Estonian, Latvian & Lithuanian Environment

# Preparation of national emission reduction and ambient air quality assessment programmes

***EuropeAid/114743/D/SV/LT***

# Final Report

**Period:** March 11 – June 10, 2006

**Beneficiaries:** Ministry of Environment and the Environmental Protection Agency

**Contract Number:** 2003.004-341.04.02.01.001

**Consultant:** SIA *Estonian, Latvian & Lithuanian Environment* (ELLE) in association with *Ecolas* and *Cambridge Environmental Research Consultants* (CERC)

**Expiry Date of Contract:** August 8, 2006

August 31, 2006
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Preparation of national emission reduction and ambient air quality assessment programmes (Contract Number: 2003.004-341.04.02.01.001): Final Report

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| For the Consultant:<br><br>Valts Vilnītis<br>Managing Director<br>SIA *Estonian, Latvian & Lithuanian Environment* | Signature<br><br>Date of submission: |
| For the Beneficiary: | Signature<br><br>Date of approval: |
| For the Contracting Authority:<br><br>Central Project Management Agency | Signature<br><br>Date of approval: |

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# 1. Introduction

This is the Final Project Report of the *EuropeAid* project *Preparation of national emission reduction and ambient air quality assessment programmes* (*EuropeAid/114743/D/SV/LT*) (hereinafter the project), prepared by *SIA Estonian, Latvian & Lithuanian Environment*, together with *Cambridge Environmental Research Consultants Limited*, and *Ecolas N.V.* (the Consultants). The overall objective of this project was to assist the Republic of Lithuania in developing the system for emission control, air quality assessment and management on different scales according to the relevant EU requirements.

The Terms of Reference define that "the Final Project Report shall be submitted not later than 60 days after the end of the period of execution defined in Article 5 of the Special Conditions of the contract" (August 8, 2006). "The draft version of the Final Project Report shall be submitted not later than 30 days after the end of the period of execution of the contract." The Steering Committee has decided that the draft version of the Final Report should be submitted on July 31, and the final version on August 31, 2006. Final version includes comments, received during the last SC meeting on August 4, 2006.

According to the Terms of Reference, the Final Project Report should include:

- A summary description of all activities, results and outputs within the project;
- An assessment of the impacts and benefits of the project;
- A critical review of any problems which may have arisen during the performance of the contract;
- Outlines of suggested terms of reference for any follow up projects which might be valuable; and
- All project output documents.

In line with the above requirements, the report provides an insight into the activities carried out, results achieved and outputs produced during the entire duration of the project (Section 2). It also focuses on potential impacts and benefits of the project (Section 3). Section 4 analyses the problems that were encountered by the project team, while Section 5 contains recommendations and suggestions for follow up activities and projects, which would ensure further strengthening of emission control and air quality management systems in Lithuania.

Annex I reflects the implementation time schedule in comparison with the original Work Plan. The remaining Annexes include all project outputs; the full list of outputs is in Annex II, and all documents produced by the project are included in electronic form on the CD (Annex III). Several project outputs, which can be used by a wider group of users as stand-alone documents, are also attached to the report as paper copies in separate volumes: an update for the National Programme for the Implementation of Directive 2001/81/EC (Annex IV); a Report on proposed improvements for the system for emission control in Lithuania (Annex V); modelling case studies from Panevėžys city and Elektrėnai Power Plant (Annex VI – electronic version only); and a Guidebook on ambient air quality assessment (Annex VII).

# 2. Summary description of the activities, results and outputs

According to the Work Plan, which was adopted with the Inception report, for better overview and easier planning and monitoring all project activities were grouped as follows: procurement (A); legal framework, institutional and administrative system (B); emissions inventory and national programme for progressive reduction of emissions (C); air quality modelling and assessment (D); and guidelines and training (E). In this Section the Consultants review all of the 17 activities carried out, results achieved and outputs produced during the entire duration of the project. The time schedule, reflecting implementation of these activities in comparison with the original Work Plan is attached to this report as an Annex I.

## *A. Procurement*

The procurement component of the project (A, comprising activities A1 and A2, and activity D1) is complete, the air pollution dispersion models were selected and delivered, and staff of the EPA have received initial training on using these models.

The project team has provided air quality expert Sarah Wilkinson, technical expert David Carruthers and procurement expert Justas Kapočius, while ELLE has ensured overall supervision of Consultants' input in this component. The Consultants' input to the component was limited to the preparation of tender documents, while assistance in the selection and evaluation process was not requested by the beneficiary.

The chosen models were:
- SAM-S for emergency modelling;
- SELMAGIS AUSTAL for industrial modelling; and
- SELMAGIS MEMO-MUSE for regional and urban modelling.

Due to factors beyond the Consultants' control, a full set of technical characteristics of the above models and the models themselves were received significantly later than initially scheduled. As availability of the air pollution dispersion models in the EPA was crucial for successful implementation of a number of other activities, the Consultants developed an alternative solution for the implementation of other components, based on the available software (please refer to Component D below).

**Activity A1.** Assessment of needs for required software and hardware equipment (4.2.16. in the ToR).

On the basis of outputs of the Activity D1, Selection of suitable air quality models and other mathematical techniques based on the current ambient air quality situation in Lithuania, the Technical Specification of software requirements was completed and inserted as part of Section C of the Model Procurement tender.

After some discussion between the EPA and CERC experts, it was decided to split the software requirement into two Lots, as follows:

- Lot 1: Industrial Dispersion Modelling Software, comprising:
    - *An Industrial Dispersion Model, for the assessment of emissions from industrial sites in Lithuania;* and
    - *A basic emergency response model, to allow the emergency services to respond to a major incident.*
- Lot 2: Air Quality Models/Systems: Regional Assessment, Forecasting and Urban Assessment, comprising:
    - *A regional air quality modelling system for the assessment of air quality and deposition of pollutants across Lithuania;*
    - *Air Quality Forecasting System;* and
    - *Urban Air Quality Model.*

In each case, a table was provided in the form of a checklist to assist the tenderers in organising their technical tender, presenting the key model features required.

The software requirements were divided between the two Lots according to the nature of the air quality assessment to be carried out using each package, paying particular attention to the role that each model is likely to play in air quality assessment in Lithuania. The industrial models are likely to be used mainly for the regulation of industrial sources rather than assessment of air quality as a whole in any agglomeration or region. In addition, it seemed likely that potential providers of each software package would find it difficult to provide all software packages. For these reasons, it was logical to split the software into two Lots in this way.

The procurement expert, in close cooperation with the EPA, assessed the needs for hardware equipment. As a result, a Technical specification for Lots 1 and 2 was prepared.

The *output* of the Activity A1 is a Technical Specification of software and hardware requirements (attached as Annex I to the first Interim Report, August 2005), covering Lots 1, 2, 3 and 4, which is based on a *needs assessment of required models, software and hardware equipment.* The Technical specification formed a part of a call for tenders, published on June 28, 2005.

**Activity A2.** Assistance to the Beneficiary Institution during the tendering period providing necessary consultations for purchase of identified software and hardware equipment (4.2.17. in the ToR).

The Consultant provided assistance to the EPA by compiling tender documents in Lithuanian and English languages. *Assistance to the Beneficiary Institution during the tendering period* was constantly available through the expertise of the procurement expert, supported as appropriate by the Team Leader, air quality expert and technical experts. However, the Beneficiary did not request advice on the technical and financial assessment of tenders, assistance in communication with the tenderers or participation in the Evaluation Committee.

The tendering period finished on November 30, 2005, when the last procurement contract was signed.

## *B. Legal and institutional framework*

This component was carried out by a group of Lithuanian and international experts and all inputs were coordinated by Aiga Kāla from ELLE. Dalia Foigt, Ieva Žebrytė, Stasys Drazdauskas provided the necessary legal expertise, while Valts Vilnītis, Rūta Bubnienė, Evija Brante, and Rasa Ščeponavičiūtė worked on the institutional issues.

**Activity B1.** Preparation of the Gap analysis of Lithuanian legislation and administrative/institutional system for the air quality management in relation to relevant EU Directives (4.2.1. in the ToR).

The legal experts have reviewed and evaluated the following legal acts of the Republic of Lithuania (Laws, Governmental Resolutions (GR), Orders of the Ministers (MO) of Environment (MoE) and Health (MoH)):

- Law of the Republic of Lithuania No. VIII-1392 of 4 November 1999 on Ambient Air Protection (hereinafter referred to as "the Law on Ambient Air Protection");
- Common Order of MoE & MoH No. 591/640 "On Designation of Ambient Air Pollution Norms" of 11 December 2001 (hereinafter referred to as "the Order on the Ambient Air Pollution Norms");
- Order of the MoE No. 596 "On Ambient Air Quality Assessment" of 12 December 2001 (hereinafter referred to as "the Order on the Ambient Air Quality Assessment");
- Order of the MoE No. 517 "On Affirmation of the Ambient Air Quality Assessment Programme" of 23 October 2003 (hereinafter referred to as "the Ambient Air Quality Assessment Programme");
- Common Order of the MoE & MoH No. 470/581 "On Affirmation of List of Zones and Agglomerations for Assessment and Management of Ambient Air Quality";
- Common Order of MoE & MoH No. 544/508 "On Affirmation of the ozone norms and assessment in the ambient air" of 17 October 2002 (hereinafter referred to as "the Order on the Ozone norms and assessment"); and
- Order of the MoE & MoH No. D1-265/V-436 "On the Approval of the Order of Provision of the Information on the Ambient Air Pollution Levels Exceeding the Alert or Information Thresholds to the Public and Concerned Institutions" of 26 May 2005.

