The number of complaints relating to nuisance odour from industrial, farming or municipal waste and wastewater management facilities (MMFs) such as landfill sites, composting plants or wastewater treatment plants (WWTPs) are increasing. Odour complaints are now the second, after noise, most common subject of public complaints across Europe. Almost all MMFs are potentially noxious in olfactory terms however special attention should be paid to WWTPs in this context. Because of the regulations, such as the EU Water Framework Directive, applicable to the quality of wastewater discharged into water or soil, the number of WWTPs operated in European Union has been growing continuously. In many cases, especially WWTPs are located in a direct neighbourhood of residential areas, therefore the number of the facilities that local population could potentially complain has been on the increase, too. This impact has grown more significantly with expansion of suburbia and the associated rural and industrial encroachment, resulting in residential and commercial properties becoming in closer proximity to these facilities than in the past. More than half (54%) of the world's population live in cities and this proportion is expected to increase. Globally, by 2030 it is estimated that urban land cover will nearly triple, and most of the world's population will be exposed to anthropogenic climate change in urban areas. In the future the urban climate will likely be affected by additional summerly heat load due to climate change, associated with the increase of heat waves of higher intensities and longer duration. Those changes which has influence on urban heat islands will likely amplify an odour emission as this emission depends on the temperature and increases with its increase. Thus, it will likely cause an extension of the odorous range increasing the amount of population for odour exposure.

Typical odours emitted from WWTPs usually consist of a wide range of chemical substances - odorants whose possess possibility to trigger olfaction stimuli. The essential components being sulfur compounds, aromatic hydrocarbons, alcohols, nitrogen compounds, halogenated compounds, aldehydes and ketones. However, some of the odorants from WWTPs emissions are unknown or poorly described. Most strategies and projects to reduce odour emissions are based on the concentration of individual odorants, such as hydrogen sulfide, or based on odour concentrations (ou_E/m^3). Based on these values, the abatement capability is determined. These values are also data for modeling the dispersion of pollutants in the atmosphere and for assessing the impact of the emission source on the local receptors. However, this approach does not take into account the actual odour composition and changes in individual odorants concentrations over time.

The core objective of the project is the progress towards a deeper understanding of the odour composition and its kinetics with atmospheric components, especially for reaction with OH radicals, NO3 radicals, O3, Cl atoms and photolysis, as it is clearly a necessary step towards a better odour abatement techniques and legal regulations tools.

Identification of all odorants including those unknown from the WWTPs emission using state of the art advanced analytical techniques such as GC-MS/ODP and GC-QTOF-MS/MS will be used for odorants identification and quantification. Advanced computational methods will be used for modelling selected odorants kinetics into the atmosphere.

One of the expected results of this project realization will be the identification and quantification of all odorants from WWTPs emission. The knowledge about full chemical speciation and chemical transformations of individual odorants allows obtain atmospheric lifetime of every single chemical species individually with the respect on time of day. The third result will be the examination how different temperature scenarios will affect the odorous range of emission sources.

Thanks to realization of the research grant it is believed to confirm the hypotheses:

1. Odorous emissions from WWTPs are composed of a complex mixture of limited number odorants, however there are only few key odorants responsible for odour impact. 2. The atmospheric lifetime of odorants depending on time of day is a parameter within selection of key odorants. 3. Knowledge about the fully composition of odorants and their theoretical interaction with the atmosphere components allows selection of key odorants.

This interdisciplinary and multi-disciplinary project, at the borderline of environmental engineering science, offers a unique integration of approaches, competences and resources from analytical chemistry coupled with olfactometry via statistical and chemometric techniques (summarise, analyse, manage and interpret complex multivariate chemical and olfactory datasets) to atmospheric physics (odorants dispersion in the atmosphere, odorants interaction with ambient factors) and finally from biotechnology to environmental engineering (optimized odour emission processes to minimize odorant formation). The proposed three stage approach focused on the most fundamental understanding of odour composition, conducted with the well qualified three persons team and with the complementary support of international collaborators should allow for progressive and substantial progresses in the complex phenomenon of odour impact.