DETAILS OF PROPOSED ACTIONS

C. Concrete (conservation/implementation) actions

ACTION C6 Inter-regional Air Quality Modelling

Beneficiary responsible for implementation:
Lead: VITO
Partners: MZP (CHMI), SHMU, Małopolska Region

Description (what, how, where and when):
Tackling the air quality problem in the hotspot region of Southern Poland, the Czech Republic and Slovakia requires collaboration and the establishment of a common air quality modelling platform between the regions.

In this action, an inter-regional framework for both emissions and air quality modelling, will be developed. The emission modelling component will build on the previous LIFE+ project WEISS (LIFE08 ENV/B/042), in which VITO developed EISS, a user-friendly and flexible emission inventory support software optimized to work with different types of emission sources and pollutants. The existing EISS tool will be adapted and applied to compile high resolution residential emission inventories for the different sub-regions. These emissions will then be integrated in a trans-boundary emission data set, required for regional air quality modelling. The air quality modelling component will build upon existing expertise and tools developed inside the LIFE+ project ATMOSYS (LIFE09 ENV/BE/000409), in which VITO developed a modular web based air quality management dashboard to support air quality management in any air pollution (hotspot) region. In this project, the module to generate air quality maps in near real time and for historic years (based on the RIO model), will be applied to the hotspot region. Moreover, the chemical transport model, CAMx, will be integrated in the framework, as to allow regional (emission reduction) scenario modelling.

The integrated emissions and air quality modelling framework will enable the calculation of homogeneous emission fields without boundary effects, thus suitable for integration in regional air quality modelling applications. Furthermore, background concentrations fields will be calculated for the whole region which then can be used as a common basis for the establishment of joint air quality policies. Adoption of the framework by each region/country involved will guarantee that the development and implementation of regional/national policies aimed at improving the air quality will be done in a homogeneous way, exploiting trans-boundary benefits.

A substantial amount of time will be foreseen for collaboration, training, and capacity building. Over the course of the project we have anticipated 6 technical workshops, 4 in phase 1 and the remainder in phase 2. The location of capacity building workshops will be chosen as to maximize the inter-regional collaboration. It is foreseen to hold one of the workshops in Prague, and the rest in Kraków in the Małopolska Region. As well as the workshops, MZP (CHMI) and SHMU will also hold a few bilateral consultations.

Task 1: Residential Emission Inventory

Development of a comprehensive high-resolution trans-boundary air emission inventory for emissions stemming from residential heating, which are of crucial importance in the region of interest. Residential heating is identified here as one of the main drivers of the observed air pollution.

Lead: VITO
Partners: MZP (CHMI), SHMU, Małopolska Region

Description:

Low-stack emissions (residential heating) are responsible for more than half of the PM_{10} emissions and at least 87% of the PAH emissions in Poland [Energy efficiency in Poland-2013 review, www.iee.org.pl]. Therefore, a specific task is dedicated to refining and updating existing residential emission inventories.

In this task, a common emission modelling framework, fulfilling the requirements of the 3 different sub-regions will be developed. This framework will build upon the Emission Inventory Support System – Air (EISSA), of which the EISS kernel was developed by VITO inside a previous LIFE project (WEISS, LIFE08 ENV/B/042). The EISSA system provides a user-friendly, flexible software framework optimized to work with different types of emission sources and pollutants. Apart from the framework itself, three independent applications (for Southern Poland, the Czech Republic, and Slovakia) providing local bottom-up residential emission inventories will be configured (based on data and methodologies of the respective regions). Since industrial emissions are required for action C4, the high resolution modelling for Krakow, Małopolska Region (using external contractor to prepare data) will also include the preparation of industrial emissions. Significant time will be allocated to capacity building and bilateral consultations between the partners.

