**Dose-response relationship for a wastewater treatment plant determined by a dispersion model and an annoyance survey**

**Yan Zhang 1,2, Weihua Yang 1,2, Günther Schauberger 3, Jianzhuang Wang1, Jing Geng 2, Gen Wang 2 and Jie Meng 1,2**

1 Tianjin Sinodour Environmental Technology Co., Ltd., Tianjin 300191, China

2 State Environmental Protection Key Laboratory of Odor Pollution Control, Tianjin Academy of Eco-Environmental Sciences, Tianjin 300191, China

3 WG Environmental Health, University of Veterinary Medicine, 1210 Vienna, Austria

Municipal wastewater treatment plants (WWTPs) are important facilities for urban management, which have been the major complaint sources of ambient odour pollution in China. To determine if annoyance can be expected at a certain site, an odour impact criterion OIC is necessary, using an odour concentration threshold and an exceedance probability. If the ambient odour exposure exceeds these two limit values, then this site is categorised by annoyance.

The OIC was determined by a dose-response relationship, which was conducted for a WWTP in the region Tianjin located in Northern China. The WWTP covers an area of about 295,000 m2 with a design treatment capacity of 400,000 m3/d waste water, which is collected from four administrative regions of Tianjin with a population of about 1.11 million and about 730 factories and enterprises. The ambient exposure (hourly mean values) was calculated by the Lagrange puff model, CALPUFF using various peak-to-mean factors to mimic human odour perception. The response was determined by the annoyance which was measured by face-to-face questionnaires. Cross-sectional questionnaires were obtained from twelve urban regions situated around the WWTP. A binomial logistic regression was used to describe the dose-response relationship between the model calculations of the ambient odour exposure and the annoyance level. Following confounders were used to improve the model fit: various peak-to mean factors and a temperature and daytime weighting. By these last two factors, those periods were determined, when residents are more sensitive to odour annoyance.

The odour exposures during “night-time of summer” were more suitable than during “a whole year” and “summer” in predicting odour-annoyance responses, which highlights the importance of temperature and daytime weighting. The best predictive performance for odour annoyance was found for an ambient odour concentration threshold of 4 ouE/m3 and an exceedance probability of 1% (99th percentile) during night-time of summer. This study provides a method to determine the OIC based on a dose-response relationship. This approach considers the specific situation of an urban environment and the related protection level, depending on the socio-economic situation of the citizens. The application of such a national OIC for China increases the acceptability and the reliability of the separation distance, calculated by the OIC.