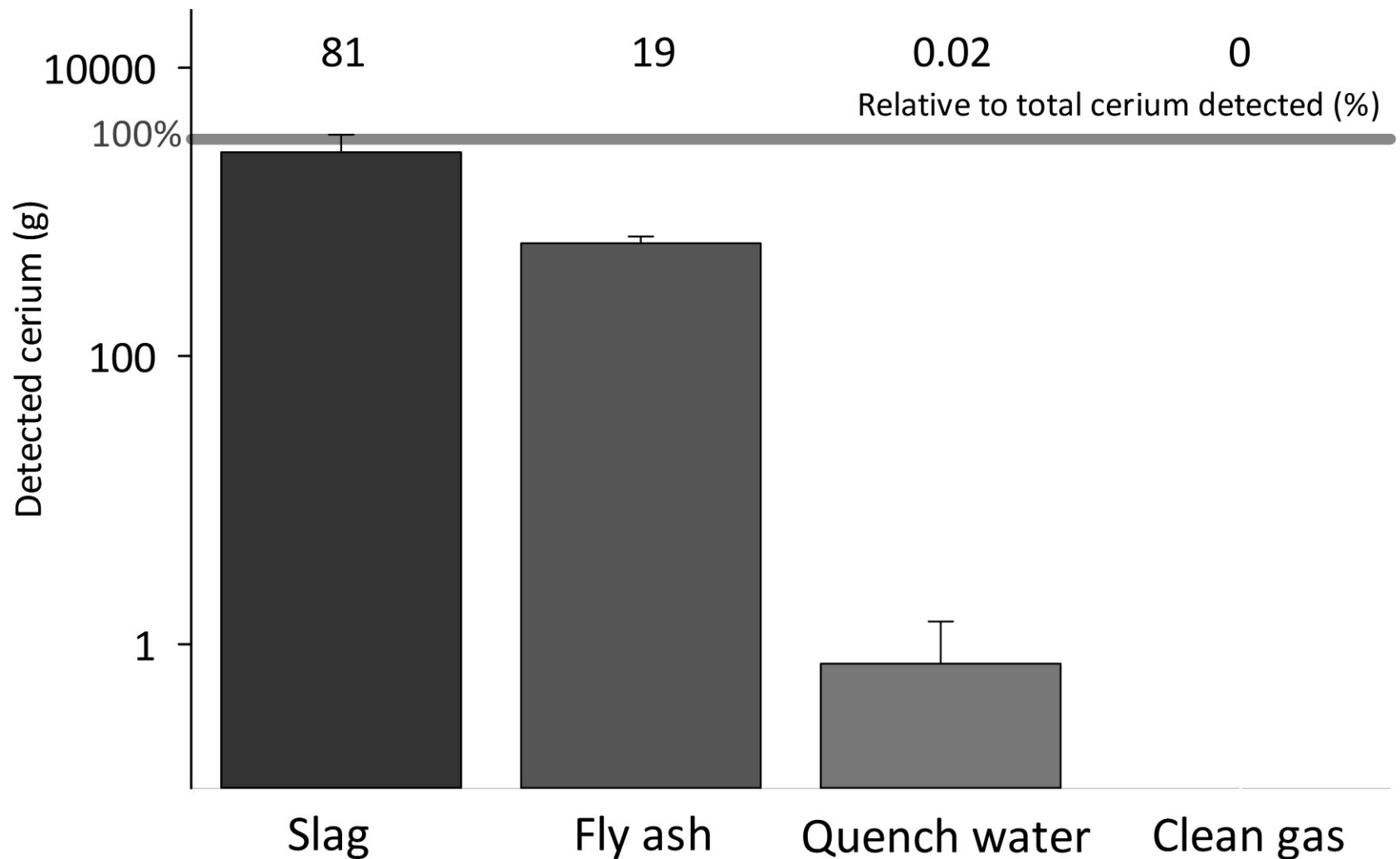
10 kg
nano-CeO₂



No alteration of nano-CeO₂



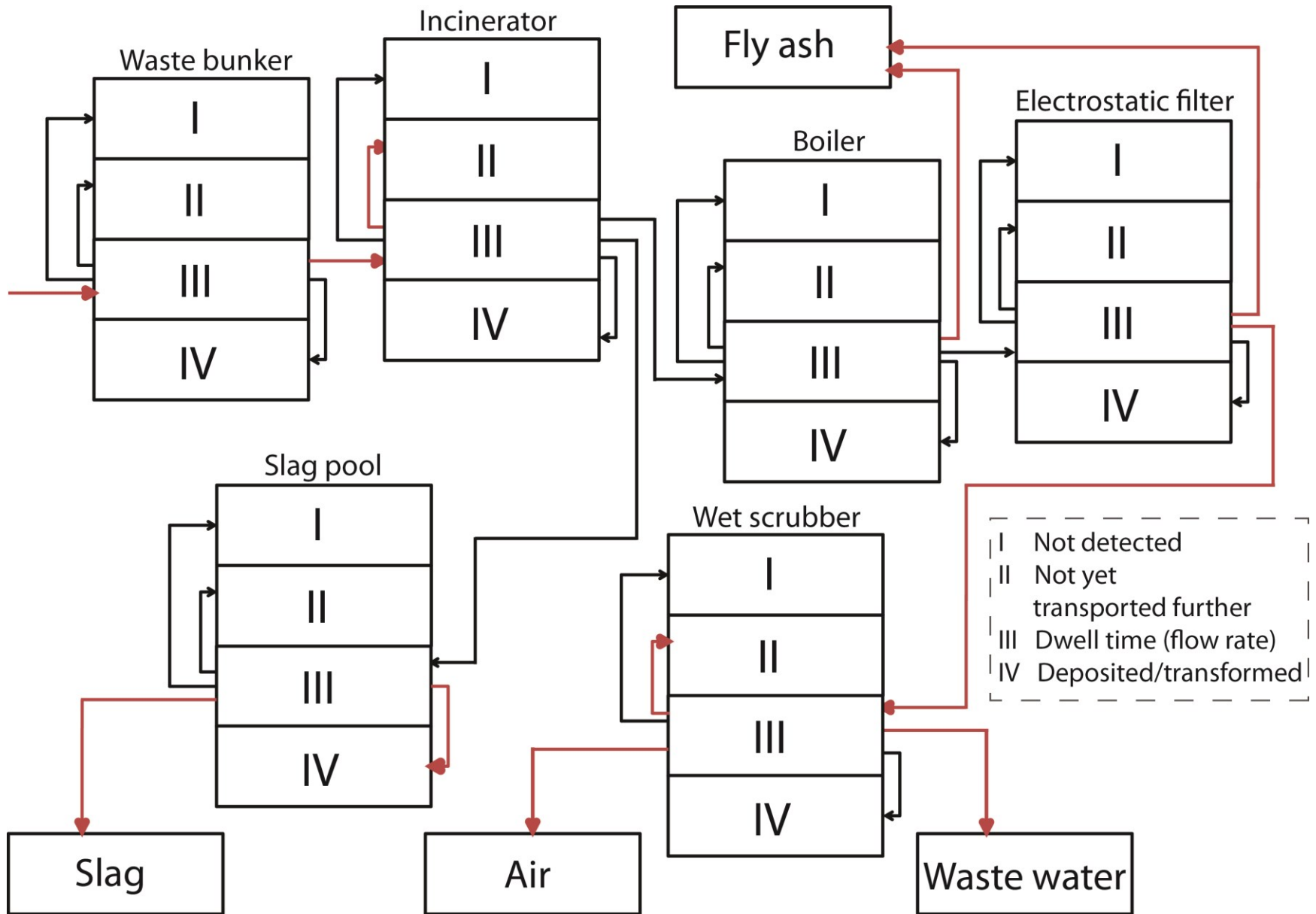