Other legal acts were taken into account as much as they were related to the integration of the EU Air Quality legislation into the cross-sectorial regulations.

Following the assessment of relevant Lithuanian and EU Ambient Air Quality legislation, conclusions were drawn on the compatibility of Lithuanian law with the following directives:

- Council Directive 96/62/EC of 27 September 1996 on ambient air quality assessment and management (Air Quality Framework Directive);
- Directive 2004/107/EC - Official Journal L 23 of 26 January 2005 (4$^{th}$ Daughter Directive);
- Directive 2002/3/EC - Official Journal L 67 of 9 March 2002 (3$^{rd}$ Daughter Directive);
- Directive 2000/69/EC - Official Journal L 313 of 13 December 2000 (2$^{nd}$ Daughter Directive); and

- Directive 1999/30/EC - Official Journal L 163 of 29 June 1999 (1st Daughter Directive).

Further, as cross-sectorial issues were examined, additional legislation regulating IPPC permitting and EIA, as well as selected health protection legislation, were assessed, as follows:

- Constitution of the Republic of Lithuania (hereinafter "the Lithuanian Constitution");
- Order of the MoE No. V-586 "On Rules for Establishment of Boundaries and Regime of Sanitary Protection Zones" of 19 August 2004;
- Order of the MoH No. 512 "On approval of the Hygiene Norm HN 35:2002 "Affirmation of the Limit Values for the Air Polluting Substances in the Residential Environment" of 18 October 2002 (hereinafter referred to as "HN 35:2002");
- Law of the Republic of Lithuania No. I-1495 of 15 August 1996 on Environmental Impact Assessment of the Planned Economic Activity;
- Law of the Republic of Lithuania No. I-1495 of 21 June 2005 Amending the Law on the Environmental Impact Assessment of the Planned Economic Activity;
- Order of MoE No. 80 "On the Approval of the Rules for Issuance, Renewal and Annulment of the Integrated Pollution Prevention and Control Permits" of 27 February 2002; and
- Order of the MoE No. 262 "On the Approval of the Regulations for the Preparation of the Environmental Impact Assessment Programme and Report" of 30 June 2000.

According to the findings of the Gap analyses, the following documents shall be amended to ensure compliance with the EU AAQ legislation:

- The Law of the Republic of Lithuania No. VIII-1392 of 4 November 1999 on Ambient Air Protection (hereinafter referred to as the Law on Ambient Air Protection);
- Common Order of MoE & MoH No. 591/640 "On Designation of Ambient Air Pollution Norms" of 11 December 2001 (hereinafter referred to as "the Ambient Air Pollution Norms");
- Order of the MoE No. 596 "On Ambient Air Quality Assessment" of 12 December 2001 (hereinafter referred to as "the Order on the Ambient Air Quality Assessment");
- Order of the MoE No. 517 "On Affirmation of the Ambient Air Quality Assessment Programme" of 23 October 2003 (hereinafter referred to as "the Ambient Air Quality Assessment Programme");
- Common Order of the MoE & MoH No 470/581 "On Affirmation of List of Zones and Agglomerations for Assessment and Management of Ambient Air Quality"; and
- Common Order of the MoE & MoH No. 544/508 "On Affirmation of the Ozone Norms and Assessment in the Ambient Air" of 17 October 2002 (hereinafter referred to as "the Ozone Norms and Assessment").

In general, the transposition was found to be close to complete. However, in addition to some minor structural changes and awaiting transposition of the Fourth Daughter

Directive, key policy issues must be reconsidered and some legislature, as well as working guidelines, amended in the Environmental and Health policy areas.

For the transposition of Directive 2004/107/EC, it was recommended to amend the Order on the *Ambient Air Pollution Norms* and the Order on the *Ambient Air Quality Assessment* to include the pollutants regulated by the directive in question.

Other conclusions from the legal gap assessment were:

- The system of ambient air pollution control parallel to the ambient air protection, as applied in residential and recreational territories, and managed by the Ministry of Health, is not fully in line with AQFD requirements;
- Legislation establishing sanitary protection zones (SAZ) in terms of ambient air pollution allows for the possibility of increased pollution within sanitary protection zones, while under the requirements of the EC law, the ambient air as a whole must be protected. The limit values for air pollution are set and must be ensured without any exceptions; and
- A number of regulations which govern IPPC permitting and EIA procedures and some guidelines on the implementation of air protection legislation shall carry a reference to the appropriate limit values.

The institutional experts carried out analysis of the administrative and institutional structure to implement the requirements of the EC AQFD and the four Daughter Directives in Lithuania. It was concluded that the hard core of the administrative and institutional structure for air quality management is in place. It is built by the key players; the Ministry of Environment (MoE), with its subordinated institutions and municipalities. Thus the implementation of these directives does not require an establishment of new institutions or structures within existing institutions.

To ensure full implementation of the EC requirements in the area of AQM and to adjust the administrative and institutional structure correspondingly, a number of recommendations were made. These recommendations are included in Section 5 of this Report.

One of the o*utputs* of Activity B1, *Report on legal gap inventory*, also containing an *action plan for the elimination of the identified gaps*, was included with the first Interim report (August 2005), while the other *output*, *Assessment of the institutional and administrative capacities needed for the successful implementation of the ambient air quality legislation*, was annexed to the second Progress report (October 2005).

**Activity B2.** Development of draft legal acts transposing the requirements of EU Directive 2001/81/EC and of Framework Directive (96/62/EC) and subsequent Daughter Directives on ambient air quality assessment and management into Lithuanian legislation on the basis of the above gap inventory (4.2.2. in the ToR); recommendations for improvements in institutional and administrative system.

Implementation of this activity started after the approval of the reports produced in the framework of the Activity B1.

A number of steps were undertaken to further develop the scope of changes required for the Lithuanian legal system to become conformant with the EU AAQ legislation.

Between August 2005 and March 2006 several meetings took place whereby the reconciliation of interests of the Ministry of Environment and Ministry of Health in the AAQ sphere were discussed:

- Possible alternative amendments in the legislation were discussed with the beneficiaries and the representatives of the Ministry of Health (MoH) on September 6, 2005 (the presentation included in the Annex I to the second Interim Report, January 2006);
- The possible next steps were discussed at a meeting with the beneficiaries on September 28, 2005. On a basis of the outcomes from this meeting, further steps were formulated and included in the second Progress report (October 2005);
- The Steering Committee meeting (November 15, 2005) revealed that the beneficiaries (further referred to as the MoE and EPA) did not have a consensus over the further actions, as described in the second Progress report;
- A meeting on November 23, 2005 was initiated by the EPA in order to formulate possible alternative ways to proceed (the minutes of the meeting included in the Annex I to the second Interim Report, January 2006);
- Another meeting with the EPA and the MoE, aiming at taking a decision on further steps to be taken, was organised on December 15, 2005 (the background document for the meeting included in the Annex I to the second Interim Report, January 2006). However, this meeting did not take the required decision;
- Some agreement was reached at a meeting between the MoH and the beneficiaries in December 2005; the decision was taken to amend the Hygienic Norms HN 35:2002 by replacing the maximum allowed concentrations for the pollutants, which are regulated by the EU legislation, with the corresponding limit values listed in the Ambient Air Pollution Norms as approved by the MoE and MoH; and
- An interministerial working group was finally approved by the Order of the Minister of Health Nr. V-150 dated February 3, 2006. This group has to propose necessary amendments to the Hygienic Norms HN 35:2002 by November 2006. From this date onwards, the Consultants did not take part in the negotiations, as the initiative is fully with the Beneficiaries. The first meeting of the working group took place on March 24, 2006.

A short summary of the steps undertaken by the Project Team is as follows:

- Amendments of the Law on the protection of ambient air quality were prepared, in accordance with the Gap analysis of Lithuanian legislation for the air quality management in relation to relevant EU Directives;
- Recommendations were prepared for excluding the EU regulated AQFD pollutants from the scope of HN 35:2002 application and references to HN 35:2002 from IPPC and EIA legislation;
- For the transposition of the Directive 2004/107/EC, the Order on the Ambient Air Pollution Norms and the Order on the Ambient Air Quality Assessment were amended to include the pollutants regulated by the directive in question. The changes were completed in the "rough draft" form in both languages;
- The Project Team checked all Lithuanian environmental legislation (not only directly regulating ambient air quality assessment and management, but also legislation in the field of EIA and IPPC), as well as manuals, instructions and guidelines, which are approved by ministerial orders. Amendments were suggested so that these legal acts would refer to the pollution limit values, set by

MoE/MoH order 591/640, instead of the maximum allowed concentrations, listed in the HN 35:2002;

- After discussions with the Beneficiary and negotiations with the MoH representatives (see above), the Consultants finalised the development of draft legal acts transposing the requirements of EU Directive 2001/81/EC and of the Framework Directive (96/62/EC) and subsequent Daughter Directives on ambient air quality assessment and management into Lithuanian legislation on the basis of the legal gap inventory, which was completed in 2005. Amendments were prepared for three legal acts:
    - Law on the protection of ambient air quality;
    - Ministerial order on ambient air quality assessment; and
    - Ministerial order on ambient air pollution standards.
- In addition to the above, Recommendations were prepared for amendments in other related legal acts.

The *outputs* of Activity B2, *the set of the amendments for the Law on the protection of ambient air quality, Ministerial order on ambient air quality assessment, and Ministerial order on ambient air pollution standards* along with the *Recommendations for amendments in other related legal acts* were submitted to the MoE in March 2006, discussed with the Beneficiary on April 11, 2006 and accepted by the Steering Committee on April 27, 2006.

## *C. Emissions inventory and national programme for progressive reduction of emissions*

Kris Devoldere from Ecolas managed the implementation of the activities listed below with other Ecolas experts plus Rūta Bubnienė and Rasa Ščeponavičiūtė being closely involved in this work.

