

Background for the June 8 INC Teleconference from Erisman

J.W. Erisman, Unit Manager Biomass, Coal & Environmental research Energy Research Centre of the Netherlands, will speak at the June 8 teleconference of the Science Advisory Board's Integrated Nitrogen Committee.

He has kindly provided the following information which may be read as preparation to his presentation.

Dr. Erisman also provided a journal. Because most journal articles are copyrighted, we do not post them at the SAB website. The paper is *The Dutch N-Cascade in the European Perspective* by J.W. Erisman, Nelleke Domburg, Wim DeVries, Hans Kros, Bronno de Haan, & Kaj Sanders, published in *Science in China Ser C. Life Sciences*, 2005 Vol 48 No 1 1-10.

Dr. Erisman's remarks begin on the next page

Dear Colleagues,

Thanks for inviting me on your meeting. I hope I can contribute something to the developments in the US by sharing with you the EU/my experiences. I used Kathleen's questions and some discussions with Jim for this short document.

Is an Integrated approach really necessary and why?

The idea of an integrated approach is based on the assumption that a nitrogen cascade exist, meaning that in the end all reactive nitrogen that is produced by different sources lead to different effects, irrespective of its origin! Furthermore, N deposition to sensitive ecosystems is regarded as one effect parameter, whether it is in the oxidized and/or reduced form. This has been emphasized at different levels within governments, the EU and the Convention of Long-Range Transport of Air Pollution (CLRTAP), with success. All support an Integrated Nitrogen approach, probably without knowing in detail what it really means! The idea of an Integrated Approach is promoted mainly by the atmospheric chemists in Europe, who are very active in nitrogen research and policy support. One of the reasons that they might be successful is because in this way agriculture is taken into account in the environmental issues associated with atmospheric transport. Until now agriculture and nitrogen was mainly connected to the nitrate in groundwater issues. The contribution of agriculture to ecosystem effects and PM exposure has up to now been neglected. Ammonia has been issued as a 'local environmental problem', mainly of importance in the Netherlands, the Po Valley, Bretagne (France) and Denmark, areas in Europe with high livestock densities. It took us many years to show that ammonia contributes to many effects on much larger scales! This has now been accepted and forms the basis of the integrated approach, because now the cascade and the distinction between reduced and oxidized forms seem much more relevant!

In Europe the other focus on nitrogen is on drinking water pollution with nitrates, which is clearly an Agricultural issue. Despite long discussions on the effect of nitrates there are limits for nitrate concentrations in surface water and ground water. This has led to the EU Nitrate Directive, which evolved into the Water framework Directive. Member States have to fulfill this Directive, amongst other by maximizing manure application to grassland on different soil types. Many measures that are proposed for reaching the nitrate concentrations are also relevant for the ammonia and nitrous oxide emissions. Therefore, the EU Commission issued a Service contract to determine the effect of ammonia measures on nitrate and vice versa. This is the start of integrated nitrogen into policy in Europe!

To my opinion there is a much stronger focus on ecosystem effects in Europe than there is in the US. In the eighties of the last century both Europe and the US were concerned with forest dieback in relation to sulphur and NO_x deposition and ozone exposure. However, legislation developed along different ways. Whereas the US moved into Air Quality standards, Europe adopted critical loads and their exceedances. The CLRTAP

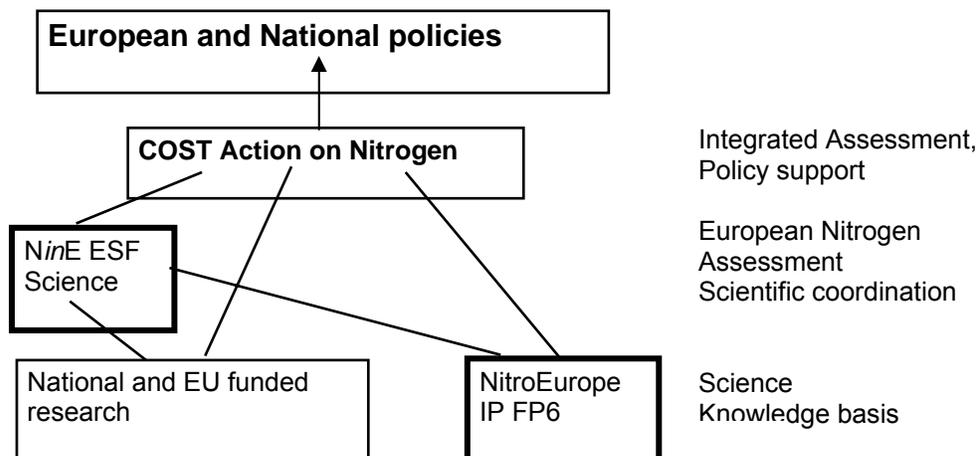
community that extended this towards multi-pollutant-multi-effect approach for the Gothenburg Protocol (and EU Nitrogen Emission Ceiling Directive, which is similar to the Gothenburg Protocol) is the same that is moving now towards an Integrated Nitrogen approach and possibly a Nitrogen Protocol (in the long-term). The Gothenburg Protocol is now in review that will result in an extended Protocol, including more emphasis on the relation between air quality and climate change and on integrated nitrogen. In an appendix I listed the conclusions of a recent workshop where this was decided.

