Kortfattet dansksproget projektbeskrivelse egnet til publikation på dansk EMPIR hjemmeside

2016 Miljø 16ENV05	Metrology for nitrogen dioxide MetNO2

Projektets formål
Der kræves mere nøjagtige målinger af nitrogendioxid (NO_2) for bedre at forstå den eksponering mennesker udsættes for, for at forbedre modeller for luftkvalitet og mængden af udsendt NO_2, for bedre mulighed for at udlede koncentrationen af NO_2 over længere tid, og for at understøtte lovgivning omkring luftkvalitet og udledning af NO_2 fra biler. Dette er væsentlig for at kunne evaluere regulering af luftforurening og for at forstå effekten af menneskeskabt NO_2 udledning på klimaet. Projektet vil opnå den nødvendige nøjagtighed ved at udvikle teknologier til direkte måling af NO_2 ved brug af nyligt udviklede metoder og ved hjælp af direkte kalibrering med mere nøjagtige og stabile primære referencenormaler for NO_2.

Projektet er delt op i 5 arbejdspakker:
WP 1 High accuracy static primary reference gas standards
WP 2 Dynamic methods for the calibration of low amount fractions and dissemination to monitoring stations
WP 3 Spectroscopic measurements of nitrogen dioxide and impurity analysis
WP 4 Creating Impact
WP 5 Management and Coordination

Antal deltagere	Projektets budget[1]	Person-måneder
16	2 072 321 EUR	279
Dansk deltager	DFM Budget[1]	Person-måneder
DFM	70,052 EUR	6,9

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DFM's bidrag:

DFM deltager i WP3, WP4, og WP5.

The aim of work package 3 is to develop new spectroscopic measurement techniques and methods for direct measurements of NO_2 amount of substance fractions (Task 3.1), to develop spectroscopic methods for impurity analysis in NO_2 static and dynamic gas standards produced in WP1 and WP2 (Task 3.2), and to carry out a lab-based round robin and a field intercomparison on NO_2 amount fraction measurements (Task 3.3). Data quality objectives defined by WMO-GAW for ambient NO_2 measurements, will be targeted.
WP4 and WP5 are standard work packages.

Konkret deltager DFM i følgende faglige aktiviteter:

[1] Angives som EU finansiering (direct costs + 5 %)

A3.1.1 DFM, in collaboration with Empa, PTB, LNE and UoY, will perform a literature review on the selective NO_2 instruments that are available (known examples include: CAPS, IBB-CEAS, QCL, CRDS, CEAS) and their quoted specifications

A3.1.3 PTB, with input from DFM, will select an appropriate wavelength range for NO_2 and will develop a method for NO2 line data measurements. PTB's FTIR facility will be quantified for NO_2 line data measurements in the infrared, i.e. establishing appropriate procedures and metrology aspects on pressure, temperature and path length assessments.

A3.1.4 PTB will measure NO_2 line data at the wavelength range selected in A3.1.3 to support accurate NO2 amount of substance fraction measurements and the development of spectroscopic transfer standards. Measurements will be carried out on 3 high concentration (≥10 µmol/mol) NO_2 gas standards developed in A1.1.3. This work will address the traceability of the line strength results and the uncertainty analysis following GUM principles. A line data report, based on at least 3 gas standards of NO_2 in air measurements at ≥10 µmol/mol from A1.1.3, will be compiled. DFM will crosscheck the spectral analysis results of PTB by reviewing the fitting and analysis procedures (i.e. they will perform measurements on the same 3 high concentration (≥10 µmol/mol) NO2 gas standards using their spectroscopy facilities).

A3.1.5 DFM will develop a compact spectrometer (exact type to be determined, but CRDS is a possibility) for use in field trials and for qualification as a spectroscopic transfer standard, targeting a sensitivity of < 100 pmol/mol and operating with an uncertainty better than 2 nmol/mol. PTB will assist DFM with the development of an IR-laser spectroscopic standard for atmospheric NO_2 amount fraction measurements that will be carried out at DFM, by assessing suitable line parameters for spectral fitting and underlying design criteria. For development and calibration, a static gas standard with 1 µmol/mol NO2 concentration in synthetic air from A1.1.3 will be used. The portable dynamic gas standards from A2.1.3, generated by permeation methods, will be used to produce 6 NO_2 concentrations in the range of 10 nmol/mol – 500 nmol/mol. These will be used to test and validate the system.