Subtasks (and involvement of partners):

- **Workshop** to define an interregional harmonized bottom-up methodology to compile residential emission inventories and to establish user requirements with respect to EISSA - VITO, MZP (CHMI), SHMU and Małopolska Region (supported by external contractor).
- **Data collection and data management** - VITO, MZP (CHMI), SHMU and Małopolska Region (external contractor)
- **Development of EISSA framework**, based on the existing kernel, but adapted to regional specific requirements - VITO
- **Capacity building** to transfer the expertise and tools towards the different authorities responsible for emission compilation - VITO, MZP (CHMI), SHMU, Małopolska Region, and any relevant authorities from the different regions

Task 2: Trans-boundary Emission Data base

Compilation of a trans-boundary emission data base which includes bottom-up emission estimates for residential heating and enables the calculation of homogeneous inter-regional emission fields without boundary effects which are required for inter-regional air quality modelling.

Lead: MZP (CHMI)
Partners: VITO, SHMU and Małopolska Region

Description:

Multi-scale regional air quality models require emission fields for both the model domain covering the area under investigation (at a typical resolution of 3-5 km) and for the model domain covering the surrounding regional area (typically 2000 by 2000 km, resolution of about 25km), the latter to take into account remote emission sources and long range transport. This is in particular relevant for regional pollutants such as fine dust and ozone. The challenge is to integrate local emissions into large scale emission fields without creating boundary effects.

In this task, a trans-boundary emission data base, containing emission data sets for a reference year (2015) and for different emission reduction scenarios, will be compiled. This data base will build upon the most recent TNO-MACC emission inventory, which was initially developed by TNO, The Netherlands, within a European 7th Framework Programme (EU FP7 MACC), and which has ever since continuously been upgraded and updated. Within the spatially resolved European TNO-MACC emissions, the high resolution bottom-up emissions stemming from the residential heating of the different regions (Southern Poland, the Czech Republic and Slovakia), resulting from Task 1 will be integrated.

Subtasks (and involvement of partners):

- **Facilitate integration of bottom-up emissions** in existing top-down emissions (TNO-MACC) through dedicated functionality in the common emission modelling framework, EISSA - VITO
- **Integration of bottom-up emissions** in existing top-down inventory **for a reference year,** 2015 – MZP (CHMI), data provision by SHMU and Małopolska Region (external contractor)
- **Integration of bottom-up emissions** in existing top-down inventory **for different emission reduction scenarios** – MZP (CHMI), data provision by SHMU and Małopolska Region (external contractor)
- **Development of benzo[a]pyrene (BaP) emission data base for regional modelling** - SHMU, MZP (CHMI)

Task 3: Inter-regional Air Quality Modelling

Assessment of the regional air quality in the hotspot region of Southern Poland, the Czech Republic and Slovakia for the current situation and for (possible) future scenarios.

Lead: MZP (CHMI)
Partners: VITO, SHMU, Małopolska Region

Description:

In this task, a common, online, regional air quality modelling platform will be established for the whole hotspot region (Southern Poland, the Czech Republic, Slovakia) comprising of near real time and historic assessments using a geospatial interpolation model, RIO (Janssen et al, 2008), complemented with scenario calculations using a chemical transport model, CAMx. The RIO model allows for near real time, fast, accurate and spatially explicit visualisation of the measured concentration fields. Its (operational) deployment will require a common database of near real time concentration measurements for the whole region as well as GIS proxy data such as land cover. The CAMx model requires meteorological input data and emissions as delivered by the above tasks, and will allow investigations of emission reduction scenarios and their impact on the pollutant concentrations. Extensive comparison between the RIO and CAMx results, validation and calibration with measurements will ensure the quality of the information provided by the platform.

A common, inter-regional scenario calculation capacity is essential for the development of an effective abatement strategy in the region whereas the operational near real time mapping will contribute significantly to the understanding of observed cross-boundary air quality phenomena. Furthermore, the RIO concentration maps are essential for providing background concentrations to the high resolution modelling work planned under the actions C4 and C5.

