

## TECHNICAL ANNEX

### **SERVICE CONTRACT FOR CARRYING OUT ADAPTATION OF TARGET LOAD FUNCTIONS FOR RAINS SIMULATIONS OF TIME DELAYS OF ECOSYSTEM RECOVERY CAUSED BY EUROPEAN REDUCTION ALTERNATIVES OF ACIDIFYING COMPOUNDS**

#### **1. INTRODUCTION**

On 4 May 2001, the European Commission launched the Clean Air for Europe (CAFE) programme<sup>1</sup> – a knowledge based approach with technical and scientific analyses and policy development that will lead to the adoption of a thematic strategy on air pollution fulfilling the requirements of the Sixth Environmental Action programme.<sup>2</sup>

The Sixth Community Environment Action Programme 1600/2002/EC requests the Commission to prepare a Thematic Strategy on Air Pollution by 2005. One of the tasks concerns the review and updating where appropriate of national emission ceilings with a view to reaching the long term objective of no exceedance of critical loads and levels and the development of better systems for gathering information, modelling and forecasting.

In 2004, the RAINS model will be reviewed by a group of international scientific experts lead by IVL. Most likely the review will give recommendations for further improvement of the RAINS model, with possible implications to the cost-benefit analysis of the present assignment.

In late 2003, the contract to carry out cost-benefit analysis of air pollution policy options was launched. As part of the assessment of the benefits of improved ecosystems, it has thus far not been possible to convert the well established concept of critical loads to something that could be linked to the valuation of ecosystems. As part of the CAFE programme, it would be important to try to establish the total benefits of reducing health and environmental risks relating to air pollution and thus, further work on ecosystem benefits is necessary. One way of establishing this is to try to further develop the ecosystem indicators so that the experts in valuation can convert the ecosystem improvements to benefits that can be used in cost-benefit analysis in a complementary manner.

---

<sup>1</sup> The CAFE programme aims at developing a baseline scenario and variants as well as policy scenarios to meet environmental targets in Europe in a cost-effective way. Also considerations of costs and benefits (and dis-benefits) of different policy options play an important part in making policy proposals, such as in the development of different EC directives. In order to carry the analytical work rigorously following a knowledge-based approach, the Commission has established several inter-linked contracts and lines of development to carry out the work required. These, as well as related projects funded by DG Research, are given at the CAFE web-site. The main contracts are the “Systematic Review of Health Aspects of Air Quality in Europe” (WHO), the “Development of the baseline and policy scenarios and integrated assessment modelling framework” (using the RAINS model of IIASA), the “Further development and application of the TREMOVE transport model” (University of Leuven) and the “Cost-benefit analysis of air quality related issues” (AEAT). For details, see <http://europa.eu.int/comm/environment/air/cafe/activities/activities.htm>

<sup>2</sup> For further details on CAFE programme, see <http://europa.eu.int/comm/environment/air/cafe/index.htm>

The Coordination Centre for Effects (CCE) develops critical load<sup>3</sup> methodologies and databases within the work programme of the Working Group on Effects (ICP-Modelling and Mapping) under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP). The CCE produces European maps of critical loads using data provided by 25 National Focal Centres (NFCs). These data were used in the RAINS model to support the CLRTAP Gothenburg Protocol to Abate Acidification, Eutrophication and Ground-level Ozone<sup>4</sup> (1999) as well as the Directive on National Emission Ceilings for certain pollutants (NEC Directive)<sup>5</sup> (2001/81/EC).

The critical loads database is now being updated and extended to include information on time delays of ecosystem damage and damage recovery following the provisions laid down in the Manual on Methodologies and Criteria for Mapping Critical Levels/Loads and Geographical Areas where they are exceeded (Mapping Manual).<sup>6</sup> This requires the use of dynamic modelling by NFCs, which will have to apply their own model as well as a common model (the “Very Simple Model”) on the national environmental data. A call for data on critical loads and dynamic modelling variables has been issued in November 2003. This call will yield Target Load Functions for forest soils and surface waters ecosystems for which European critical loads of acidity are available. Target Load Functions provide information on combinations of sulphur and nitrogen atmospheric deposition which lead to recovery within pre-defined time horizons (e.g. 2030, if emission reductions are implemented in e.g. 2020). Potentially, NFCs could provide the requested data for a large number of forest and surface water ecosystems (the total number of ecosystem points being about 1,500,000 for the whole of Europe). The deadline for the call for data is in March 2004. A task force under the CLRTAP Working Group on Effects will hold a workshop 19 to 23 May 2004 to present validated data for the dynamic effects of acidification.