High removal rate of nano-CeO₂



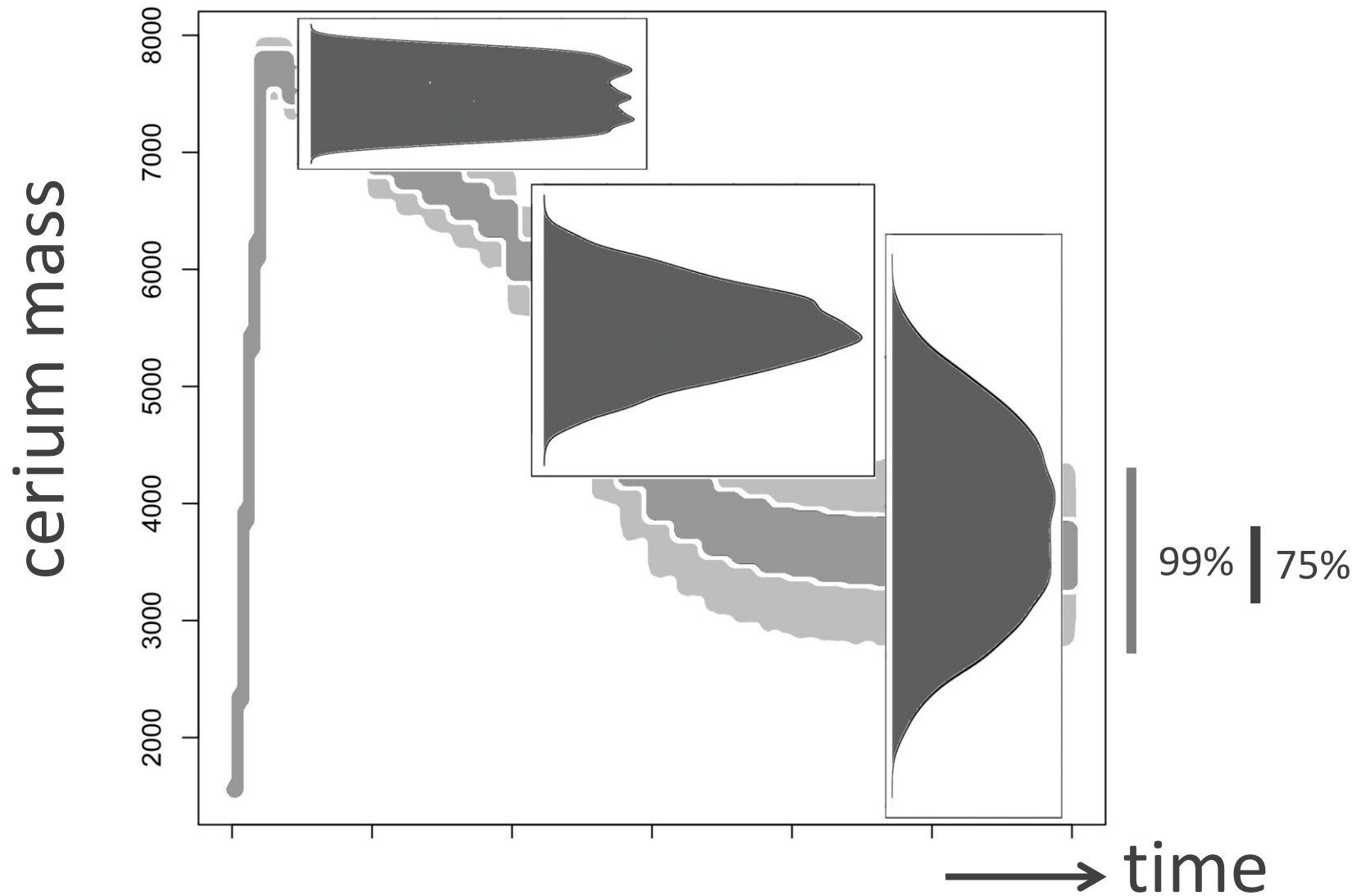
Aim of the study

- Structure of a dynamic stochastic flow model
- Associated uncertainties with their propagation
- Evidence for consistency of measurement results
- Benefits for future experiments

