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POLICY AND EXPLOITATION FACTSHEETS

FACTSHEET 5

FATE OF ENGINEERED NANOMATERIALS (ENMS) IN THE ATMOSPHERIC ENVIRONMENT

Even though ENM concentrations in the air are currently low (based on data considered up to 2015), the most recent model trends from 2015 to 2018 show increases in ENM atmospheric concentration, reaching up to 1 ng/m^3. These model concentrations are approaching maximum acceptable concentrations for heavy metals, which fall between 1 and 5 ng/m^3 depending on the specific heavy metal. In general, it seems that regional air can contain several weak sources of ENM, contributing to higher loads than the average. The ENMs are very likely to be found agglomerated with other particles that are often coated with adsorbed gases. ENM effects on atmospheric chemistry, however, are expected to be very low if not negligible.

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RECOMMENDATIONS

The NanoFASE combination of an experimental approach with exposure modelling proved to be the most straightforward way to improve the knowledge of fate and behaviour of ENMs in air. The experimental component consisted of a series of controlled laboratory-based experiments, as well as field observations with measurement campaigns, in order to be able to inform modelling input parameters as well as to validate the model outcome results. The lab-scale experiments conducted for selected particles achieved reaction rates and atmospheric baseline chemistry information. Results from the field measurements showed that the captured stack emissions were already present as large aggregates with two distinct size distributions: one a few hundred nanometers in size and a second few micrometers.

The data gained from these NanoFASE approaches could be used in long-range modelling to predict the dispersion of ENMs across Europe and the associated atmospheric effects. Overall results showed that the effects of ENMs on atmospheric chemistry are very low, as concentrations are generally low with the exception of areas close to the emission source (e.g. a factory). From the laboratory experiments, a very limited impact on atmospheric chemistry is expected because the high TiO_2 NM (Mio NP/cm^3) emissions would have to occur during high NO_x concentrations under high solar irradiation, which is not likely due to the fact that NO_x concentrations are highest during morning and evening rush hours when the solar irradiation is at its lowest.

While current OECD guidelines and CEN standards address topics such as the dustiness of nanopowders and the related ENM released into sectors including construction, more efforts should be undertaken to develop new guidelines for studying the release of ENM into the atmosphere. NanoFASE advanced development of a standardisable test setup to aerosolize ENMs and determine the effect of airborne ENMs on atmospheric chemistry. Further standardisation and feed-in of NanoFASE results into references including an OECD guidance document has been planned, but moving forward this should also be considered for additional references and methodologies.

RELATED NANOFASE DELIVERABLE REPORTS

D6.3: Report on the laboratory tests of airborne ENM on surface transformation and atmospheric chemical reactions.

D6.4: Report on the field tests of airborne ENM on transport, transformation and deposition

D6.5: Report on the field tests of airborne ENM on transport, transformation and deposition.

All NanoFASE deliverable reports are available at: **http://www.nanofase.eu/documents/reports**