**Activity C1.** Review and update, in accordance with EU requirements, existing emissions inventory data (4.2.3. in the ToR).

In the framework of this activity the existing emissions inventory for Lithuania was reviewed and some shortcomings were detected:

- Sources, which might yield important additional emissions due to anthropological activities, have not been considered in full detail or were not included in the inventory at all. Important sources are emissions from fuel distribution (only gasoline considered), emissions from solvent and product use (paints, glues and inks; plastics processing, etc.), emissions from brake and tyre wear, dust resuspension from roads, etc. These sources should be included in the emissions inventory for the evaluation of the meeting of the requirements of the NEC Directive, as well as in the emissions inventory used for the air quality modelling;
- Sources, which might yield important additional emissions from natural sources, have not been considered at all (wind erosion from soils, VOC emissions from vegetation, forest fires, etc.). These sources should be included in the emissions inventory used for air quality modelling.

Project activities C2, C4 and C5 focused on closing these gaps.

The *output* of the Activity C1, the draft *report* was distributed with the second Progress report in October 2005 and discussed at the meeting of the Steering Committee; the *final version of the report* was attached to the second Interim report (January 2006).

**Activity C2.** Proposal and development of procedures for data collection on emissions to atmosphere of pollutants in accordance with EU requirements (4.2.5. in the ToR).

The review of the existing emissions inventory (see the section on the Activity C1 above) has identified which emission data were not available with the required degree of accuracy or even which emission data were currently not included in the emissions inventory. Implementation of this activity comprised: attempts to further improve data quality for certain activities and to take into account emissions from activities that were not considered in the inventory until now; and collection of additionally required data for estimation/calculation of less detailed or missing emissions. Use was made of publicly available (statistical) data, and traffic count data were purchased.

The results of the implementation of this activity are included in a Report on proposed improvements for the system for emission control in Lithuania, covering almost the entire Component C – activities C2, C4, C5 and C6. This report covers, *inter alia,* a methodology for calculating emissions from fuel distribution, tyre and brake wear and road abrasion, VOC emissions from vegetation and emissions due to forest fires, as well as a more detailed methodology for the calculation of traffic emissions and emissions due to air transport. The report also provides a methodology for the calculation of emissions of heavy metals.

The *output* of this activity is *a Report on proposed improvements for the system for emission control in Lithuania, covering activities C2, C4, C5 and C6*. The draft of this document was submitted to the Steering Committee, in April 2006, it was discussed at the SC meeting on April 27, 2006, and the comments were received from the Beneficiary in early May and at the SC meeting on August 4, 2006. The *final version of the Report on proposed improvements for the system for emission control in Lithuania* is included with the Final Report as Annex V.

**Activity C3.** Preparation of emission projections for 2010 and 2020 as benchmarks for the pollutants referred in EU Directive 2001/81/EC (4.2.7. in the ToR).

This activity was foreseen for the end of the project and was supposed to serve as input for the national programme for progressive reduction of the emissions, according to Article 6 of the Directive 2001/81/EC (NEC Directive). However, the Ministry of Environment of Lithuania was urged by the European Commission to send in their national programme for progressive reduction of the emissions by May 15, 2005. As a result of this request from the European Commission, the project team developed a national plan for progressive reduction of the emissions based on available data from IIASA. The IIASA data were checked against data from other studies available. Brief conclusions follow below.

***National emission ceilings***

The National Emission Ceilings for Lithuania were negotiated during the accession period and were set at the following values (Table 1).

Table 1: Negotiated national emission ceilings for Lithuania

| *National emission ceiling (kton/year)* | | | |
|---|---|---|---|
| $SO_2$ | $NO_x$ | *VOC* | $NH_3$ |
| 145 | 110 | 92 | 84 |

***Emission forecast according to IIASA***

The data from IIASA indicate that:

- Emissions of $SO_2$ will be reduced by 15.9% in 2010 compared to the reference year 2000 (Figure 1). The main reasons for this decrease are the implementation of the large combustion plants Directive (2001/80/EC) and of the Directive relating to the quality of petrol and diesel fuels (98/70/EC, amended by 2003/17/EC);
- Emissions of $NO_x$ will be reduced by 10.9% in 2010 compared to the reference year 2000 (Figure 2). The main reasons for this decrease are the implementation of the large combustion plants Directive (2001/80/EC) and of the Directive on motor vehicle emissions (70/220/EEC + amendments, 88/77/EC + amendments);
- Emissions of NMVOC will be reduced by 24.2% in 2010 compared to the reference year 2000. The main reasons for this decrease are the implementation of the Directive relating to the quality of petrol and diesel fuels (98/70/EC, amended by 2003/17/EC), the Directive on the control of volatile organic compound emissions resulting from the storage of petrol and its distribution from terminals to service stations (94/63/EC), the Directive on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations (1999/13/EC) and the gradual switching to new equipment (with lower emissions) in the degreasing, dry cleaning, printing and vehicle refinishing sector; and
- Emissions of $NH_3$ will increase by 10.5% in 2010 compared to the reference year 2000.

It is clear from the examples in Figures 1 and 2 that the emission ceilings for 2010 will be met for the main pollutants, so for the moment no additional actions, besides the ones already taken within the framework of the implementation of other Directives, should be taken. The future evolution of the yearly emissions will be monitored through the national emissions inventory.

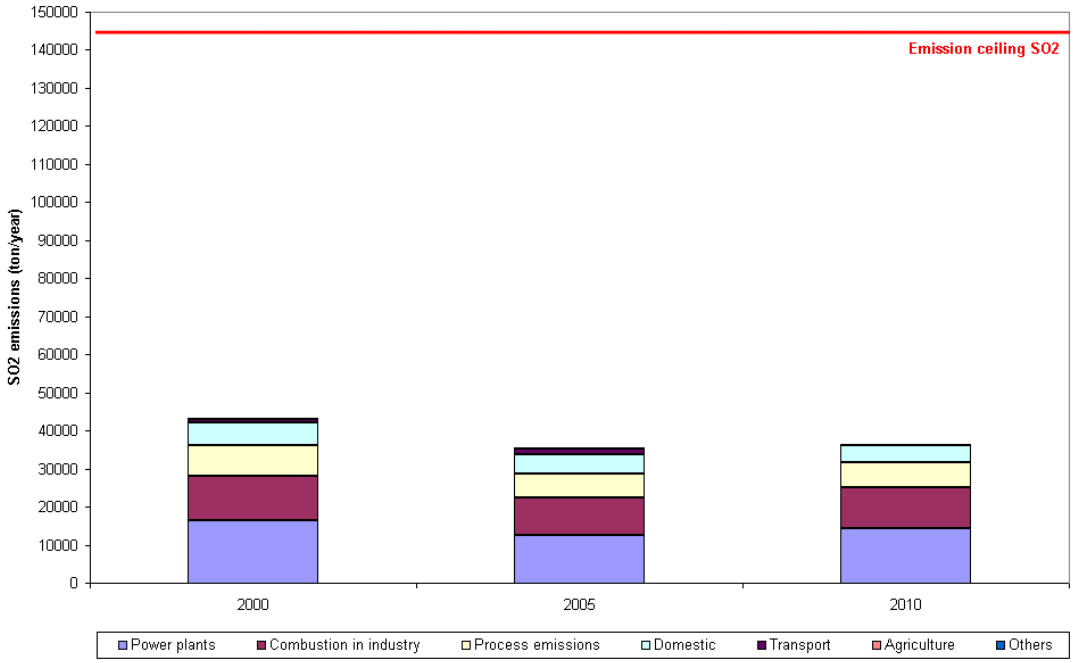


Figure 1: Evolution of emissions of $SO_2$ in Lithuania until 2010, and negotiated ceiling for $SO_2$

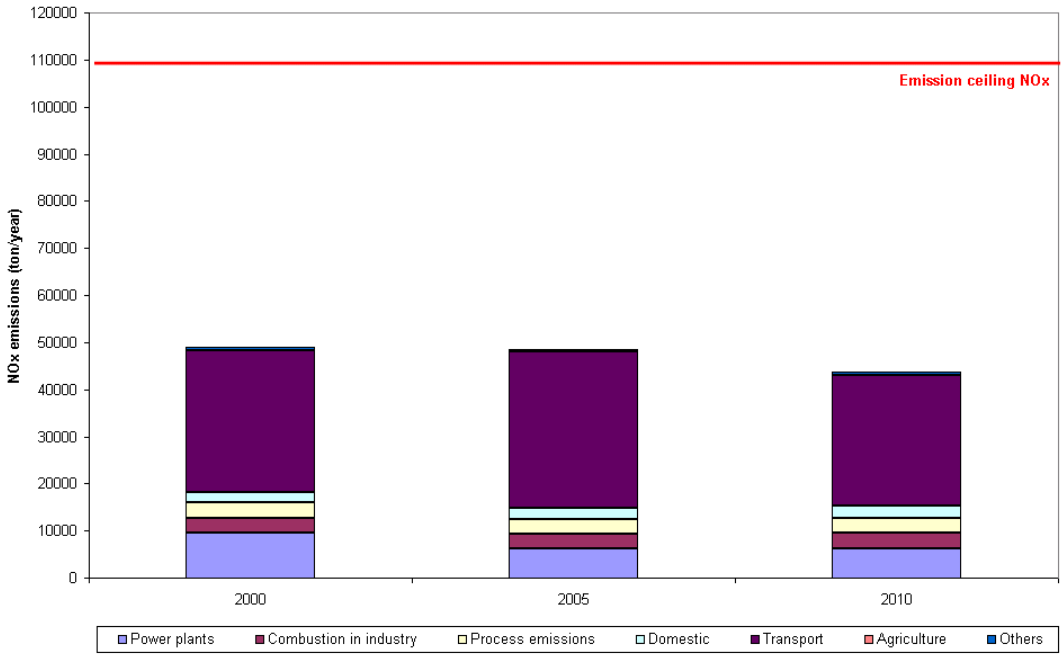


Figure 2: Evolution of emissions of $NO_x$ in Lithuania until 2010, and negotiated ceiling for $NO_x$