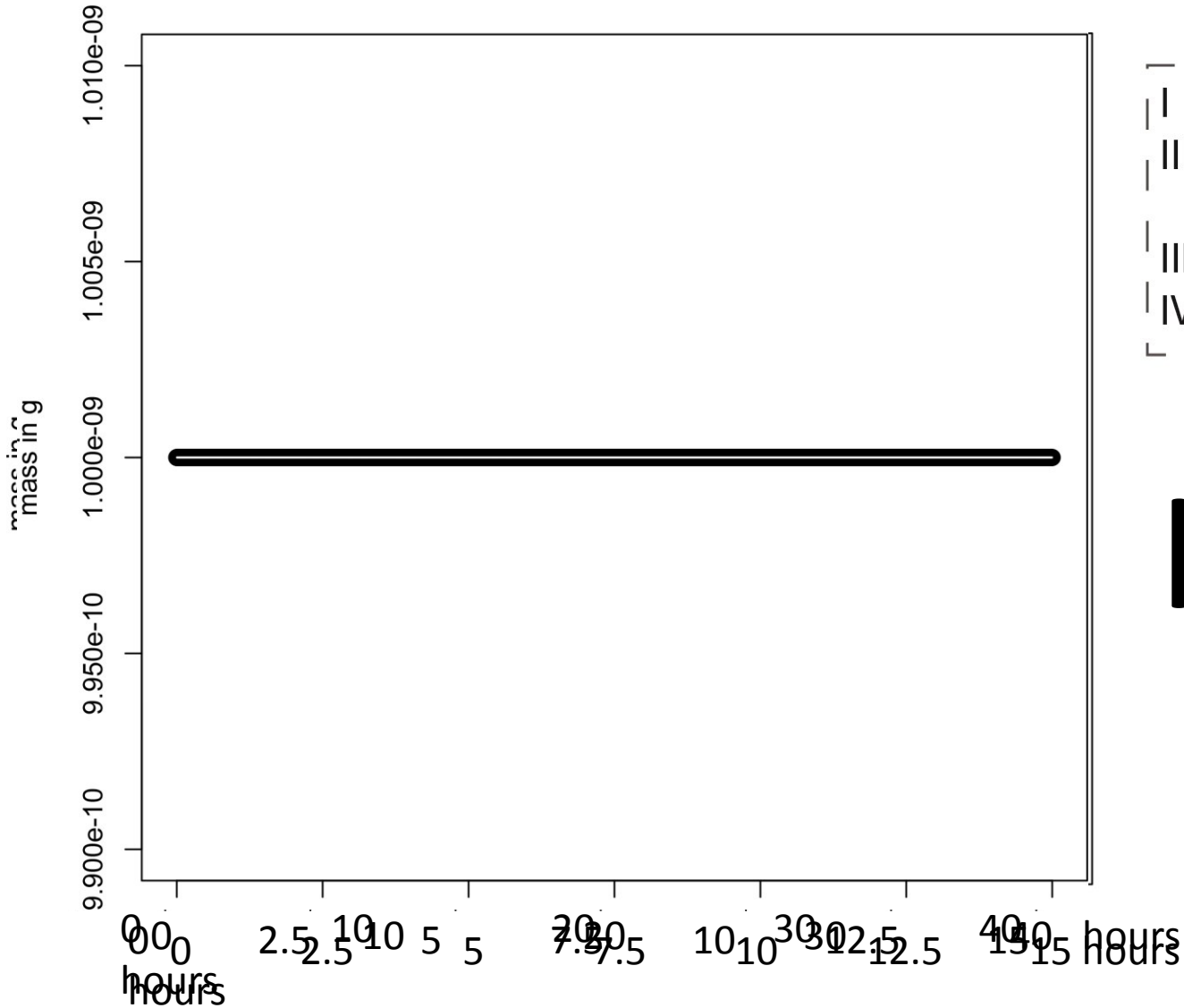
Model



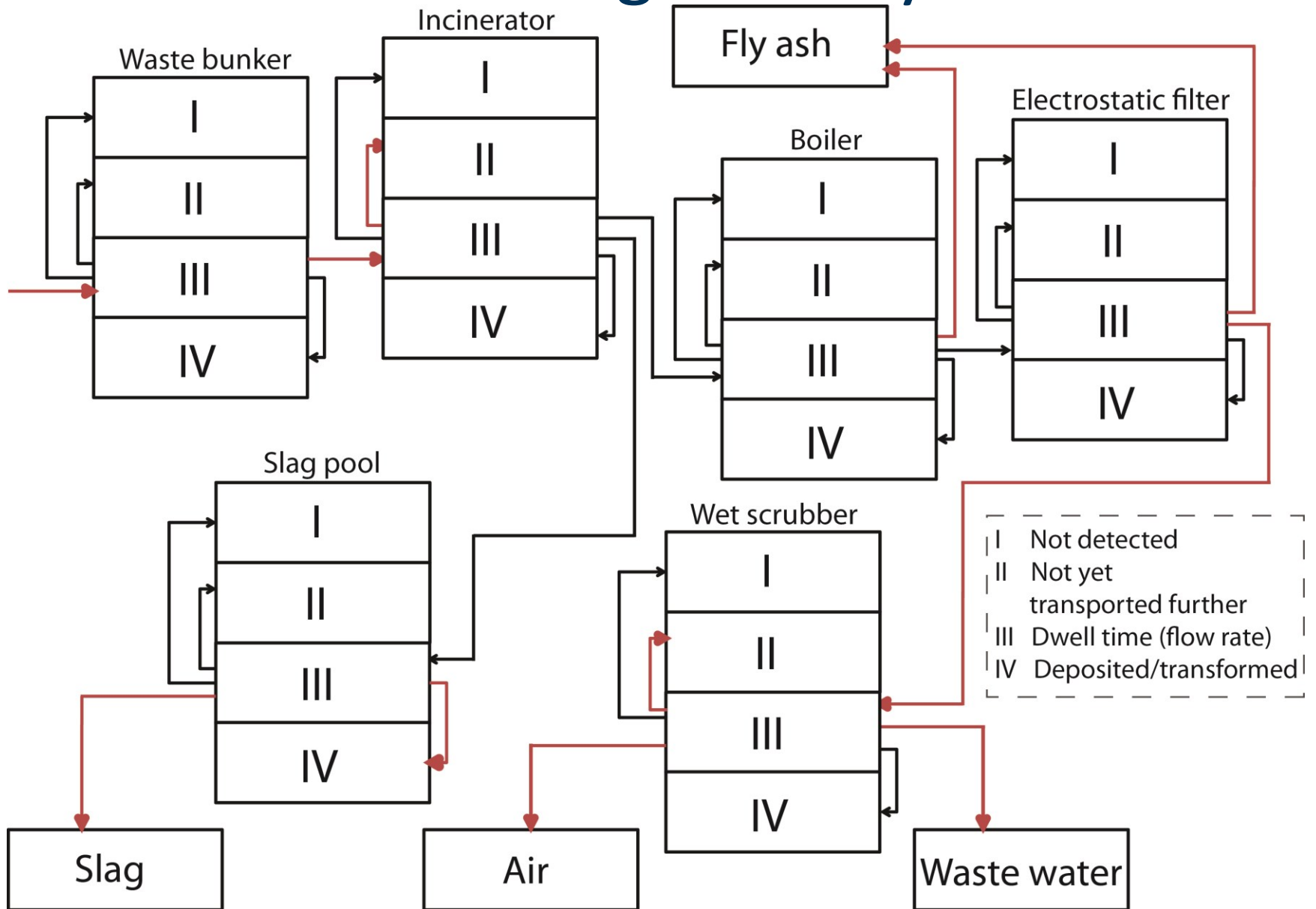
Output interpretation