The validated database will not have complete coverage for Europe since not all (but most) countries will submit data on dynamic effects on ecosystem and target load functions. Also, the data base will hold data for a number of points in each county that needs to be generalised and to be representative for all similar ecosystems in Europe. The database will be publicly available from May 2004 at the Coordination Centre for Effects.

The response to the call for data and the validated database will then have to be adapted to geographically cover Europe as a whole and made suitable for the RAINS model, i.e. “aggregated” for use on the EMEP 50x50 km<sup>2</sup> (or 150x150 km<sup>2</sup>) grid system. This does not only involve the update of the European critical loads database, but also the introduction of the dynamic effects through recovery response functions. The CLRTAP International Cooperative Programme on Modelling and Mapping (ICP MM) has developed the concept of “Target Loads”, also described in the Mapping Manual. The Target Loads take into account the atmospheric acid deposition (the “load”) to be

---

<sup>3</sup> A definition of critical loads is generally accepted as *'a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge'*. In this context, 'significant harmful effects' may be (a) chemical changes in soils and waters which might cause direct or indirect effects on organisms, or (b) changes in individual organisms, populations or ecosystems (Nilsson and Grennfelt 1988).

<sup>4</sup> See [http://www.unece.org/env/lrtap/multi\\_h1.htm](http://www.unece.org/env/lrtap/multi_h1.htm)

<sup>5</sup> See <http://europa.eu.int/comm/environment/air/ceilings.htm>

<sup>6</sup> <http://www.oekodata.com/icpmapping/index.html>

achieved/respected a certain implementation year in order to achieve ecosystem recovery a certain target year. According to the Mapping Manual these Target Loads are well suited for integration into Integrated Assessment Modelling, such as the one used for the CAFE programme (RAINS). The Target Load functions for acidification could be also be used for (monetary) valuation purposes and thus facilitate the inclusion of at least part of the ecosystem benefits to the cost-benefit analysis.

## **2. OBJECTIVE**

The main objective of this service contract is to integrate the scientific knowledge of ecosystem dynamic effects of damage and damage recovery due to acidification and eutrophication into the integrated assessment modelling by RAINS and the subsequent cost benefit analysis of policy options in the context of CAFE. Specifically the objectives are to

- (1) Have developed the methods for the translation the scientific knowledge of ecosystem dynamic effects and ecosystem damage recovery provided by National Focal Centres and the Coordination Centre on Effects, both under the CLRTAP, into the RAINS modelling framework with a resolution of 50x50 km<sup>2</sup>, such as through the development of “Target Loads” and “Target Load Functions”.
- (2) Have developed the methodology to use the information of ecosystems damage and damage recovery from air pollution for (monetary) valuation purposes that would be part of the benefit assessment in the CAFE programme.
- (3) Have provided the data (or parametrisation) for an update of the RAINS effects module to include updated critical loads for acidification and eutrophication, and the dynamic effect for acidification, such as through “Target Loads” and “Target Load Functions”.
- (4) Advise, as appropriate, on the possible use of RAINS environmental impact indicators, i.e. (1) critical load exceedances, (2) ecosystem protection, and (3) time delays of damage or recovery for carrying out Cost-Benefit Analysis (CBA) of air pollution issues, in particular in the CAFE Programme. The possible use of these indicators is subject to the suitability of CBA methodologies which are being developed elsewhere under CAFE.

## **3. SCOPE**

The work described in this technical annex relates to the tasks of the multi-criteria and cost-benefit analysis that will be carried out in the CAFE context. In cost-benefit analysis the contractor (AEA Technology) needs to quantify the environmental effects on forests and (semi-) natural ecosystems (including acidification, eutrophication), and on waters (including acidification and eutrophication). The contractor will also carry out a multi-criteria analysis on environmental effects of reduced air pollution. The contractor also needs to make estimates of the environmental impact in relation to the critical loads and levels that are used for the development of environmental targets within CLRTAP. Thus, the ultimate aim for the present assignment is to provide support in the integration of the scientific knowledge on air pollution dynamic effects on ecosystems in to the RAINS model so that the cost-benefit analysis team may estimate the marginal damage of air pollution to ecosystems for 2010, 2015 and 2020.