At the request of the MoE, an update for the National Programme for the Implementation of Directive 2001/81/EC was prepared before the end of the project. In this update, the expected evolution of the emissions of $SO_2$, $NO_x$, $NH_3$, VOC and $PM_{2.5}$ up to 2020 was considered under two scenarios (current legislation, including

climate change measures and maximum feasible reduction) in view of the global EU25 reduction targets set forth under the CAFE (Clean Air for Europe) programme. Cost efficiency of the proposed measures was also considered, making use of marginal cost curves. This report shows that full implementation of the current legislation scenario will be insufficient to meet the global EU25 reduction targets on the national level. Partial implementation of the maximum feasible reduction scenario will allow meeting the global EU25 reduction targets on the national level for the parameters $SO_2$, $NO_x$, VOC and $PM_{2.5}$ but not for $NH_3$. The global EU25 reduction target for $SO_2$ can be met by implementing cost efficient measures only (measures for which the marginal reduction cost is lower than the external cost of pollution for Lithuania), while meeting the target for $NO_x$, VOC and $PM_{2.5}$ also requires some measures for which the marginal reduction cost exceeds the external cost of air pollution. Meeting the global EU25 reduction target for $NH_3$ is impossible even by implementation of measures with a very high marginal reduction cost. Upon setting of the new ceilings, the marginal cost curves provide insight into which measures are the best to implement (lowest marginal reduction cost).

A *supporting document for a national programme for progressive reduction of the emissions* constitutes the *first output* of this activity (included with the first Interim report in August 2005). The *second output* of the Activity C3, *the update for the National Programme for the Implementation of Directive 2001/81/EC*, was prepared in July 2006, comments were received at the SC meeting on August 4, 2006, and its final version is included as Annex IV to the Final Report.

**Activity C4.** Identification of emission data requirements for ambient air quality calculation/modelling (4.2.4. in the ToR).

During the first half of the project, information regarding the generic data requirements for modelling was collected, and data availability identified. In addition to the emissions data being collected by Ecolas, the EPA made available to CERC some ambient monitoring data and meteorological data. The finalisation of this activity greatly depended on the selected air quality dispersion models, so the project team was waiting for the procurement contract to be signed. As the selected models were still not available to the Consultants by February 2006, the Consultants agreed with the Steering Committee to base their studies on the data requirements of the models available at that time (please refer to the section on the Activity D2 for details).

Also *output* from this activity is *a Report on proposed improvements for the system for emission control in Lithuania* (please refer to the section on the Activity C2 for more details). The *final version of the Report* is included with the Final Report as Annex V.

**Activity C5.** Preparation of methodology for estimating emissions to atmosphere of pollutants that are the subject of assessment under relevant EU air quality directives (4.2.6. in the ToR).

Besides providing methodologies for estimation of emissions that have not yet been taken into account in the emissions inventory (fuel distribution, brake and tyre wear, road abrasion, cold start, hot soak and diurnal losses, emissions from natural sources

such as forests, wind erosion from agricultural land, etc.), an overview of emission factors for the pollutants under the fourth daughter directive was also provided. It was judged that emission factors for $SO_2$, $NO_x$, CO and $PM_{10}$ are readily available from EMEP Corinair and other data sources and are also regularly updated. Therefore, efforts within this task were mainly aimed at collecting a set of useful emission factors for heavy metals (Pb, As, Cd, Ni, Hg) and PAH. Emission factors were either activity based or expressed as a particulate bound concentration (and thus dependent on the $PM_{10}$ emission).

Also *output* from this activity is *a Report on proposed improvements for the system for emission control in Lithuania* (please refer to the section on the Activity C2 for more details). The *final version of the Report* is included with the Final Report as Annex V.

**Activity C6.** Inventory of pollutants (4.2.15. in the ToR).

An inventory of pollutants was drawn up along the methodology developed under Activity C5 of this project. It provides an overview of the total emissions of the various pollutants, including the contribution of the various sectors to the total inventory. Also *output* from this activity is part of *the Report on proposed improvements for the system for emission control in Lithuania* (please refer to the section on the Activity C2 for more details). The *final version of the Report* is included with the Final Report as Annex V.

## *D. Air quality modelling and assessment*

CERC took a lead in this component, and Sarah Wilkinson was responsible for the implementation of the activities listed below. She was working in close cooperation with other experts from CERC: Dr. David Carruthers; and Matthew Williams; from ELLE: Aiga Kāla; Raimonds Veinbergs; Oskars Beikulis; and Valts Vilnītis; as well as with the EPA staff, particularly Mindaugas Bernatonis and Arūnas Maršalka.

**Activity D1.** Selection of suitable air quality models and other mathematical techniques based on the current ambient air quality situation in Lithuania (4.2.8. in the ToR).

This activity has provided the main inputs for Activity A1, Assessment of needs for required software and hardware equipment. The assessment of software needs was carried out mainly through discussion with EPA staff in Vilnius, in order to establish the way in which the software is expected to be used, and by whom. The assessment also drew on CERC's experience in the use of air quality modelling software in a variety of relevant applications, bearing in mind the outputs required from the modelling in this case. As well as the choice of software packages, these discussions informed the number of licenses required and any additional equipment that might be necessary for the use of the software.

During this period, many discussions were had by CERC staff and presentations made to EPA staff, namely:

- an overview of air quality assessment in the UK; and

- a potential approach to forecasting and urban modelling.

These presentations have contributed to the EPA's understanding of the way in which air quality assessment is carried out in the UK and other EU member states.

The *output* of this activity was a *proposal for the Beneficiary on suitable types of air quality model based on current ambient air quality situation in Lithuania and depending on pollutant with respect to the relevant EU air quality directives*, which formed a basis of the Technical Specification of software requirements (included in the Annex I to the first Interim Report, August 2005).

**Activity D2.** Acquisition and application of selected air quality models and mathematical techniques (4.2.9. in the ToR).

This activity included the tender for modelling software (please refer to the section on Component A above) and setting up the selected models for provision of model output compatible with the air quality directives.

As a result of the procurement component the beneficiary chose the following models:

- SAM-S for emergency modelling;
- SELMAGIS AUSTAL for industrial modelling; and
- SELMAGIS MEMO-MUSE for regional and urban modelling.

By February 2006, the selected models were not available to the Consultants and consequently the entire modelling and training components of the project were threatened. The Consultants prepared an alternative solution: in order to continue with the project activities, CERC made available to the EPA licences for two air pollution dispersion models: ADMS 3 for industrial modelling; and ADMS-Urban for urban modelling; free of charge. This proposal was approved by the Steering Committee on February 3, 2006.

The project team carried out an analysis of the ambient monitoring data supplied by the EPA for monitoring stations in cities around the country, to determine the current situation with regard to air quality and EU monitoring requirements. Rural monitoring data were received from the EPA at a later stage. The Consultants have concern over the lack of rural $PM_{10}$ data for Lithuania, and various potential methods for addressing this difficulty were discussed. One method, used for the Panevežys case study discussed under Activity D3, was to estimate an annual average background concentration by interpolating sulphate and nitrate concentrations between four rural monitoring sites in and around Lithuania. Ammonium sulphate and ammonium nitrate concentrations were calculated and combined to give a total background $PM_{10}$ concentration.

The EPA, in cooperation with LHMS, also supplied meteorological data and an initial analysis was carried out to see which parameters are currently recorded. On the basis of this analysis the EPA and the Consultants received from the LHMS yearly sets of 3-hourly meteorological data for Vilnius and Panevėžys for 2004 and 2005. These data were processed by CERC into hourly sequential data sets, which can be used directly for both industrial and urban scale modelling.

Activity D2 ties in with training activities E3 and E4 discussed below, as the training of various stakeholders has brought out the issues that were addressed regarding data requirements and data availability. At the same time this activity is very closely related to the Activity D3, so all recommendations and *outputs from both these activities are further described below*.

**Activity D3.** Implementation of system for air quality modelling, forecasting and data processing (4.2.14. in the ToR).

Execution of this activity started in February 2006, when decisions were made by the Steering Committee concerning the use of the ADMS 3 and ADMS-Urban air pollution dispersion models for further implementation of the project and for carrying out two modelling case studies, for Panevėžys city and for Elektrėnai Power Plant. In the following six months the Consultants were able to:

- collect a vast array of emissions and other data, which were used in case studies and provided to the EPA for further use;
- reformat meteorological data for direct use with the models; and
- demonstrate various air pollution dispersion modelling techniques at different scales, closely involving staff of the EPA.

Two pilot studies were carried out: an urban scale air quality modelling study for Panevėžys; and an industrial modelling study for Elektrėnai Power Plant.

The ADMS-Urban model was used by CERC and the EPA for the pilot air quality modelling study for Panevėžys. The study was reported by CERC. Road traffic, industrial sources, trains and domestic heating emissions data were collected by the EPA. CERC made an examination of these data, then CERC and EPA staff developed a methodology for processing the data for the compilation of a Panevėžys emissions inventory within the Emissions Inventory Toolkit, EMIT, for import to ADMS-Urban. Where data were unavailable, it was decided that national averages and other estimates would be used – for example, for domestic fuel use and petrol stations.