Input data and uncertainty ranges

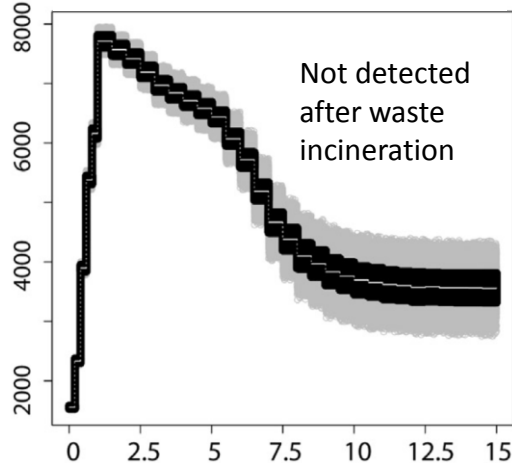
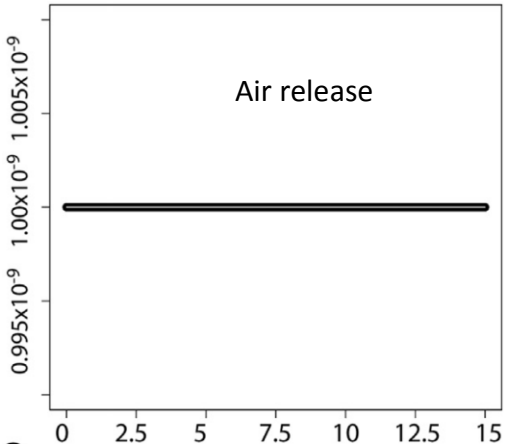
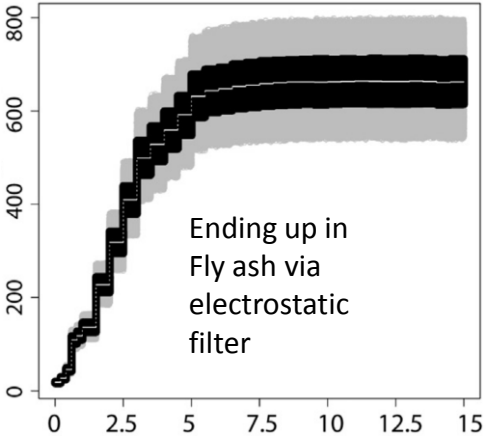