#### 4. METHODOLOGY

Improvements in the quantification of environmental damage resulting from acidification and eutrophication will need to be based on an assessment of the time profiles of ecosystem stress. Dynamic models have been developed over the past decades which describe the time lags between exposure and damage of ecosystems<sup>7</sup>. A Mapping Manual has been developed under the UN/ECE Working Group on Effects describing a variety of complex dynamic models, as well as a “Very Simple Dynamic” (VSD) model. The CLRTAP has requested the National Focal Centres to assess the dynamics of acidification of their ecosystems according to the methodologies recommended by the manual and to report the results back to the Coordination Centre for Effects.<sup>8</sup>

It is important that the assessment methodology of the dynamic effects on ecosystems is fully compatible with the concepts and data produced through the CLRTAP working groups conclusions and Mapping Manual.

The Mapping Manual also includes possible linkages between dynamic modelling results and their use in integrated assessment. The most promising method is the use of so called Target Load Functions. NFCs will be requested to “back-calculate” Target Loads, starting from a number of optional target years (= year of recovery; probably 2030, 2050) to identify the combination of Sulphur and Nitrogen deposition in the implementation year of emission reductions which is in the context of CAFE is either 2015 or 2020.

Information supplied by NFCs needs to be aggregated to “Target Loads” on EMEP grid cells to have the RAINS model ultimately provide an answer to the question “*if the emission reduction of Sulphur and Nitrogen compounds is x% in 2020, what is the percentage of ecosystem area which is likely to recover in (say) 2050 (or any other chosen target year)*”.

The method to derive “Target Loads” parameterisation for EMEP grid cells, will be broadly similar to the method (described in the Mapping Manual) used to produce Protection (or Exceedance) Isolines from the Critical Load Functions. Those isolines have been derived from the critical load database to enable RAINS applications and optimization. Whether this similarity in methodology holds need to be explored and confirmed.

At the same time, information obtained from dynamic modelling could provide critical insight for an economic assessment of benefits. Dynamic models quantify the time during which an ecosystem was under stress due to increased deposition, which is an important step towards the quantification of damage compared to the steady-state approach of the critical loads concept.

#### 5. TASKS

The following tasks shall be conducted and deliverables produced:

---

<sup>7</sup> An overview of the status of dynamic modelling is provided in the Dynamic Modelling Manual (Posch et al. 2003). <http://www.rivm.nl/bibliotheek/rapporten/259101012.pdf>

<sup>8</sup> Training in the use of this and other models have been conducted in Tartu (19 May 2003) and in Prague (13-15 October 2003).

Task 1: Construct a database of “Target Loads” and “Target Load Functions” as result of the call for data<sup>9</sup> and include in the database indicators that could be used for valuation purposes in the Cost-Benefit analysis in the CAFE programme.

Task 2: Test the appropriateness of alternative methods to convert output of dynamic models into input for integrated assessment models

Task 3: Develop “Target Load” parameterisation to be consistent with the Mapping Manual at the scale of the EMEP grid size and to make them available for the RAINS model as well as – in a suitable form – for the team who will carry out the Cost-Benefit analysis in the CAFE programme.

Task 4: Assist testing the “Target Load” methodology in the RAINS Environment and report to the Working Group on Effects.

Task 5: Assist the team that will carry out the Cost-Benefit analysis in interpreting the ecosystems data correctly so that the value of ecosystems can be included in the multi-criteria assessment and if possible also in the Cost-Benefit Analysis the analysis. Specifically it would be important to provide results split down by type of ecosystem, to show which are at risk and which are not. If quantification of economic benefits of reduced damage to ecosystems is not possible, the contractor needs to give specific recommendations on how to achieve the most useful form of output for valuation research by e.g. refining the “Target Load” methodology.

## **6. SCHEDULE**

A Preliminary European critical load data and Target Load Functions (i.e. tasks 1-3) need to be completed within 2 months of the signing of the contract. Results will be presented at the CCE workshop and Task Force Meeting of the ICP Modelling and Mapping<sup>10</sup>.

A CCE report describing the results will be completed and presented to the Working Group on Effects in its meeting of 1-3 September 2004 and to an appropriate meeting under the CAFE programme later that year. Further interactions on the application of results in the RAINS model as well as with the team developing the Cost-Benefit analysis in the CAFE programme will continue according to the work plans under the LRTAP Convention and the CAFE programme, as appropriate.