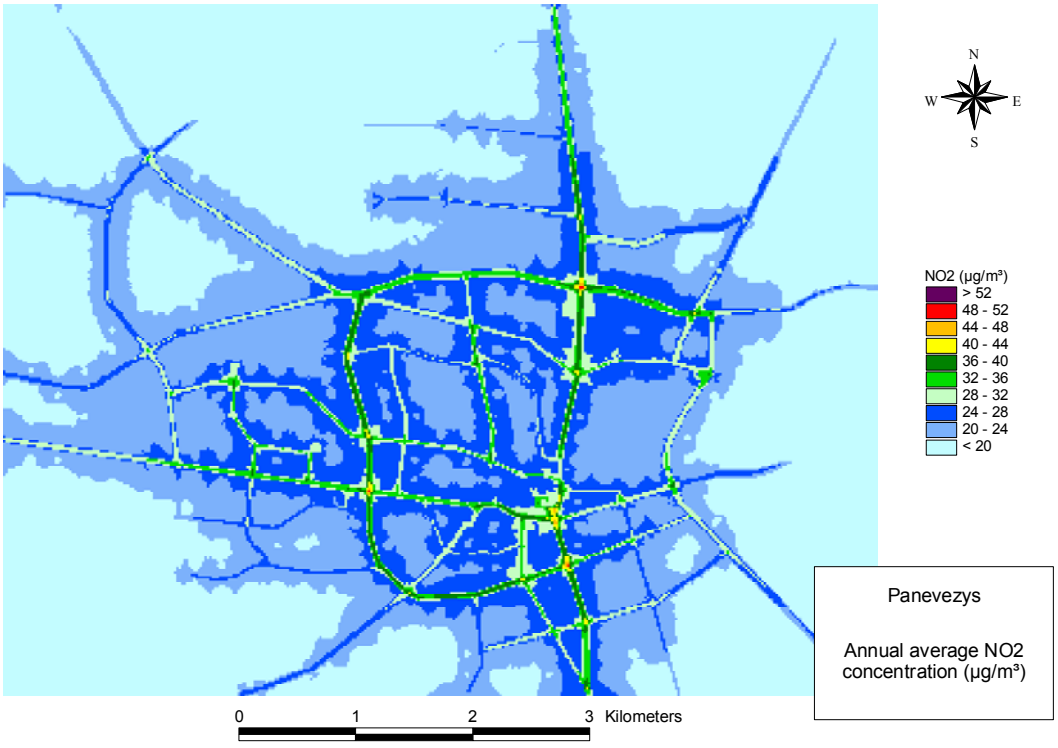


Figure 3: An example of pollution concentration maps, acquired in the urban scale air quality modelling study for Panevėžys

Suitable data were also acquired from which to derive time-varying emissions for road traffic in the Panevėžys area. These were processed for use in the modelling. In addition, ambient air quality monitoring data for the city were also collected, for comparison against modelled output in the model verification.

Further data were also collected for general use in modelling studies, rather than specifically for the Panevėžys case study. These included:

- National emissions data, provided by Ecolas and ELLE, which were processed by CERC ready for use in the ADMS-Urban model; and
- Data representing fleet composition in terms of engine age and size from which to derive traffic "route types". These data were required as UK data are not representative of the situation in Lithuania.

All data were used in the pilot study, as well as being provided to the EPA for future use.

Although further work could have been done to improve the accuracy of the results, it was decided that the work has been completed to a useful and appropriate level for the study's purpose. The study report includes recommendations on how to improve and take the study further.

The ADMS 3 model was used by ELLE for the pilot air quality modelling study for Elektrėnai Power Plant. The study was reported by CERC. The EPA supplied all data used in the study.

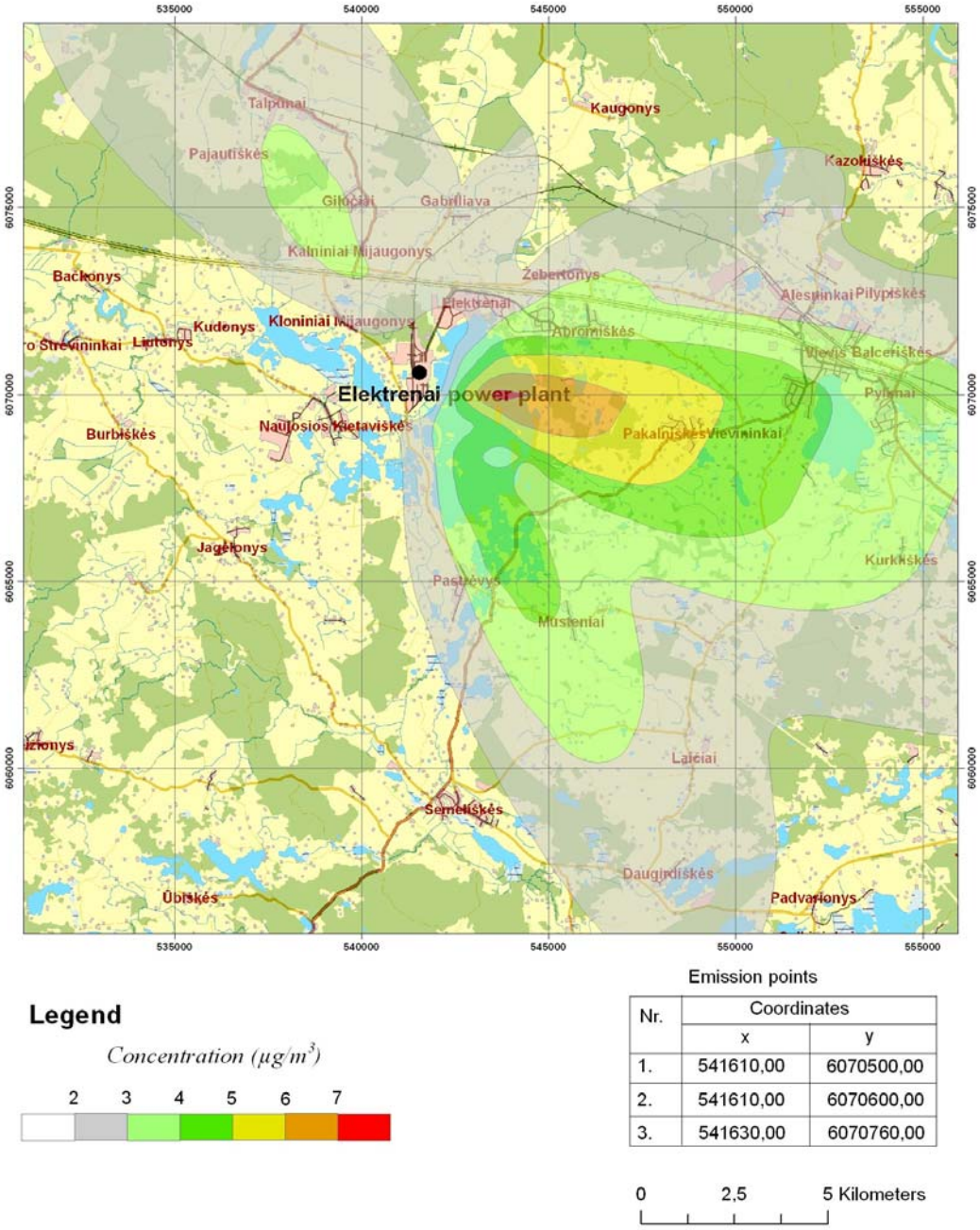


Figure 4: An example of pollution concentration map (sulphur dioxide annual mean concentrations), acquired in the pilot air quality modelling study for Elektrėnai Power Plant

In general, recommendations for further progressing air quality modelling in Lithuania are concerned with:

- improvement of the availability of suitable data for modelling: emissions and associated data; meteorological data; and background concentration data; and
- further development of best practice for carrying our air quality modelling in Lithuania, based on the Guidebook on ambient air quality assessment.

The *outputs from the Activities D2 and D3*, *Air quality modelling case study reports for Panevėžys city and for Elektrėnai Power Plant*, are attached to the Final Report as Annex VI (electronic version only; paper copies were attached to the Draft version of the Final Report). The *recommendations* regarding further development of air pollution dispersion modelling techniques in Lithuania are briefly summarised in Section 5 of this report, as well as included in the Guidebook on ambient air quality assessment (Annex VII to the Final Report).

## *E. Guidelines and training*

ELLE had a lead in this block of activities, and Valts Vilnītis, Aiga Kāla, Rūta Bubnienė, as well as Dr. David Carruthers, Sarah Wilkinson and Dr. Tricia Gilmour from CERC provided most of the inputs to the activities listed below. EPA staff provided valuable contributions to the development of the Guidebook on ambient air quality assessment (Rita Tijunaitė) and to the training sessions (Mindaugas Bernatonis).

**Activity E1.** Preparation of guidebook on ambient air quality assessment (4.2.10. in the ToR).

Work on this manual started before the original schedule by setting up chapter headings, but the main part of the work was carried out between March and July 2006, as more data became available and more experience was gained during the various training events. The Consultants agreed with the Beneficiary, that the guidebook should:

- Focus on ambient air quality (outdoor air quality);
- Be built on the outputs of the current project and summarise its main conclusions and outcomes;
- Incorporate EU and international expertise and follow EU guidance for good practice;
- Take into account national circumstances (transition from the Soviet based assessment standards to the pollution limit values based EU requirements) and describe the system as of June 2006; and
- Be prepared in close cooperation with national institutions, particularly the EPA.

The primary aim of the guidebook is to serve as a handbook for all national stakeholders involved in ambient air quality assessment and to present an overview of the ambient air quality management system in Lithuania following the requirements of the EU. The manual will facilitate better public information and cooperation among the institutions involved.

