



**Economic and Social
Council**

Distr.
GENERAL

EB.AIR/GE.1/2000/11
EB.AIR/WG.5/2000/2
9 May 2000
Original: ENGLISH

ECONOMIC COMMISSION FOR EUROPE

EXECUTIVE BODY FOR THE CONVENTION ON
LONG-RANGE TRANSBOUNDARY AIR POLLUTION

**Steering Body to the Cooperative Programme for Monitoring and
Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)**
(Twenty-fourth session, Geneva, 4-6 September 2000)

Working Group on Strategies and Review
(Thirty-second session, Geneva, 29 August - 1 September 2000)

INTEGRATED ASSESSMENT MODELLING
Progress report by the Chairman of the Task Force

Introduction

1. This report presents progress in integrated assessment modelling, in particular the inclusion of particulate matter into the model, as well as a long-term work programme for integrated assessment modelling under the Convention. It includes the results of the twenty-fifth meeting of the Task Force on Integrated Assessment Modelling, held in Saltsjöbaden (Sweden) on 12-14 April 2000.
2. Experts from Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, the Netherlands, Norway, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, the United States and the European Community (EC) participated in the meeting. Representatives from the European Environment Agency and the EC Joint Research Centre, as well as from the International Institute for Applied Systems Analysis (IIASA), the Oil Companies' European Organization for Environment, Health and Safety (CONCAWE) and the World Conservation Union (IUCN), were also present. Mr. Rob MAAS (Netherlands) chaired the meeting.

Documents prepared under the auspices or at the request of the Executive Body for the Convention on Long-range Transboundary Air Pollution for GENERAL circulation should be considered provisional unless APPROVED by the Executive Body.

I. INPUT PARAMETERS FOR INTEGRATED ASSESSMENT

A. Effects

3. The Coordination Center for Effects (CCE) informed the Task Force about the dynamic modelling activities in progress under the Working Group on Effects and the possible relevance of this work to integrated assessment modelling. The work is undertaken jointly by several International Cooperative Programmes (ICPs), including ICP Mapping and Modelling, ICP Forests, ICP Waters and ICP Integrated Monitoring, as well as nationally by some Parties. A joint ICP meeting of experts is scheduled for October 2000. At present work at CCE focuses on the relationship between the base cation to aluminium ratio in soils and the ecosystem damage or recovery periods. The aim is to estimate the time that elapses before damage occurs once deposition reaches the critical load and remains above it and the time needed for recovery to start once deposition has been reduced below the critical load. It is the intention of CCE to involve the Centre for Integrated Assessment Modelling (CIAM) in this work once sufficient progress has been made. Similar work is planned on nitrogen deposition and its relationship to eutrophication.

4. The Task Force will follow the work with interest. It noted that such a chemical approach would form a first step towards an illustration of the actual damage and recovery processes that was of interest to policy makers.

B. Emission and economic activity data

5. The secretariat informed the Task Force about the latest round of emission data reporting. While many of the reports had been submitted after the deadline, the amount of data reported had significantly improved. Even for substances that had caused difficulties in the past, such as ammonia and volatile organic compounds (VOCs), a lot of data had been received.

6. CIAM presented a proposal for a streamlined data request to Parties to facilitate the introduction of nationally supplied data into the integrated assessment models. The proposal, developed in collaboration with the EMEP Meteorological Synthesizing Centre-West (MSC-W), refers to national level data, relying largely on published information. It is expected that data will be easier to compile than CORINAIR SNAP 2 emission data currently requested.

7. Figure I explains the method employed in the RAINS model to calculate emissions and abatement costs. In the past, IIASA used international and national statistics on energy, agriculture, industries and specific sectors responsible for other VOC emissions. The data on

control measures and legislation were taken from the reports on strategies and policies for air pollution abatement.

8. While it may be inappropriate to request all the required data from Parties, some key inputs, such as the data on economic activity and on control measures and legislation, might best be provided by Parties. The proposed new data format uses, wherever possible, information covered by the reporting obligations under the United Nation Framework Convention on Climate Change.

9. CIAM intends to make all the information used to calculate emissions in the integrated assessment model available via the Internet, giving Parties a possibility to comment also on those data that came from other sources.