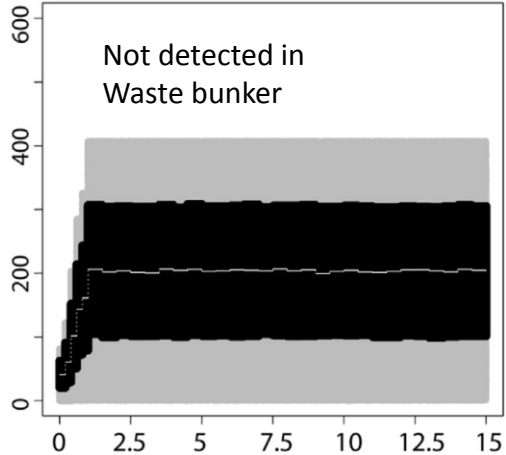
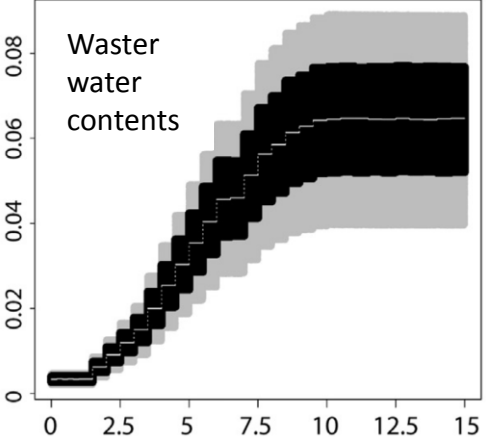
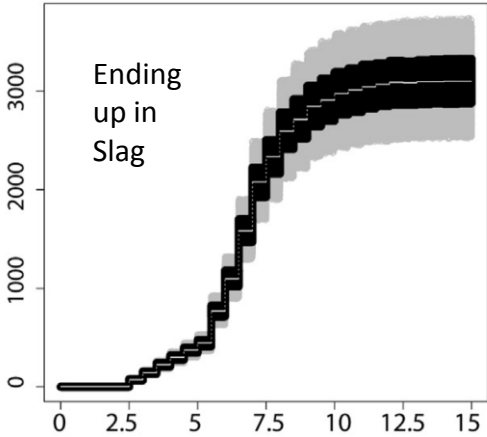


