



INSTITUT FÜR  
UMWELTPHYSIK



UNIVERSITÄT  
HEIDELBERG  
ZUKUNFT  
SEIT 1386

## Master Thesis:

### Determination of CH<sub>4</sub> Emissions from Biogenic Sources (Landfills, Wastewater Treatment Plants, Biogas Plants)

**Background:** Methane (CH<sub>4</sub>) is a potent greenhouse gas emitted in Germany mainly by ruminants, landfills, wastewater treatment plants, and biogas plants, as well as through leaks in natural gas pipelines. However, the emission factors from biogenic sources such as landfills, wastewater treatment plants, and biogas plants are subject to high uncertainties. Biogas plants contribute to reducing CH<sub>4</sub> emissions from agriculture, but leaks from imperfect sealing and opening of overpressure valves are the main cause of CH<sub>4</sub> emissions from these facilities, making them difficult to quantify. Spectroscopic techniques enable mobile measurements of greenhouse gases with sufficient accuracy. In our research group (GGWI), we apply various methods for mobile CH<sub>4</sub> measurements, including the determination of  $\delta^{13}\text{C}_{\text{CH}_4}$  isotopes, and continuously improve them through release experiments and comparison on campaigns.



**Objectives:** In this master's thesis, you will learn various aspects of scientific work, including laboratory measurements, campaign participation, and data analysis. To quantify CH<sub>4</sub> emissions of landfills, biogas plants and waste water treatment plants in the Heidelberg region, you will conduct regular measurement drives in the region using a car or bicycle. The measured values can then be analyzed with a Gaussian dispersion model and compared to emission factors from other studies and the national emission inventory.

**Requirements:** Interest in environmental physics questions, independent experimental work, and complex problem-solving. A driver's license (class B) is desirable. Programming skills in R and Python are advantageous (can also be learned during the project). Additionally, fluency in German language is required, as you will need to communicate with operators of biogas plants and other facilities in the Heidelberg region.

## Contacts:

If you are interested in this master's thesis, please do not hesitate to contact us.

**Dr. Martina Schmidt:** [Martina.Schmidt@uni-heidelberg.de](mailto:Martina.Schmidt@uni-heidelberg.de) Tel: 06221-545481

**Dr. Julia Wietzel:** [Julia.Wietzel@iup.uni-heidelberg.de](mailto:Julia.Wietzel@iup.uni-heidelberg.de)

## References:

Wietzel, J. B., Korben, P., Hoheisel, A., and Schmidt, M.: Best Practices and Uncertainties in CH<sub>4</sub> Emission Quantification: Employing Mobile Measurements and Gaussian Plume Modelling at a Biogas Plant, EGU sphere [preprint], <https://doi.org/10.5194/egusphere-2025-1344>, 2025.