10. The Task Force:

(a) Welcomed the proposal and prospects of a clear and transparent module to help national experts understand how the RAINS model calculated national emissions and abatement costs;

(b) Recognized the need for better coordination between international organizations and conventions on the specification of data to avoid duplication and an excessive reporting burden on Parties;

(c) Decided to recommend that the EMEP Steering Body should include activity data in the emission data requests in line with the reporting requirements for similar data under the United Nations Framework Convention on Climate Change (five-year steps up to 2020) and to suggest that the Task Force on Emission Inventories should amend the reporting guidelines accordingly;

(d) Decided to keep 1990 as the base year for modelling until the data were available to make it possible to change to 2000;

(e) Agreed that information on control measures and legislation should be covered as much as possible in the Parties' reports on their strategies and policies, and requested CIAM to examine the questionnaire used for these reports with a view to proposing amendments, if necessary.

11. The European Commission informed the Task Force about a study it had commissioned to prepare an inventory of emissions of sulphur, NO_x, VOCs and CO from ships in the Mediterranean for 1990 at the level of the EMEP 50 km by 50 km grid. The work has been carried out by Lloyds and is now being incorporated into the EMEP emission database. The Task Force welcomed this as an important step forward. It noted that it was important to avoid any double counting of emissions from ships in territorial waters that should in principle be included in national emission reports.

II. MODELLING PARTICULATE MATTER

12. Mr. Markus AMANN of the Centre for Integrated Assessment Modelling (CIAM) at IIASA presented the interim report on an initial framework to assess the control of fine particulate matter in Europe. The report is posted on the Internet at www.iiasa.ac.at/~rains. However, its results are very preliminary and still subject to extensive verification. CIAM nevertheless presented the report with the objective of involving national experts in the discussion as early as possible and of enhancing transparency. The work was conducted with financial support from the Federal Environment Agency of Germany and the Department for the Environment, Transport and the Regions of the United Kingdom.

13. The RAINS model (see fig.I) has been extended to include a separate module for primary particulate matter (PM) and to link the modules of the other pollutants (sulphur, NO_x, NH₃, and VOCs) through the formation of secondary aerosols to estimate overall population exposure to PM. In view of the gaps in the knowledge about the exact relationship between PM concentrations and observed health impacts, the model currently makes it possible to look at PM₁₀, PM_{2.5}, ultra-fine particles and total suspended particles (TSP) in parallel. The model is flexible enough to focus on other measures or groups of PM.

14. The atmospheric dispersion modelling is based on work conducted at Imperial College London (related to primary PM) and MSC-W (related to secondary PM). While it is the intention to base this part of the model on the Eulerian model at the 50 km x 50 km resolution, which will include dynamic aerosol formation, it is currently based on a linear version of the Lagrangian model.

15. Most of the work has so far focused on an initial inventory and projections of primary PM. IIASA used the inventory prepared by the Netherlands consultancy TNO for 1993 as well as its own database on economic activities. Emission factors were either taken from the

literature or re-estimated. As there may be important country-specific differences in emission factors, these needs to be further developed in collaboration with national experts.

16. EEA has initiated a coordinated programme together with EMEP, the European Commission and several Parties to develop a complete set of emission inventories and projections for PM₁₀ and PM_{2.5} by the end of 2000 and to develop guidance for Parties to produce their own inventories in 2001. This will be presented to the Task Force on Emission Inventories so that the relevant part of the Guidebook can be updated. The terms of reference for the consultants were drafted on the basis of the outcome of the workshop in Interlaken (Switzerland).

17. CIAM has completed a first set of control cost curves for primary PM. They will be presented at an informal meeting of experts at the end of April 2000. Once proposals for changes have been incorporated, CIAM intends to present the methodology and data to all Parties at a workshop in the autumn of 2000.

18. The Task Force welcomed the progress and congratulated CIAM on its work. It noted that this work and the workshop planned for the autumn were very timely given that EC member States had to start developing policies to be able to meet the air quality standards included in the EC directive on PM.

19. Much work remains with respect to the integration of the effects of PM concentrations on human health. There is a need to link better the rural to urban concentrations and possibly to personal exposure. While existing dose-response functions are often based on daily concentrations, the model will have to use other measures. The Task Force agreed that a special workshop should cover these and related questions, including the definition of meaningful indicators used in integrated assessment modelling. It should attract health effects experts and especially bring in the results of work done in North America, including the United States criteria documents that will become available in the autumn of 2000. Due account should be taken of the initiative of the EC Directorate-General for Health to continue in collaboration with the World Health Organization (WHO), the former Air pollution health effects in Europe (APHEA) programme related to health impact indicators.