## **7. ORGANISATION OF THE WORK**

The contractor will work exclusively for the European Commission services, represented by the Directorate-General for the Environment. In its work, the Commission will be assisted by different groups in the CAFE programme. In its day-to-day work the contractor will work closely with the Integrated Assessment Model team lead by IIASA and the team that is developing the Cost-Benefit analysis of CAFE, lead by AEA Technology.

---

<sup>9</sup> The deadline of the call for data is 31 March 2004.

<sup>10</sup> This is hosted by the Austrian Ministry of Environment and organised in collaboration with the International Institute of Applied Systems Analysis (IIASA) from 24-28 May 2004 in Laxenburg, Austria.

Since the CLRTAP is developing air pollution policies for Europe as well, sharing of information between the CAFE programme and CLRTAP is essential to ensure coherence between the two lines of work. Coherence of work should also be reflected in the work plan of the assignment.

It is therefore expected that the methodology and results are presented and discussed within the CLRTAP experts group such as the Task Force on Mapping and Modelling (meeting 24 to 28 May 2004) and the Working Group on Effects (meeting 1 to 3 September 2004). The methodology and the results are also to be presented and discussed at the CAFE working groups and Steering Group. The Contractor should therefore plan for such travel provisions to meet the needs of communicating with external expert groups.

The Commission will set up a reference group for the further guidance of the assignment with participation from the Commission, the contractors for the Integrated Assessment Modelling (IIASA), the Multicriteria Analysis and Cost-Benefit Analysis (AEA Technologies) and a representative of the CLRTAP Working Group on Effects.

## **8. DURATION OF THE CONTRACT**

The contract duration is 8 months from the signature of the contract.

## **9. VALIDITY OF THE OFFER**

The offer has to be valid from the date of submission of the tender and valid for six months thereafter.

## **10. DELIVERABLES**

The contractor will prepare the following main reports:

- (1) A short inception report which includes mainly the workplan including a description of a draft methodology to use information derived from dynamic models for an economic benefit assessment. This is to be delivered within two month of the signing of the contract.
- (2) A final report which summarises how the work has been carried out and in particular how the results (e g “Target Loads” and Target Load Functions” and their parameterisation) were included in the RAINS model and how the work contributed to the estimation of marginal damage in the cost-benefit analysis. The report needs to contain a **well-written executive summary** (max 5 pages) showing the main findings of the work. The contractor will also draft as summary suitable to be included in a CCE report the response to the call for data which will also include latest European maps of critical loads, and NFC reports justifying national contributions.

## **11. METHOD OF PAYMENT**

This contract will be paid on a lump sum basis.

A pre-financing payment of 30% will be paid upon signature of the contract.

A final payment of 70% will be paid upon acceptance by the Commission of the final report.

The Commission is exempt from all taxes and dues, including value added tax, pursuant to the provisions of Articles 3 and 4 of the Protocol on the Privileges and Immunities of the European Communities with regard to its financial contribution under the contract.

## **12. AWARD CRITERIA**

The award criteria are the following:

- (1) Methodology: The degree to which the methodology shows the capacity to resolve the questions underlying the tender in a realistic and well-structured way as well as to whether the methods proposed are in conformity with the need of the Commission expressed in the technical annex.
- (2) Project management and availability: The offers will be assessed as regards the quality of the team organisation and the time share attributed to each of the members, which should clearly be outlined in the tender.
- (3) Understanding: This criterion is intended to assess whether candidates have taken into consideration all the aspects of the tasks required by the contract, such as they appear above, as well as the contents of the proposed end product.

## **13. POINTS SYSTEM**

**Points**: A maximum of 50 points will be attributed to the criterion 'methodology', a maximum of 30 points is awarded to the criterion 'Project management and availability' and a maximum of 20 points will be attributed to the criterion 'understanding'. To be selected the companies will have to obtain a minimum of 35 points of the points for the criterion 'methodology, a minimum of 20 points of the points for the criterion 'project management and availability' and a minimum of 15 points for the criterion 'understanding', with a total minimum of 75 points to be achieved.

**Budget**: The budget is fixed at a maximum of €60.000 (including travel, fees and all other costs).

**Price**: The bid offering the best value for money will be chosen, providing the minimum number of points is achieved. This is calculated by dividing the price by the number of points awarded.