Model geometry



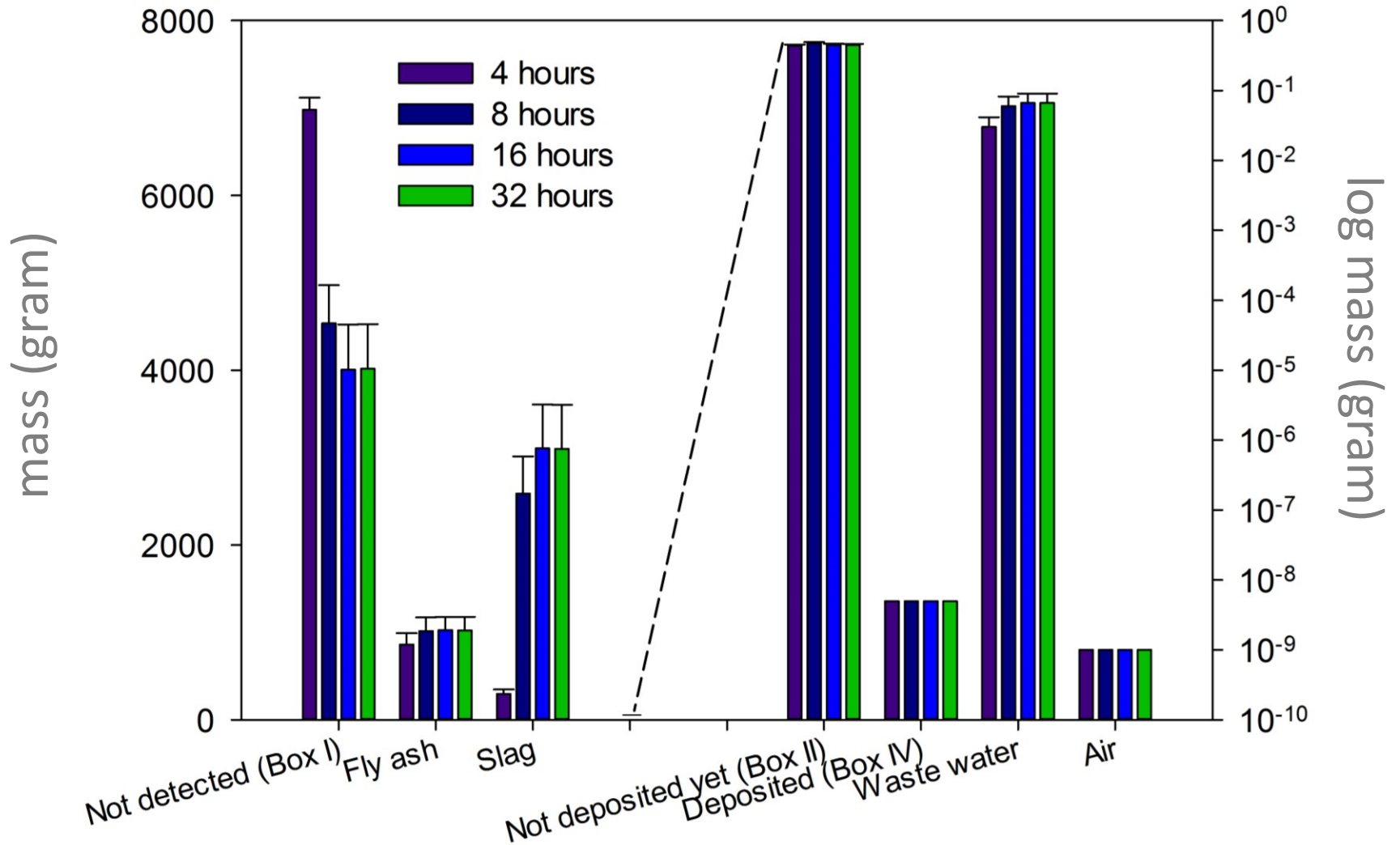
Some results

ENM mass in g



time in h

Overall recovery



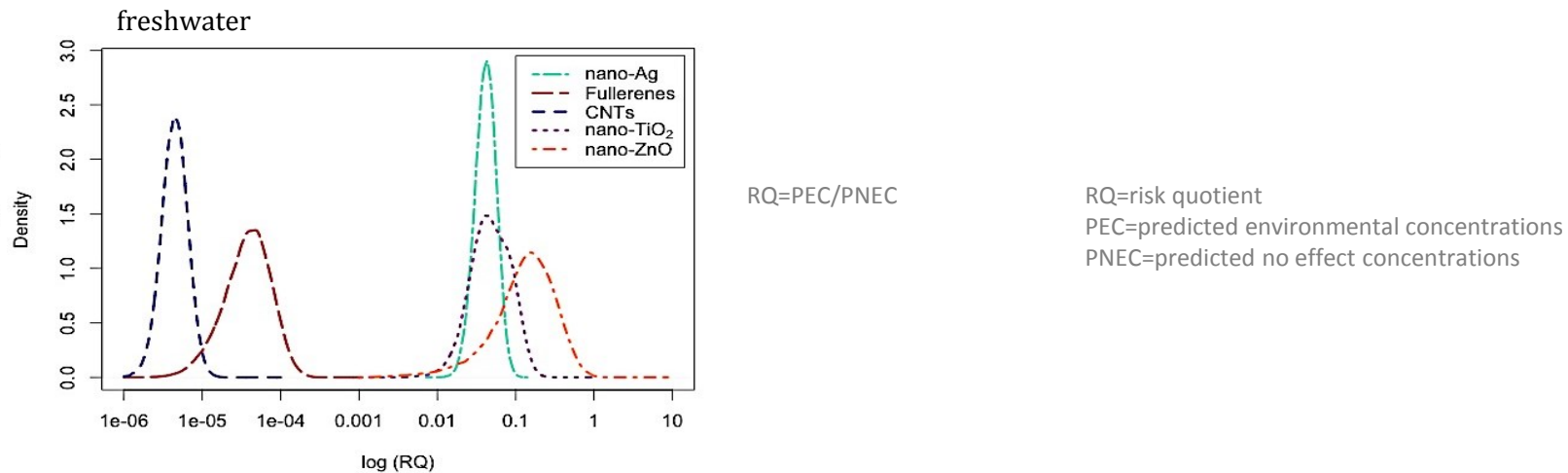
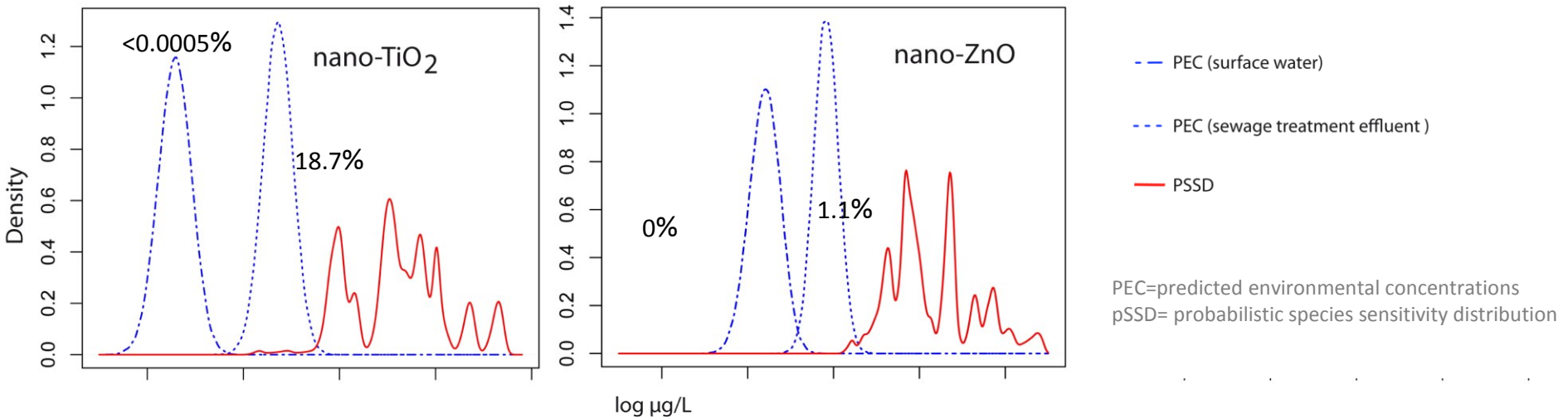
Conclusion

- Dynamic probabilistic flow model, based on real, time dependent measurements
- Model adds an additional flow in comparison to the measurements
- Consistency of measurement results
- Underlying mass flows are decisive for uncertainty range
- The model can be easily adapted to various types and conditions of MSWI plants

Outlook

- non-rhythmic material transfer, e.g. pulse releases
- inclusion of reactivity and bonding, and other chemical processes
- Added **new** engineered nanoparticles

... this helps improving fully probabilistic risk evaluation for engineered nanomaterial (ENM)



Gottschalk F, & Nowack B. (2013). Engineered nanomaterials (ENM) in waters and soils: a risk quantification based on probabilistic exposure and effect modelin. *Environ. Toxicol. Chem.*

Coll, C., Notter, D., Gottschalk, F., Sun, T.Y., Som, C., Nowack, B., submitted. Probabilistic environmental risk assessment of five nanomaterials (nano-TiO₂, nano-Ag, nano-ZnO, CNT, and Fullerenes).

Thank you for your attention!

<https://www.etss.ch/>

Acknowledgment **Tobias Walser**

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