20. Imperial College informed the Task Force of its progress in modelling PM. Besides secondary PM that it had reported on at previous meetings, it was now also incorporating primary PM into the abatement strategies assessment model (ASAM). Imperial College provided modelling results for the report on health risks of PM from long-range transboundary air pollution published by the joint WHO-UN/ECE Task Force on the Health Aspects of Long-range

Transboundary Air Pollution. Modelling results had also been published in the journal Atmospheric Environment.

III. OTHER MODELLING ACTIVITIES

21. The European Commission informed the Task Force of progress in the political discussion on its proposal for a national emission ceilings (NEC) directive in the European Parliament and in the Council. It presented some results of integrated assessment modelling work done subsequent to the adoption of the Gothenburg Protocol. This work showed that given the emission ceilings in the Protocol for non-EU countries, the environmental targets of the proposed NEC directive (which are those of the G5/2 scenario presented by the Task Force previously) (EB.AIR/WG.5/1999/14) could be achieved at lower cost (EUR 1.2 billion less) than originally estimated. Some of the proposed ceilings for EU countries could even be further relaxed given the additional measures on shipping emissions that were possible now that the International Maritime Organization (IMO) had designated the Baltic and the North Sea as SO_x emission areas under the MARPOL Protocol. This would yield an additional saving of about EUR 0.5 billion. Reports are available on the Internet at:
<http://europa.eu.int/comm/environment/docum/99125sm.htm>.

22. The Swedish NGO Secretariat on Acid Rain presented the main conclusions of the report "Getting more for less - an alternative assessment of the NEC directive". The report shows that by following an alternative low CO₂ energy scenario (-15% CO₂ in EU), the estimated annual costs of achieving the interim environmental targets of the draft NEC directive can be reduced by nearly two thirds - from EUR 7.5 billion to 2.7 billion. The results are based on modelling of EU member States with the RAINS model. They confirm those of earlier analyses investigating the impact of low CO₂ energy scenarios, that estimated costs to reduce by 40-60%. The report as well as other related reports are posted on the Internet at www.acidrain.org.

23. The Integrated Assessment Unit at Imperial College London is further developing ASAM. Work includes experiments with the first results of the Eulerian model in collaboration with MSC-W. Other modelling activities cover links to global scale and local scale problems, including the development and application of integrated assessment modelling to air quality strategies for PM₁₀ in London.

24. An expert from France presented a study on the sensitivity of the RAINS model conducted at the research unit of the French electricity utility EDF. The study aimed to develop an analysis by varying, at random, model input parameters (transfer matrices, acidification targets and cost

curves) by +/- 20%. The resulting variations in the calculated emission ceilings turned out to be up to 80%. The study covered only seven model runs and was therefore not able to develop statistical distributions of the model outputs, which requires several thousands of model runs. The study used the last publically available model version (RAINS 7.2), which has since been upgraded, e.g. introducing a compensation mechanism to increase robustness.

25. Imperial College reminded the Task Force of the results of its sensitivity studies. The report on uncertainties in integrated assessment modelling of abatement strategies, which has been published in the Journal of Environmental Science and Policy, illustrates the large degree of robustness of derived abatement strategies to uncertainties in critical loads, meteorological data and cost information.

26. A study at the French Institut National de l'Environnement Industriel et des Risques (INERIS) has evaluated some of the modelling work undertaken by IIASA for the French Ministry for Land-use Planning and the Environment. The full IIASA report (Further analysis of scenario results obtained with the RAINS model, Second interim report, December 1999), which was the basis for the INERIS study, is available on the Internet at: www.iiasa.ac.at/~rains. The INERIS study itself is available on the Internet at: www.ineris.fr/en/recherches/scientifique.htm. The study further examines the optimization approach taken in the RAINS model and proposes alternative approaches. It argues that strategies aiming at reducing the total European area that is unprotected against acidification, eutrophication or exposure to ozone would be less costly than optimized scenarios. Such strategies would, however, violate environmental targets in certain countries that are binding for the optimal solution (Netherlands is the example shown in the study) and would change the distribution of costs and benefits among the countries.