A3.1.8 Using input from A3.1.1-A3.1.7, PTB, in collaboration with LNE, Empa, DFM and UoY, will write a report on the spectroscopic techniques that have been developed for direct NO_2 measurements and on the achieved uncertainties

A3.3.1 Based on input from Task 3.1, Empa, NPL, DWD, LNE, IL, DFM and METAS will undertake individual evaluations and characterisations of their own selective NO2 instruments in their laboratories (NB: METAS will only provide reference standards). The following instruments will be used: DWD (CAPS), LNE (IBB-CEAS) [A3.1.6], Empa (QCL) [A3.1.2], NPL (CRDS), DFM (CRDS) [A3.1.5], IL (CEAS or CAPS), UoY (CAPS) [A3.1.7], AU (CLD), FZ-Juelich (CLD). Empa, in collaboration with NPL, DWD, LNE, IL, DFM and METAS, will write a protocol for the characterisation and evaluation of selective NO2 instruments for direct NO2 measurements. The protocol will contain the concentration levels to be tested by the instruments (at least three), guidelines on the evaluation of noise, response time, linearity, cross sensitivities including the characterisation of analyser zeros and interferences. METAS and NPL will provide dynamic (METAS) and static (NPL) reference gas standards for zero air (pre-existing), NO (pre-existing), NO2 (from A1.1.3, A2.1.3), water vapour (pre-existing) and HNO3 (from A1.2.2, A2.2.2) to Empa, NPL, DWD, LNE, IL and DFM for the characterisation and evaluation of the analysers. Empa in collaboration with NPL, DWD, LNE, IL, DFM and METAS, will write a draft report on the characterisation and evaluation of selective NO2 instruments for direct NO2 measurements. This draft report will include results on the performance parameters of the different NO2 instruments outlined in the protocol.

A3.3.2 LNE, DWD, DFM, METAS, Empa, IL, UoY, AU and NPL will undertake a lab-based round robin comparison of NO2 quantification using the instruments stated in A3.3.1. LNE will draft a technical protocol for this comparison, for agreement by DWD, DFM, METAS, Empa, IL, UoY, AU and NPL. The protocol will contain the concentration levels to be tested by the instruments (at least three) and will describe whether a travelling static or a dynamic NO2 gas standard from A1.1.3 or A2.1.3 will be used. These standards will be analysed and spectroscopic amount of substance fractions will be compared to each other and to the standard's certified value. LNE will compile a report of the results for review by DWD, DFM, METAS, Empa, IL, UoY, AU and NPL.

A3.3.3. DWD, Empa, DFM, UoY, IL, AU and FZ-Juelich will undertake a field-based side-by-side comparison of the spectroscopic instrumentation specified in A3.3.1 at the SAPHIR atmospheric simulation chamber at FZ-Juelich. DWD will draft a technical protocol for this comparison, which needs to be agreed by Empa, DFM, UoY, IL, AU and FZ-Juelich. Static and dynamic NO2 reference standards, developed in A1.1.3 and A2.1.3, will be used at ≥ 3 concentrations in the range of 10 nmol/mol – 1000 nmol/mol to calibrate participating instruments. DWD will compile a report of the results, for review by Empa, DFM, UoY, IL, AU and FZ-Juelich. FZ-Juelich and AU will provide comparisons to the standard reference method with their CLD systems.

A3.3.5 UoY, with input from Empa, NPL, DWD, LNE, IL, DFM, METAS, AU and FZ-Juelich, will write a summary report on the comparison of the NO2 measurements, that were undertaken within A3.3.1–A3.3.3, to the existing standard reference method (based on chemiluminescence, EN 14211:2012). A3.3.6 PTB, in collaboration with Empa, NPL, DWD, LNE, IL, DFM, METAS, AU and UoY, will review the draft report from A3.3.1 on the characterisation of selective NO2 instruments for direct NO2 measurements and will send the revised report to the coordinator. Once agreed by the consortium, the coordinator will then submit the report to EURAMET as D6:'Report on the characterisation and evaluation of the direct NO2 instrumentation for long term ambient monitoring'. A3.3.7 DWD, in collaboration with LNE, Empa, DFM, UoY, IL, AU and FZ-Juelich, will review the comparison report from A3.3.5 on the field-based side-by-side comparison of spectroscopic instrumentations and will send the revised comparison report to the coordinator. Once agreed by the consortium, the coordinator will then submit the report to EURAMET as D7: 'Report on the field-based side-by-side comparison of selective NO2 instrumentation'.