Subtasks (and involvement of partners):

- **Implementation of BaP chemistry module to regional chemical transport model** - SHMU
- **Setting up and running** CAMx - MZP (CHMI)
- **Setting up and operational deployment of RIO** for near real time and historic air quality assessments – VITO
- **Capacity building** to transfer the skills required to operate the RIO and CAMx models going forward to the relevant authorities from the different regions
- **Intercomparison of CAMx and RIO model results** - MZP (CHMI), VITO
- **Combination of CAMx and RIO tools** (i.e. calibration of CAMx reference results with RIO model results) for the evaluation of the emission reduction scenarios – MZP (CHMI), VITO

References

Janssen S., Dumont G., Fierens F. and Mensink C., 2008, Spatial interpolation of air pollution measurements using CORINE land cover data, Atmospheric Environment 42, 4884-4903

Reasons why this action is necessary:

Tackling air quality problems in hotspot regions requires collaboration and the establishment of common emissions and air quality modelling platforms between the different administrative units identified within the hotspot, in our case being the Małopolska Region, the Czech Republic and Slovakia, as air pollution is a trans-boundary phenomenon.

This action will lead to trans-boundary harmonization of emissions and regional air quality modelling through the development of a common, inter-regional framework for assessment of both emissions and concentrations. Adoption of the framework by each region/country involved will guarantee that the development and implementation of regional/national policies aimed at improving the air quality will be done in a homogeneous way, exploiting trans-boundary benefits. Moreover, the framework will facilitate cooperation between different regions and allow for harmonization of abatement strategies.

Also at local scale this action will have a significant impact. Application of the tools in the different sub-regions will help the local partners to improve emission reporting obligations, to elaborate on evolving towards cleaner heating systems, to assess plans for air quality improvements, and so on. Not in the least, the framework will provide access to resources (air quality modelling tools) which are currently lacking and thus hindering the implementation/assessment of their air quality plans.

Constraints and assumptions:

This action uses an extensive amount of input data: activity data on residential heating systems required to compile bottom-up emissions (Task 1), meteorological data to simulate pollutant concentrations with CAMx (Task 3), and ground based measurements to set up the RIO model and to validate the modelling setups (Task 3). In order to set up RIO in operational mode (Task 3), it is required that near real time data are available for the three different regions (Małopolska Region, the Czech Republic, and Slovakia). Moreover, transfer of the data to a central data repository should be made available.

The success of this action partly relies on the availability and quality of these data. The emissions and air quality modelling frameworks have been extensively validated within the previous LIFE projects. Moreover, they have been applied for various applications in other regions, yielding a solid base to build the platform for the hotspot region.

Expected results (quantitative information when possible):

The common modelling framework proposed in this action will enable the calculation of homogeneous emission fields over the region of interest. Such an homogeneous approach implemented via a common emission inventory support system (EISSA) will result in enhanced cooperation and a harmonised approach in

the calculation of bottom-up emissions. Furthermore, a common emission inventory for the whole region can easily be integrated inside a regional air quality model, thus guaranteeing that the development and implementation of regional/national policies aimed at improving the air quality will be done in a homogeneous way, exploiting trans-boundary benefits.

Task 1 will lead to a comprehensive high-resolution regional trans-boundary air emission inventory for emissions stemming from residential heating. These emissions which are of crucial importance in the region of interest in terms of air quality will be integrated in the trans-boundary emission data base specified in Task 2. This database is a key input to the regional modelling proposed in Task 3.

The operational air quality assessments in Task 3 will be made available on a dedicated online platform based upon technology developed during the ATMOSYS (www.atmosys.eu) LIFE+ project.