27. The INERIS study draws a number of conclusions for further work, suggesting that models should:

- Be as simple and transparent as possible;
- Remain flexible as long as possible to allow the analysis of different strategies;
- Perform robustness evaluations in view of the main uncertainties of their parameters;
- Also take long-term objectives and global factors into account; and
- Use thorough and realistic assessments of technical and structural measures to abate emissions.

While there was some disagreement with some of the criticisms of the modelling work formulated by the study, in particular of the way the non-linearities in ozone formation had been covered, the Task Force agreed on the usefulness of keeping these general conclusions in mind in its further work.

28. Mr. Ramon GUARDANS (Spain) informed the Task Force about a joint research project of the University of Kassel (Germany), the Centro de investigaciones energéticas, medioambientales y tecnológicas (CIEMAT) of Spain, and the Netherlands National Institute of Public Health and the Environment (RIVM). AIR-CLIM is funded by the European Commission, Directorate-General for Research, and aims at linking regional air pollution in Europe and climate change. In particular, its objectives are to examine whether climate change will alter the effectiveness of policies to reduce regional air pollution, to evaluate the relative importance and overlap of regional air pollution and climate change impacts, and to identify comprehensive policies that address at the same time regional air pollution and climate change. First results indicate that critical loads and levels will be affected by climate change. The Task Force will be informed about the results of the project, which is to be finalized by the end of 2000. More information can be obtained via the Internet at: www.usf.uni-kassel.de/English/Projekte/Air-Clim ENG.

29. The Chairman informed the Task Force about a study prepared by RIVM for the United Nations Environment Programme (UNEP) on a global assessment of acidification and eutrophication of natural ecosystems. The study is a first attempt to assess the effects beyond the continental scale in view of the sharply increasing emissions of sulphur and nitrogen compounds outside Europe and North America. It provides an indicative view of the potential effects of S and N inputs on ecosystems at the global scale and the existing gaps in knowledge. The report is available on the Internet at: www.rivm.nl/env/int/geo.

IV. LONG-TERM WORK PROGRAMME

30. On the basis of the conclusions of the workshop on the future needs for regional air pollution strategies, in Saltsjöbaden (Sweden) on 10-12 April 2000, the Task Force developed elements for a long-term work programme to cover the period up to the review of the Gothenburg Protocol, expected for 2004. The work programme elements set out below are the result of a brain-storming exercise and reflect the requirements from an integrated assessment modelling perspective. They are suggestions for a long-term work programme for consideration by the EMEP Steering Body and the Working Group on Strategies and Review. The Task Force recognized that it was not the appropriate forum to discuss or determine the priorities of other bodies. It would therefore communicate this first draft, which covered the next four years, to the

relevant groups or their chairpersons. The Chairman of the Working Group on Strategies and Review announced his intention to take up the draft at the upcoming thirty-second session of the Working Group.

31. The Task Force also noted that several elements of this draft work programme related to what was expected to be part of the EC Clean Air for Europe (CAFÉ) Programme, which would start in 2001. As much work as possible should be conducted jointly with CAFÉ, such as the organization of joint projects, workshops and the development of joint databases and methods.

A. Particulate matter

32. The following table gives an overview of activities and time frames to develop an adequate integrated assessment modelling framework on particulate matter (PM) so that integrated assessment models (IAM) can be operational at the beginning of 2004. Many uncertainties surround planned work on PM and many of these may not be resolved by the end of 2004. Efforts will therefore be necessary to develop robust scenarios emphasizing the use of “no-regret” measures wherever possible.

Year	Source-Receptor		Emissions	Costs	Effects	IAM*
2000	Work on completing PM module in Eulerian EMEP model (including organic PM)		First prelim. inventory & projections 2010/20	Review of cost data, workshop	Workshop on economic assessment of health benefits	Cost curve development
2001	Regional model-ling study	Workshops (North America/ Europe): - Hemispheric modelling. - PM composition and monitoring	Initial review by countries	Preliminary cost curves	Review of new effects data by WHO & TFHealth Effects (with N.American experts)	Development & test of reduced-form model
2002	Urban modelling study and workshop		Final inventory & projections. Work on base year 2000 inventory		New WHO guideline. Workshop on choice of indicator for health impacts in IAM*	Development & test of interface to urban scale. Develop ways to account for structural changes
2003				Final cost curves		Test of scenario analysis and optimization
2004	Application of IAM*					

* Integrated assessment modelling.

