# InGOS – Integrated non-CO2 Observing System

Detailed workplan, appendix to the online application. Request for access to an infrastructure (TNA1-TNA2-TNA3). The plan must not exceed 6 pages in 12 pt single line spacing, applications exceeding this limit will not be evaluated. The following information should be included in order to be evaluated:

1. **Project name (acronym), name and contact information of the researcher(s), duration of the project (dates, number of working days), type and name of the infrastructure requested**

**Project name:** Characterization of 13C signature of CH4 sources in Krakow and Silesia region, Southern Poland

**Researcher:** Alina Jasek

**Project duration:** 24-28 June 2013

**Number of working days:** 3

**Infrastructure requested:** TNA-2

1. **Background**
   1. Significance of the research

Methane is the second most important anthropogenic greenhouse gas. Having high global warming potential, its slightest unnatural concentration variations in the atmosphere can trigger disproportionate changes in the system. Besides natural sources such as wetlands, methane emissions to the atmosphere are mostly anthropogenic: industrial, agricultural or waste management. In the Silesia and Krakow region all these sources can be found, as well as the city's natural gas transmission network, from which possible leakages could be detected.

* 1. Previous research relevant to the topic and how the proposed project links to this

The emissions of methane from the urbanized area of Krakow and industrialized Silesia region have been studied for several years in Environmental Physics Group at AGH-UST. In 1999, Necki et al. took an attempt to construct a local CO2 and CH4 balance in Krakow, using the atmospheric concentration of both gases. They found that the largest anthropogenic methane source in Krakow at the time was a large leakage of this gas from the city gas network. Kuc et al. (2003) have been measuring seasonal variability of CO2 and CH4 atmospheric concentration as well as 13C and 14C isotope composition of both gases to find the increasing concentration over the years caused by anthropogenic emissions.

Upper Silesia, which is located West of the Krakow city, is the most industrialized region in Poland, with a number of coal mines. A proposed project is intended to be a part of extension of previous study of anthropogenic CH4 emissions in the city to industrial CH4 sources that can be found in the Silesia. In recent years, car transects throughout the Silesia and Krakow were performed using mobile CH4 concentration analyzer to find several methane sources across the region. However, only the spatial distribution and approximate strength of the sources were determined because of inability to measure stable isotopic composition of CH4. A proposed project makes it possible to perform such an analysis. The results will help to determine the sources of elevated CH4 atmospheric concentration encountered during the planned transects.

* 1. Links with current research of the applicant

I am interested in general topic of stable isotopes as a tool in ecological studies. Although my PhD is focused on CO2 biogenic sources in an urban area, I would like to expand the field of interest to other greenhouse gases, especially if it is possible to study its stable isotope abundances. The requested project also fits in the work of the Environmental Physics Group at AGH-UST, as it focuses on atmospheric greenhouse gases.

1. **Objectives**
   1. Hypothesis and research objectives

Previously encountered high concentrations of methane spatially distributed over the highly polluted Krakow and Silesia regions are mostly of unknown origin. The assumed sources in the region have distinct isotopic signatures, so with the 13CH4 analysis it should be possible to determine each source contribution to the elevated CH4 concentration.

* 1. Connection with the InGOS objectives and the ‘fitness’ of the use of the requested infrastructure to the objectives

The results of performed analysis are going to be a part of thorough study of methane emissions in highly polluted region. Determining the CH4 spatial distribution over the urbanized and industrialized area combined with its sources characterization will contribute to better understanding of this gas transport to the atmosphere.

1. **Methods and materials (legal and ethical issues)**
   1. Research method, explaining how to reach the objective

Two car transects throughout the Silesia and Krakow region are planned, with mobile CH4 concentration analyzer combined with a system to collect air samples for further isotope analysis. During the transect, CH4 concentration will be monitored online, as well as the GPS coordinates. When the high concentration event is noticed, the car will stop and air sample (or samples) will be taken. If possible, more thorough measurement will be performed, driving around the neighborhood of encountered event and taking more samples. The tedlar bags with sampled air will be sent to GGLES, and measured during the visit.

* 1. Research materials, instrumentation

The concentration measurement during the transects is being performed by Picarro analyzer provided by AGH-UST. Twenty tedlar bags for air samples are being supplied by the GGLES.

* 1. Governance procedures, safety precautions, permit requirements and procedures

After the transect campaigns, the air samples will be shipped to GGLES. Maximum expected time between the sampling and laboratory analysis is three weeks. No specific permissions are required.

1. **Implementaton: timetable, budget, distribution of work**
   1. Timetable for the research including personnel efforts, favorably table wise

|  |  |
| --- | --- |
| Date | Action |
| 1–15.06.2013 | Two mobile measurement and sampling campaigns, exact dates depending on the weather conditions. During each campaign it is planned to collect approximately ten air samples, depending on number of sources encountered. |
| 17-20.06.2013 | Shipment of the air samples. |
| 24-28.06.2013 | Travel to Egham, with a visit in GGLES Laboratory and 13CH4 analysis of samples (25-27.06). |

* 1. Total budget for travel and logistical support as requested

|  |  |
| --- | --- |
| Subject | Maximum expected cost |
| 1. Travel  - plane ticket KRK-STN  - train ticket Stansted - Egham | 120€  60€ |
| 2. Subsistence | 5 days x 50€ = 250€ |
| 3. Logistics  - air samples transport | 100€ |
| **Total** | **530€** |

* 1. Plan for specific logistal needs like visa, import/export licenses etc.

No specific needs are required.

1. **Expected results and possible risks**
   1. Expected scientific impact of the research

13CH4 analysis will complete the methane sources in the Krakow and Upper Silesia highly polluted region study. Determining the isotopic composition of CH4 sources will enhance the understanding of this gas emissions in highly transformed regions.

* 1. Applicability and feasibility of the research results

It is planned to use obtained data to design a map of CH4 sources spatial distribution in the region. In the future developing a simple model of CH4 balance in the atmosphere of urbanized and industrialized region is possible.

* 1. Publication plan

A publication of CH4 spatial distribution over the region of Krakow and Upper Silesia is planned. The results obtained in the frame of requested project will be an extend of existing research to a stable isotopic CH4 analysis.

* 1. Data access plan

The results will be published in the planned publication.

1. **Key literature**

Kuc T., Rozanski K., Zimnoch M., Necki J., Korus A., 2003. Anthropogenic emissions of CO2 and CH4 in an urban area environment. Applied Energy, 75(3-4), 193-203.

Necki J., Zimnoch M., Miroslaw J., Lasa J., 1999. Construction of local atmospheric CH4 and CO2 balance in heavily polluted urban areas on the example of Krakow city. Chemia analityczna, 44(5), 841-847.