It is expected that the users of the manual will be:

- Ambient air quality assessment specialists at EPA;
- Environmental inspectors and specialists of EIA at REPDs;
- Environmental and planning specialists at regions and municipalities;
- Enterprises and companies preparing applications for environmental permits (TIPK);
- Project owners and companies preparing EIA; and
- Scientific and education institutions that carry research in ambient air quality.

It was also agreed with the Beneficiary that the Guidebook would not include the assessment of indoor air quality and pollutants assessed by the State Public Environmental Health Centre. As the manual covers a fairly broad range of air quality related issues, it does not present technical details of the methodologies and methods of ambient air quality assessment. The Guidebook contains references to legal documents and other EU and national documents instead of repeating their contents. It is expected that after the end of the project the EPA will update it following the changes in the system.

The Guidebook will be used as electronic document in Adobe Acrobat PDF format only, as it may need updating with precise legal references shortly after the end of the project.

The *output* of this activity is the *Guidebook on ambient air quality assessment* itself, which is attached to the Final Report as Annex VII.

**Activity E2.** Assessment of training needs for the staff of the Ministry of Environment and Environmental Protection Agency related to the implementation of all the above-mentioned measures (4.2.11. in the ToR).

There were a number of interviews and discussion with the staff of the EPA and Regional Environmental Protection Departments as to their educational background, current role and relevant knowledge, as well as potential training requirements. The Consultants concluded that the training needed to address the overall air quality assessment and management system and its links and relations with other elements of the environmental protection system, such as:

- General policy;
- Environmental enforcement principles;
- An integrated permitting system;
- Environmental Impact Assessment and Strategic Environmental Assessment;
- Information exchange and cooperation between various national and regional authorities; and
- Informing the general public.

The *output* of the Activity E2, *results of the training needs assessment*, was included as an Annex III to the second Interim Report (January 2006).

**Activity E3.** Preparation of training programmes and modules (4.2.12. in the ToR).

The first training programme, targeting at larger municipalities, was prepared at the end of 2005, and the first training session was carried out in December 2005, followed by training for the EPA staff on urban air quality modelling in January 2006 (please refer to the next section, Activity E4, for more information). Preparation of the remaining training programmes and modules was completed in April 2006: a short report, containing a description of the training modules, was discussed in great detail at the Steering Committee meeting on April 27, 2006, followed by a separate meeting with the EPA senior staff. The EPA approved the training modules in a first week of May 2006.

The *outputs* of this activity, *final version of the description of training modules* together with all *training materials*, are included in the Annex III to the Final Report.

**Activity E4.** Training of specialists of relevant stakeholders of the Ministry of Environment and Environmental Protection Agency related to the implementation of all above-mentioned measures (4.2.13. in the ToR).

The first steps for this Activity were taken in December 2005, before the original project schedule. A training workshop was carried out on December 14, 2005 in the EPA; this training aimed at assisting the municipalities and Regional Environmental Departments in preparing Air Quality Management Programmes. The larger municipalities and Regional Environmental Departments attended the workshop. Presentations were made on the preparation of ambient air quality management programmes, including a description of the legal provisions for such programmes, plus the experience available so far in the UK, Lithuania and Latvia. A useful discussion followed on the ways in which to proceed in Lithuania.

A four day training course was run by CERC at the end of January 2006, introducing EPA delegates to the use of the Emissions Inventory Toolkit, EMIT, and the ADMS-Urban model.

In February 2006 a one-day training seminar was organised in Šiauliai. The seminar addressed, *inter alia*, air quality assessment and management and preparation of air pollution reduction programmes on the level of urban municipalities. Twenty-nine participants from Šiauliai municipality, regional environmental authorities, municipalities of Kaunas, Kėdainiai and Panevėžys attended the seminar.

In March 2006, a one-to-one training session took place using real data for the Panevėžys pilot study to demonstrate practically the way in which each type of emissions data is processed ready for input to the Emissions Inventory Toolkit, EMIT, for eventual import to ADMS-Urban for modelling. CERC staff demonstrated the way in which the road network is digitised using the ArcGIS, and the way in which required traffic flow and other data are added to the created shape file. Industrial and railway sources were also processed. EPA staff proceeded in carrying out these tasks for the modelling case study for Panevėžys. A discussion took place on the way in which time-varying emissions can be included for each source type at a later stage of the modelling.

On May 25, 2006, a half-day course for managerial staff in the MoE, EPA, LHMS and SEPI, and staff of State Public Health Service and State Public Health Centre was held comprising the following topics:

- Understanding the requirements of the Air Quality Framework Directive;
- Environmental policy instruments in air quality management;
- Application of air quality assessment on various levels (industrial, urban, regional/national); and
- Introduction to air quality modelling.

Fourteen delegates from the above-mentioned institutions attended the course.

On June 6, 2006, a 1-day course for senior staff from urban municipalities and Regional Environmental Protection Departments was held, comprising the following topics:

- Overview of EU legal provisions for air quality assessment and management;
- Linking of emissions, monitoring, modelling, permitting and EIA;
- UK and Latvian experience; and
- Lithuanian case studies and discussion.

Eighteen participants from EPA, Panevėžys, Kedainiai, Vilnius, Kaunas, Klaipėda municipalities and Mariampole, Utena, Klaipėda, Alytus, Šiauliai and Vilnius Regional Environmental Protection Departments attended the meeting.

Further support was also given to EPA staff in using ADMS-Urban on a one-to-one basis in June 2006.

The training programme was concluded in July 2006 with the two 2-day training courses, on 4-5$^{th}$ July in Nida and on 18-19$^{th}$ July in the Kaunas region. In each case, the course itinerary covered the requirements of the EU Framework Directive for air quality management, introducing air quality modelling, applications of different models and their minimum criteria, boundary layer theory, background to industrial and urban models including inputs and parameters, processing and understanding outputs and worked examples, and case studies for Panevėžys and Elektrėnai Power Plant. Eighteen participants from urban municipalities, Regional Environmental Protection Departments and environmental consulting organisations attended the two courses.

During all training sessions and workshops English-Lithuanian translation was provided.

The electronic versions of the *outputs* of Activity E4, *including workshop agendas, lists of participants and handouts of all presentations*, are included in the Annex III to the Final Report.

# 3. Possible impacts and benefits

The overall objective of this project was to assist the Republic of Lithuania in developing the system for emission control, air quality assessment and management on different scales according to the relevant EU requirements. The Consultants suggest that implementation of the project activities has more than met this objective and that the project has already had a significant long-term impact on the overall air quality assessment and management system in the country, producing noticeable benefits to the staff of the institutions who deal with AQM on various levels.

Firstly, the legal gap analysis has not only shown the gaps between the legal requirements of the European Union and air quality related legislation in Lithuania, but has also revealed critical issues in the functioning of the overall AQM system in the country. Among these, poor distinction between ambient and indoor air quality issues, insufficient application of EU air quality limit values in integrated permitting and EIA procedures, and the potential danger of increased pollution within sanitary protection zones can be named as the most prominent. As well as producing the outputs in line with the ToR, i.e. the draft legal acts, which would complete transposition of the Directive 2004/107/EC (the fourth Daughter Directive) and eliminate gaps between the AQFM requirements and Lithuanian legislation, a discussion within the MoE and between MoE and MoH has been initiated, which should address the above-mentioned critical issues going forward. An interministerial working group, approved by the Order of the Minister of Health Nr. V-150 dated February 3, 2006, is charged with the task to propose necessary amendments to the Hygienic Norms HN 35:2002. The first meeting of the working group took place on March 24, 2006; it is supposed, that the results will be achieved by November 2006.

Secondly, the Beneficiary received timely support in meeting its reporting obligations to the EC when the Consultants helped in preparing the National Programme for the Implementation of Directive 2001/81/EC. This document was prepared in May 2005 and was again updated in July 2006, fulfilling all national reporting requirements. These tasks not only fulfilled reporting obligations to date, but also prepared the way for future such reporting.

Thirdly, not only have the Consultants delivered fully functional air pollution dispersion models for industrial and urban air quality studies but, together with the EPA staff, have also demonstrated and tested in detail such activities as input data collection procedures and analysis of the modelling results. Implementation of the modelling studies has driven the staff involved through the process on a step-by-step basis, which will enable the EPA to continue with its own studies going forward. In addition, through this experience, EPA staff now has sufficient familiarity with the requirements and objectives of air quality modelling to assist them in establishing methodological support to the Regional Environmental Protection Departments, urban municipalities, and consulting organisations.

Finally, the Consultants fulfilled the training aspects of the project, in order to allow those involved in ambient air quality assessment in Lithuania to take ownership of the

project outputs and to further progress the work of the project. The training activities were concentrated in two important areas.

A Guidebook on ambient air quality assessment was produced, taking into account national circumstances whilst incorporating EU and international expertise. The Guidebook will serve as a handbook for those involved in ambient air quality assessment, presenting an overview of the ambient air quality management system in Lithuania in the light of EU requirements, and facilitating better public information and cooperation among the institutions involved. Rather than a completed report, it should be seen as a working document, which will be expanded and improved as the air quality management system in Lithuania develops.