Explanations:

(a) **Source-receptor relations:** Work on the Eulerian EMEP model to enable simulation of secondary PM (including organic particles) is expected to be completed in 2001. This work will also cover the interaction between secondary organic aerosols and photochemical processes. A modelling study will be performed in 2001. It will also include other regional models with the aim of deriving reduced-form models for inclusion into integrated assessment models. The development of urban-scale modelling should receive good support and start as early as possible. Testing of urban models on a selected number of urban sites will follow in 2002 in combination with the development of an interface to integrated assessment models. In

cooperation with North American experts, two workshops are proposed for 2001: one on hemispheric modelling and the other on PM composition and monitoring;

(b) **Emissions:** This work is expected to advance in line with the terms of reference of the coordinated European programme on PM emissions inventories, projections and guidelines (see para.16 above);

(c) **Effects:** The most appropriate indicator for use in integrated assessment models has to be chosen in the course of 2002. To take account of the emerging scientific knowledge and data on health effects from exposure to PM (in particular results of work in North America) and to examine the interaction with ozone exposure, a review of these findings should be started in 2001.

B. Atmospheric modelling inputs into integrated assessment models

1. Regional (European) modelling

33. The main input will be the revised set of source-receptor relationships calculated with the new Eulerian model and available at a 50 km by 50 km resolution. Ozone modelling will be consistent with the level II approach. Model validation and comparison with measurements will be conducted in close collaboration with national experts under the guidance of the new Task Force on Measurements and Modelling.

34. National modelling activities will also make it possible to define abatement strategies at the sub-national level. So far, this has not been considered useful by policy makers, but given the level of abatement it may be necessary to target better the most harmful emission sources within a country. Such an option would require preparation, starting with the preparation of atmospheric models.

35. Further modelling will evaluate the new data on shipping emissions for the Mediterranean. A workshop with a broader agenda should be planned for 2002. It should attract experts from the whole Mediterranean area, non-Parties to the Convention, and might be organized in collaboration with the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean.

36. Modelling of heavy metals and POPs may become relevant to integrated assessment modelling only in the longer run. However, such dispersion models may be used to show secondary impacts of PM control.

2. Global atmospheric modelling

37. Links with the United Nations Framework Convention on Climate Change (UNFCCC) may help to establish global emission scenarios. Input should be sought before 2001 for presentation at the next meeting of the Task Force on Integrated Assessment Modelling.

38. Based on these scenarios, the contribution from non-European emission sources to depositions and concentrations in Europe will be examined. These data will be ready for incorporation into integrated assessment models in 2002.

3. Urban-scale modelling

39. Based on experience with the EC Auto-Oil Programme and in collaboration with the EC CAFÉ programme, specification for modelling requirements should be completed by the end of 2000 to be able to launch work in 2001. Specific integrated assessment modelling could examine a selection of sample cities. A workshop in the second half of 2001 could be used to present the results of this work and discuss ways of linking the urban to the regional modelling. A precondition for the usefulness of modelling at the urban level is that emission data, effects criteria, abatement options and their costs should be consistent.

C. Abatement options and their costs

40. The RAINS model covers all commercially available abatement technologies, some of which have reduction efficiencies of up to 90%. New and more efficient technologies will develop. Available data therefore have to be constantly updated. Such work should be carried out in close collaboration with the EC Bureau of the Integrated Pollution and Prevention Control (IPPC) Programme at the Joint Research Centre in Seville (Spain) and by using the large number of national databases on abatement techniques. The experience of updating the abatement options database in RAINS may provide the basis for a study that extrapolates this development and estimates possible future trends. A research project could provide useful input for integrated assessment modelling by 2002.

41. The costing method employed by the RAINS model seems to be appropriate for the purpose of integrated assessment modelling, where consistency of estimates is the most important criterion. As integration of measures and policies increases, it may be useful to depart from the costing of abatement separately for each pollutant and look at joint costs, as was already done for transport-related emissions of NO_x and VOCs. A short summary of this method, explaining the main assumptions and the data used, would be very useful for experts not

directly involved in integrated assessment modelling and for policy makers. As emission reduction requirements grow and marginal costs of abatement increase, the calculation of least-cost abatement strategies for all of Europe may create some unfair cost distributions. Once modelling has progressed, it may be useful to examine questions of burden sharing, in particular where differences in marginal costs determine the allocation of emission reductions between neighbouring States. It may also be useful to examine the distribution of (marginal) costs between economic sectors.