Cost estimation:

€349,670 exclusive of the Małopolska external contractor budget & the 7% overhead

Costs are primarily based on the costs for the various air quality (emissions) modelling experts (with support from their ICT colleagues), from each of the core implementing expert organisations, VITO, MZP (CHMI) and SHMU, to deliver the various air emission databases and tools, and provide capacity building and training. VITO will also need some man days to co-ordinate the whole action over the phases. Most of the 6 partner meetings, workshops and capacity building will take place in Malopolska, but it is foreseen to hold one of the workshops in Prague, and maybe another in Bratislava. Bilateral partner consultations are also planned between MZP (CHMI) and SHMU.

VITO = 325days * €688/day (€223,600) & €13,440 for 12 meetings/training events (2 persons)
MZP = 296days * €120/day (€35,520) & €7,752 for 15 meetings/training/ consultations events (1-4 persons). Plus an extra 60days * €62/day (€3,720) for specific project administrative assistance.
SHMU = 480days * €90-€105/day (€48,150) & €17,488 for 16 meetings/training/ consultations events (2-4 persons)

Enter details on role (data provider) and costs for Małopolska Region external contractor:

Deliverables:

30/09/2016 – EISSA emission modelling framework (Task 1) available for the three different regions (the Małopolska Region, the Czech Republic and Slovakia)

31/12/2016 – High resolution residential emission inventories (Task 1) compiled for the three different regions (the Małopolska Region, the Czech Republic and Slovakia)

31/03/2017 – Trans-boundary emission data base (Task 2) available

30/09/2017 – Regional air quality assessment report and data base (Task 3) available

31/12/2017 – Operational RIO set-up, providing near real time air quality information for the whole hotspot region, available

Milestones:

31/12/2016 – The staff in the three different regions (the Małopolska Region, the Czech Republic and Slovakia) are trained in the configuration and the use of the EISSA modelling framework

31/12/2016 – First setup of RIO for the whole hotspot region, available

31/12/2017 – The staff in the three different regions (the Małopolska Region, the Czech Republic and Slovakia) are trained in the configuration and the use of the RIO interpolation model

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DELIVERABLE, MILESTONES AND REPORTING SCHEDULE

MAIN DELIVERABLE PRODUCTS OF THE PROJECT

Name of the Deliverable	Code of the associated action	Deadline
EISSA emission modelling framework (Task 1) available for the three different regions (the Małopolska Region, the Czech Republic and Slovakia)		30/09/2016
High resolution residential emission inventories (Task 1) compiled for the three different regions (the Małopolska Region, the Czech Republic and Slovakia)		31/12/2016
Trans-boundary emission database (Task 2) available		31/03/2017
Regional air quality assessment report and database (Task 3) available		30/09/2017
Operational RIO set-up, providing near real time air quality information for the whole hotspot region, available		31/12/2017

MAIN MILESTONES OF THE PROJECT

Name of the Milestone	Code of the associated action	Deadline
The staff in the three different regions (the Małopolska Region, the Czech Republic and Slovakia) are trained in the configuration and the use of the EISSA modelling framework		31/12/2016
First version of the RIO interpolation model with regional background concentration maps available		31/12/2016
The staff in the three different regions (the Małopolska Region, the Czech Republic and Slovakia) are trained in the use of the RIO interpolation model		31/12/2017

ACTIVITY REPORTS FORESEEN

Type of report	Deadline

TIMETABLE

List all actions ordered by number and using their numbers or names. Tick as appropriate.

Action	2015	2016				2017				etc.			
Number/name	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
A. Preparatory actions, elaboration of management plans and/or action plans :													
C. Concrete (conservation/implementation) actions :													
EISSA emission modelling framework (Task 1) available for the three different regions (Małopolska Region, the Czech Republic , and Slovakia)													
High resolution residential emission inventories (Task 1) compiled for the three different regions (Małopolska Region, the Czech Republic , and Slovakia)													
Trans-boundary emission data base (Task 2) available													
Regional air quality assessment report and data base (Task 3) available													
Operational RIO set-up, providing near real time air quality information for the whole hotspot region, available													
D. Monitoring of the impact of the project actions													

E. Public awareness and dissemination of results :													
F. Project management and monitoring of project progress:													