Training was tailored to the requirements of those involved in ambient air quality assessment in Lithuania through discussion with the staff of the EPA and Regional Environmental Protection Departments. Training activities ranged from one-to-one training sessions with the EPA using real data, through detailed technical training for potential model users, to workshops dealing with such issues as the requirements of the EU Air Quality Directives and the preparation of Air Quality Management Programmes. Training material was based on case studies from the UK, Latvia and Lithuania itself and the rich and varied experience of the Consultants. In all, over 100 delegates took part in project training courses, which were held at locations in Vilnius, Šiauliai, Kaunas and Nida to ensure relative ease of access for those based at different locations. Delegates came from, amongst other organisations:

- the MoE, EPA, LHMS and SEPI;
- the State Public Health Service and State Public Health Centre;
- the municipalities of Vilnius, Klaipėda, Šiauliai, Kaunas and Kėdainiai; and
- the Regional Environmental Protection Departments of Vilnius, Panevėžys, Mariampole, Utena, Klaipėda, Alytus and Šiauliai.

English-Lithuanian translation was provided during all training sessions and workshops, to enable full participation of all delegates. As a result, each training course provoked useful discussion amongst the delegates and Consultants as to how air quality assessment in Lithuania might develop in the future.

# 4. Review of the problems

The project has met comparatively few problems during its implementation period – most probably due to a close cooperation between the Consultants and the Beneficiaries. The problems which occurred were addressed in a timely manner and successfully solved in bilateral meetings with the Beneficiaries or during Steering Committee meetings. A short overview follows below of the main issues that caused some complications to the otherwise smooth implementation of the project.

## *4.1. Additional modelling software*

The biggest problem the Consultants faced was the very late arrival of the air pollution dispersion models that were purchased by the Beneficiary and were to be used for implementation of Activities D2 and D3. Component A of the project was complete; technical specifications and other tender documents were submitted on time to the Beneficiary and the Consultants were not in a position to influence the procurement process. Unfortunately, a number of delays followed, and by the end of January 2006 neither technical documentation for SELMAGIS AUSTAL for industrial modelling and SELMAGIS MEMO-MUSE for regional and urban modelling, nor the software itself, were available, while the Consultants had to proceed with the majority of tasks in the framework of the Activities D2 and D3. The overall delay had already been 3 months so, in the second Interim Report (January 2006) the Consultants proposed an alternative solution, to be discussed with the Steering Committee: in order to immediately continue with the project activities CERC was ready to provide to the EPA non-commercial licences for two air pollution dispersion models: ADMS 3 for industrial modelling, and ADMS-Urban for urban modelling; free of charge. The Steering Committee approved this proposal on February 3, 2006, so the Consultants immediately proceeded with data collection, implementation of the case studies and training.

## *4.2. Additional tasks at short-term notice*

Other issues that frequently demanded a quick response from the Consultants were various requests from the Beneficiaries to carry out tasks not originally envisaged in the ToR. For example, the MoE requested support in preparing a supporting document for the National Programme for progressive reduction of emissions, which was due to be delivered to the European Commission by May 17, 2005. The Consultants re-scheduled their activities and prepared the requested document, in both English and Lithuanian languages, in a very short time frame. The amended schedule was further endorsed by the Steering Committee.

Furthermore, at the request of the EPA, the Consultants provided assistance to the participation of an EPA staff member in an AQ modelling workshop in the UK. At a later stage, the EPA also requested support in preparing GIS data, which were necessary to run the emergency release modelling software (SAMS), procured in the framework of Component A of the project. Again, the project team supported these requests with the approval of the Steering Committee.

The above few issues, related to unexpected amendments in the ToR and project time schedule, were solved by timely bilateral communication between the project team and the Beneficiaries, and were always discussed and approved by the Steering Committee.

## *4.3. Staffing issues*

On implementation of an urban scale air quality modelling study for Panevėžys and an industrial modelling study for Elektrėnai Power Plant, it became apparent that in addition to the members of the project team who were initially approved by the Steering Committee, there was a need to include three more experts, who would be mainly involved in the implementation of the case studies, preparation and analysis of GIS data, and training of the EPA staff. These were Oskars Beikulis, Raimonds Veinbergs (both from *ELLE*) and Matthew Williams (*CERC*). The Steering Committee consequently approved these additions to the Consultants' staff in April 2006.

At the same time work on the Panevėžys case study clearly demonstrated that the staff members of the EPA, who were involved in the implementation of the study, did not have enough time to carry out all necessary activities. As soon as this became apparent, the project team sought solution in bilateral consultations with the Beneficiary and, at a later stage, discussed this issue in detail with the Steering Committee. Consequently, necessary arrangements were decided upon and carried out by the Beneficiary, allowing for proper execution of all necessary tasks and acquiring essential skills and knowledge.

All problems related to insufficient staffing were successfully solved during the implementation of the project. However, the Consultants made the observation that the EPA does not presently have sufficient staff to cover modelling and other activities associated with the outcomes of the project.

# 5. Recommendations, suggested follow up activities and projects

During the entire duration of the project the Consultants had an opportunity to analyse in a great depth present AQM system in Lithuania; excellent opportunities to discuss possible improvements with a range of stakeholders occurred also during the various training events. Consequently, a large number or suggestions, recommendations and proposals for follow up activities were developed. Most of those are included in corresponding project outputs along with detailed justification; the section below comprises a brief summary.

## *5.1. Amendments of legal acts*

One of the main outputs of the project is suggested amendment of the three legal acts:

- Law on the protection of ambient air quality;
- Ministerial order on ambient air quality assessment; and
- Ministerial order on ambient air pollution standards.

The texts of the amendments along with the other project outputs are included in the Annex III to the Final Report. However, the Consultants have discovered, that even if the above three main legal documents, directly implementing the AQFM and the four Daughter Directives, will be fully in line with the EC requirements, the whole environmental management and enforcement system in the country needs some fine-tuning to match the EU air quality management philosophy and principles.

Consequently, the project team suggested changes in a large number of legal acts, concerning not only AQM issues, but also environmental permitting (IPPC) and EIA. Among those the following laws and regulations have to be mentioned:

- Law of the Republic of Lithuania No. X-258 “On Environmental Impact Assessment of Planned Economic Activity” dated June 21, 2005;
- Order of the Minister (hereinafter MO) of Environment of the Republic of Lithuania (hereinafter “MoE”) No. 262 “On Approval of Regulations on Preparation of the Environmental Impact Assessment Programme and Report” dated December 23, 2005;
- Order of the MoE of the Republic of Lithuania No. 263 “On Approval of Methodical Guidelines for Screening under the Environmental Impact Assessment” dated December 30, 2005;
- Order of the Minister of Environment of the Republic of Lithuania No. 80 “On Approval of the Regulations of Issuance, Renewal and Annulment of Integrated Pollution Prevention and Control Permits” dated February 27, 2002 (as amended);
- Order of the Minister of Environment of the Republic of Lithuania No. 387 “On Approval of environmental normative document of the republic of Lithuania LAND 32-99 “Issuance of Permits for Usage of Natural Resources and Setting Limits for Usage of Natural Resources as well as Norms of Permitted Emissions of Pollution into the Environment”” dated November 30 1999;
- MO of the MoE No. V-586 “Rules on Determination of the Boundaries and Regime of the Sanitary Protection Zones” dated August 19, 2004;

- Rules on Performance of Assessment of the Effects on Human Health in the Instances not Stipulated by the Law on the Republic of Lithuania Environmental Impact Assessment of the Planned Economic Activity (affirmed by the July 5, 2004 MO of the MoE No. V-511);
- Recommendations for the Environmental Impact Assessment of Planned Economic Activity (Landfills) (affirmed by the October 23, 2002 MO of the MoE No. 555);
- Regulations on Preparation of the Reports on Impact of Implemented Economic Activity on Ambient Air, Establishment of the Contents and Execution (affirmed by the January 25, 2001 MO of the MoE No. 64;
- Environment Protection Inspection Guide published by the State Environment Protection Inspection;
- MO of MoE No. 230 "On Approval of the Order of Implementation of [Private] Environmental Monitoring" dated 15 May 2003.

It shall be noted that the above list is not exhaustive for the reasons of the scope of the Project and pursuant agreement with the Beneficiary. The feasibility and transparency of the below recommendations with respect to aim of maintaining sound Lithuanian legal system which would be harmonised with EU ambient air quality (AAQ), monitoring, environmental impact assessment (EIA) and integrated pollution prevention and control (IPPC) legislation must be assessed. The scope of amendments and the list of legal acts must be further investigated by the Beneficiary before proceeding.

The Consultants recommended the following changes in the above-mentioned legal acts:

- Ceased usage of the sanitary protection zones (SAZ) concept in the AAQ assessment procedures and AQM at large;
- Amendment of the legal acts, which regulate AAQ assessment on the national, municipal (AAQ management plans or programmes), and industrial (EIA and IPPC permitting) levels to achieve the following:
    - Basing AAQ management plans or programmes on air quality limit values instead of maximum allowed concentrations (MAC/DLK);
    - Providing for sound legal basis for EIA procedures with respect to the AQFD pollutants;
    - Ensuring that cross-referencing is correct in all legal acts and serves for consistent application of the legal; and
    - Introducing requirement for modelling as an air quality assessment tool and minimal requirements for modelling software (this issue is also dealt with in the section 5.3. below);
- Provision of clear guidance for the environmental authorities and their personnel as regards application of the air quality limit value based system, especially if MAC-concept remains with respect to other than AQFD pollutants; and
- Implementation of the indoor / ambient (outdoor) air concept in the Health and Environmental legislation in Lithuania. The clear division of the responsibilities of the Governmental institutions (MoE and Ministry of Health Protection of the Republic of Lithuania) must be delimited in accordance with the "indoors"/"outdoors" principle.

Part of the above-mentioned recommendations is being implemented already now: as it was already mentioned in the Section 2 of the Final Report, an interministerial working group was approved by the Order of the Minister of Health Nr. V-150 dated February 3, 2006. This group has to propose necessary amendments to the Hygienic Norms HN 35:2002 by November 2006. However, not only more activities are necessary to carry out a broad revision and updating of the above-listed legislation, but also a high-level political agreement and firm decision, providing necessary back up for a consequent and comprehensive action.