42. As emission reduction requirements grow, the use of new policy instruments, in particular economic instruments, will become more important. The former Task Force on Economic Aspects of Abatement Strategies developed a guidance document on the use of economic instruments to reduce nitrogen oxides, sulphur, volatile organic compounds and ammonia and a background document summarizing national experience (see: www.unece.org/env/tfeas). Specific examples from this document, for instance the Swedish NOx charge, could be used in integrated assessment modelling to investigate the impact of introducing such measures on a European scale.

43. Much work has already been done regarding the use of non-technical or structural measures to reduce air emissions. The Task Force organized a workshop on restructuring energy systems in Pruhonice (Czech Republic) in 1994. The VOC cost curves developed by the French-German Institute for Environmental Research (IFARE) at the University of Karlsruhe (Germany) are based on a dynamic mass flow model to be able to analyse structural measures. In the framework of the EC Auto-Oil Programme, new methods for costing structural measures have been developed. A workshop with the participation of experts from the most important sectors (transport, energy, agriculture), if possible to be held in 2001, could develop a methodology for RAINS to incorporate structural measures in an appropriate manner. For this work, a study linking the RAINS model to a general equilibrium model (possibly at the national level using one country as an example) would provide useful insights.

D. Effects

44. The impacts of ozone and PM on human health will become priorities for modelling in view of future air pollution abatement policies. Much of the work to be done is listed under section A. For health effects, as well as for ecosystem effects, a multiple stress approach may become more appropriate than traditional approaches. As abatement strategies become more stringent and more costly, the economic evaluation of benefits will become more important. A series of workshops, starting with a workshop on the economic assessment of health benefits in late 2000 and a workshop on the economic assessment of ecosystem effects in 2001, will help to

resolve uncertainties of previous benefit assessments. An overall assessment of benefits should follow these workshops in 2002.

45. Dynamic modelling will advance as set out in paragraphs 3 and 4 above. A meeting of Working Group on Effects experts is planned for October 2000. Once this work has sufficiently advanced, its incorporation into integrated assessment models should be a priority. Modelling effects at a higher resolution (moving from a 150 km x 150km to a 50km x 50 km resolution and beyond) will give a better grasp of hot-spot problems. Such work will require better data but will help to reduce some of the modelling uncertainty.

46. The first steps have been taken to evaluate loss of biodiversity. This work is expected to lead to new criteria for the evaluation of nitrogen deposition. To develop acceptable indicators, good cooperation with forums dealing with habitat and wildlife protection is necessary. A criteria workshop is planned for spring 2001.

47. Damage to buildings and materials would be suitable for inclusion into integrated assessment modelling once accepted stock-at-risk maps are available. Work is progressing and may lead to results in 2001. A joint workshop by ICP Mapping and Modelling and ICP Materials will be held in June 2000.

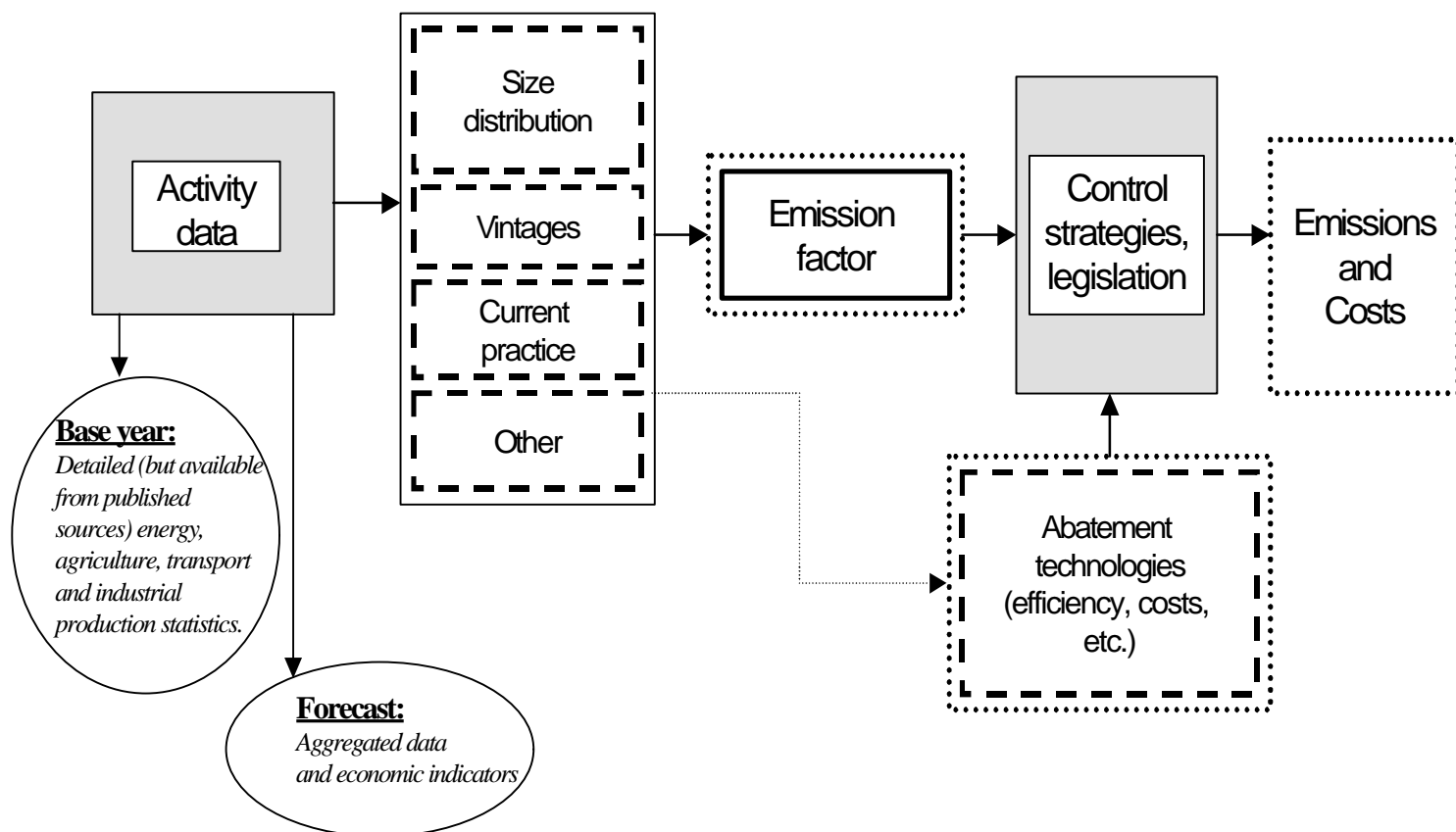
48. Under the Working Group on Effects, work will continue on the development of threshold values for heavy metal deposition, as will similar work to cover POPs. The results of this work are not expected to be ready for full inclusion into integrated assessment models in the coming years, but could serve as background.

E. The role of integrated assessment modelling

49. One of the biggest challenges for integrated assessment modelling remains increasing model complexity while keeping the model highly transparent. Another challenge will be to move from uncertainty identification towards supporting policy makers in uncertainty management. One of the main tasks for the coming period, in line with the objectives established by the EMEP Steering Body, will be to foster closer links with experts working at national level. The Task Force on Integrated Assessment Modelling therefore recommends that the EMEP Steering Body should establish national focal points for integrated assessment modelling. The tasks of these national focal points would include:

- (a) Facilitating communication between the Task Force on Integrated Assessment Modelling, CIAM and government officials, regional authorities, stakeholders in the private sector and other experts;
- (b) Helping to provide the national data needed for integrated assessment modelling by CIAM;
- (c) Developing national integrated assessment models or parts of such models which can be used for national purposes and to examine the uncertainties and sensitivity of international modelling work.

50. It will be the responsibility of CIAM to integrate as far as possible input from national experts into models and evaluate national reports submitted under the Convention. If necessary, it will comment on the data and information received and propose changes. The information from integrated assessment modelling could serve as an early warning of potential compliance problems. All data and modelling results will be made available via the Internet as soon as possible, even if they are only preliminary. If preliminary, the information should be used carefully and not be circulated beyond those involved in the modelling work. As far as technically possible the RAINS integrated assessment model will be made available via the Internet to all national experts for their use. The CIAM will support capacity building at the national level and offer to host national experts to work at IIASA for several months and to assist such national modelling activities.

Figure I: Emission and cost calculation in the RAINS model*Legend:*

	- Data asked for		- Data assumed in the model but available for review
	- Data available from guidebooks		- Result of calculation

Figure II: Flowchart of the RAINS model extended to address particulate matter