## *5.2. Institutional system for the implementation of the AQFD*

Basically the administrative and institutional structure to implement the requirements of the EC Directives is in place in Lithuania, comprising:

- Council Directive 96/62/EC on ambient air quality assessment and management;
- Directive 1999/30/EC relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air;
- Directive 2000/69 relating to limit values for benzene and carbon monoxide in ambient air;
- Directive 2002/3/EC relating to ozone in ambient air; and
- Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air.

The key players – the Ministry of Environment (MoE) with its subordinated institutions and municipalities – build the hard core of the administrative and institutional structure for the air quality management. Thus the implementation of these directives will not require an establishment of new institutions or structures within existing institutions.

To ensure full implementation of the requirements of the above-mentioned directives and adjust the administrative and institutional structure correspondingly the following recommendations are made:

- The MoE, apart from drafting legal acts, is responsible for reporting to the EC and dissemination of information regarding air quality and air management issues. As two structural units of the MoE: Air Division of the Environmental Quality Department; and Public Information and Public Relations Department are involved, their role and responsibilities have to be clearly defined.

  The Air Division has to be responsible for management of the reporting process to the EC and for reporting itself with respect to the collection and processing of core information by the Environmental Protection Agency (EPA) and Lithuanian Hydrometeorological Service (LHMS). The Air Division has to
  - take a leading role in this process by setting a clear reporting schedule for the EPA and LHMS in accordance with the reporting requirements laid down by the above-mentioned directives; and
  - provide a methodological guidance to both involved institutions to ensure that the reports are consistent and reflect EC requirements.

- As the Air Quality Assessment Division of the EPA will play a key role in providing methodological guidance on air quality modelling, the staff of the

Division has to be sufficient in quantitative terms, as well as trained in modelling and having a background knowledge in air quality management issues. The staff of the Division has to be trained to provide methodological guidance to the main actors dealing with air quality management on municipal (agglomeration) and industrial (installation) levels. It has been assumed that air quality modelling can also be carried out by EPA staff, when necessary (see below).

- Larger municipalities will be involved in air quality modelling at an urban (or agglomeration) level when preparing air quality management plans or programmes. They will need appropriate guidance and support from the Air Quality Assessment Division of the EPA. The EPA should also be capable to verify urban modelling studies, if necessary.

- Regional Environmental Protection Departments and State Environmental Protection Inspectorate (SEPI) should be able to understand air quality modelling sufficiently that they can review consultants' reports and determine whether or not the work done is fit for purpose and the correct conclusions have been reached; ideally they also have to be able to perform modelling on an industrial (installation) level to check the consistency of permit applications and verify compliance with limit values if needed. They also have to receive methodological guidance and training or air quality modelling from the Air Quality Assessment Division of the EPA. Some larger, more complicated studies, such as those involving multiple sources or complex effects or sensitive cases of IPPC permits or EIA will require direct involvement of the EPA in the modelling study as well, all others should be a subject to a screening or regular quality control.

- Different units of the EPA, LHMS and SEPI hold and use various databases, which are directly and indirectly related to air quality and air management issues. As this information and data would be crucial for air quality modelling at various levels, the inventory of databases should be carried out with respect to content and structure of databases. To optimise usage and operation of databases they should be synchronised or combined as much as possible to fit the needs of various users. In order to optimise human and financial resources required for database management the Monitoring and Information Department of the EPA should be responsible for maintenance of database(s), and users at various levels should have access to required data.

## *5.3. Recommendations regarding air quality modelling*

Those project activities involving training and the case studies, as well as their previous experience, leave EPA staff in a good position to carry out air quality modelling studies for various applications. Obviously further experience will be gained and lessons learned as work progresses, enabling the development of country-specific guidelines and procedures for data processing, with the Guidebook on ambient air quality assessment as a useful starting point.

One main area requiring attention in the short- to medium term is the development of procedures for the inclusion of background concentration data in modelling studies. The project has led to a better understanding amongst stakeholders in terms of what is required and the reasons behind the inclusion of a background concentration, so that

suitable procedures can be set up in the short-term. This issue can then be further developed in the longer term, for example to include a wider monitoring network for background concentrations, especially for rural $PM_{10}$. Similarly, in order to model nitrogen and acid deposition in Lithuania, the development of country-specific procedures will be required, as these depend on local ground use and the existing loads on ecosystems.

As the modelling repertoire is widened and the infrastructure for modelling is expanded, the Guidebook for the assessment of ambient air quality should be developed. It will be important to tailor it even better to the Lithuanian situation, both with respect to currently available data and to improved data that may be available in the future. The Guidebook should not be a static document, but should be a working document that is revised periodically in line with progress made.

In the meantime, based on the Consultants' experience in sourcing data for the case studies, recommendations can be made for general improvements to the infrastructure for obtaining the data required for modelling. Although much of the required data already exist, the situation could be improved by the development of a "modelling-specific" framework for data collection; this is partly an institutional issue.

Please also see the institutional recommendations dealt with by the final bullet point under Section 5.2, which are related to the recommendations made under this heading concerning the availability of data required for modelling.

Examples of data that can be made more readily available include:

- Accurate emissions data for industrial sites, particularly variation throughout a typical year;
- Traffic data. As well as traffic flows themselves, further work can be done to make use of country-wide data such as fleet composition and to make these data more readily available, for use in developing more accurate emissions estimates;
- Hourly sequential meteorological data. Three-hourly data are currently available, and can be interpolated to produce hourly sequential data, but ideally hourly sequential data should be available for sites around the country; and
- Terrain data; not a high priority for Lithuania.

Finally, the Consultants stress the importance of introducing requirement for modelling as an air quality assessment tool in line with the requirements of the AQFD, ensuring also that modelling results can be used for air quality assessment purposes in agglomerations and other territories along with or instead of direct measurements. Of course, this also assumes, that the minimal requirements for modelling software are applied and enforced by the MoE. Summary recommendations for the selection of air pollution dispersion models follow.

For any particular study, a model capable of taking into account all relevant emissions sources should be used. The model should be able to consider a sufficient number of industrial sources, including point, area and volume sources, and road sources in the case of the urban scale model. In addition, the models used for permitting should fit the following criteria:

- The model should provide output on a local scale, up to around 50 km, with a high output grid resolution.

- The model should be able to calculate wet and dry deposition as well as concentration output.
- The model should be able to include the effects of complex terrain on dispersion using various digital terrain data formats, including parameterisation of surface roughness.
- It should be possible to define the variation of emission parameters and rates with time, i.e. hour to hour, day to day and month to month variation.
- The model should be a so-called "new generation" model with respect to the parameterisation of the boundary layer, i.e. including Monin-Obukhov length scale and boundary layer scaling. The model should be able to describe dispersion under all types of atmospheric stability conditions in the atmospheric boundary layer.
- The model should be able to accept, as a minimum, standard hourly sequential meteorological data without the need for any further meteorological measurements. Standard meteorological parameters are assumed to be surface temperature, wind speed and direction, cloud cover, precipitation. The model should ideally also be able to accept more advanced meteorological parameters such as heat flux, Monin-Obukhov length, boundary layer height and solar radiation.
- The model should include $NO_x$ chemistry in order to calculate concentrations of $NO_2$ for direct comparison against $NO_2$ limit values.
- The output should be able to be displayed in graphical form as contour plots on a map covering the area of interest. The output must also be exportable for other purposes, e.g. as text files for further processing in spreadsheets.
- It should be possible to output results from the model for direct comparison with the EU limit values, i.e. in percentile format with the full range of averaging times, including for example daily averages and rolling 24-hour averages, without requiring the use of factors to determine the values for different averaging times.
- The model should include the impacts of plume rise and buildings on dispersion of industrial pollutants.
- The software supplier should provide validation papers to demonstrate the performance of the software proposed, including examples of the application of the model and comparison between simulated and measured results.

## *5.4. Conclusions*

The Consultants suggest that carrying out all of the above recommendations will ensure excellent functionality of the air quality management system in Lithuania and smooth implementation of EU air quality requirements in the country. It is impossible to stress too much that the strong political will of the Ministry of Environment and good cooperation with all key stakeholders, primarily the Ministry of Health and the municipalities, is required in order to complete the work already started and to improve air quality, while maintaining economic competitiveness and satisfying the requirements of the broad range of economic actors.

# List of abbreviations

| | |
|---|---|
| AAQ | Ambient air quality |
| AQFD | Air Quality Framework Directive |
| AQM | Air quality management |
| CERC | Cambridge Environmental Research Consultants Limited |
| EC | European Commission |
| EIA | Environmental Impact Assessment |
| ELLE | SIA Estonian, Latvian & Lithuanian Environment |
| EMEP | Co-operative programme for monitoring and evaluation of the long range transmission of air pollutants in Europe |
| EPA | Environmental Protection Agency |
| EU | European Union |
| IIASA | International Institute for Applied Systems Analysis |
| IPPC | Integrated Pollution Prevention and Control (TIPK) |
| LHMS | Lithuanian Hydrometeorological Service |
| MAC | maximum allowed concentrations (DLK) |
| MoE | Ministry of Environment |
| MoH | Ministry of Health |
| $NO_2$ | nitrogen dioxide |
| $NO_x$ | nitrogen oxides |
| PAH | polycyclic aromatic hydrocarbons |
| PM | particulate matter, dust |
| REPD | Regional Environmental Protection Department |
| SAZ | sanitary protection zone |
| SEPI | State Environmental Protection Inspectorate |
| $SO_2$ | sulphur dioxide |
| ToR | Terms of Reference |