The 'effect-based' approach we follow in Europe starts with an assessment of the effects and establish causal relations. Through the developments of Integrated Assessment Models, the different measures and policy options are developed and tested. The IAM forms the basis for negotiations, which in the end result in most (cost)effective emission reduction measures. The current integrated nitrogen approach is focused on the potential pollutant swapping that occurs with different measures (e.g. manure injection), but will be extended through the effect-based approaches towards more integrated policies in the future.

Is there an integrated EU-wide program on N?

What programs on N have been initiated within the EU?

In the following scheme I show the current programs that are associated with nitrogen to support policies. It looks as if this is well coordinated. The only reason why we can show it in one diagram is because there is a core of people that work together in these different projects and 'glue' everything together. Next year a Taskforce on Integrated Nitrogen will be established within the CLRTAP and this would provide an opportunity to build more solid foundations for a holistic/integrated approach. The US is also part of the CLRTAP and it would be very welcome to work together in this Taskforce. One of the first activities will be the organization of a Workshop on Integrated Assessment Modelling of Nitrogen, 28-30 November 2007, IIASA, Laxenburg, Austria (see Appendix II for background info). More information of the different parts of the scheme can be found at the websites listed below.



How successful have European country programs been?

For this to answer I attach my paper that I presented at the 3rd International Nitrogen conference and provide background for the Netherlands, including successful and unsuccessful policies/measures.

Relevant links:

- Service contract EU:

http://ec.europa.eu/environment/air/cape/activities/ammonia_en.htm

- NitroEurope and links to COST 729, ESF NinE and European Nitrogen Center

<http://www.nitroeuropa.eu/>

<http://www.nitroeuropa.eu/?q=links>

Appendix I Nitrogen

Background

Fixed or reactive nitrogen is of increasing environmental concern. At the same time as it is a prerequisite for life and our supply of food, it is also causing a series of environmental threats and damages on local, regional and global levels. There are several research and scientific assessment initiatives with respect to nitrogen. There is however a lack of policy arenas able to take a wider perspective on nitrogen. At the workshop the possibility of adopting such a wider view in support of policy development was considered.

Conclusions

- Presently, there are several science-driven international initiatives and activities (INI, COST729, ESF NinE, NitroEurope etc.) set up in order to form a holistic approach on nitrogen.
- There are also upcoming policy demands. In addition to policy demands related to the various effects of the nitrogen cascade, these include needs for more intense use of ecosystems for food and energy production, and also needs for re-decisions on already existing agreements (e.g. for the EU agricultural sector).
- A holistic approach to policy development may help policy-makers to include a wider set of aspects in these decisions than normally being done.
- Since several of the nitrogen problems are related to atmospheric emissions, the workshop considered CLRTAP to be a suitable arena for further science-based policy development.

Recommendations:

An overall recommendation from the workshop is that the CLRTAP should take a leading role in using the outcome of ongoing assessments and further investigate how a holistic policy approach could be developed. In addition the following more specific recommendations were given:

- establish an expert group on nitrogen under the Convention to provide a framework on integrated N approaches and policy options. (CLRTAP EB, WGSR, TFIAM)
- enhance integration and synergies between the existing bodies of CLRTAP relevant to the nitrogen issue. (EB)
- draw from and link to other Conventions (UNECE Helsinki Convention on Waters, CBD, FCCC, UNECE Espoo Convention on Transboundary EIA) : e.g. by establishing an (inter-)Convention WG. (EB, EMEP, WGE)
- explore the possibilities of an integrated Nitrogen Protocol, possibly joint with other UNECE Conventions. (WGSR, TFIAM)
- establish a stronger link with agricultural stakeholders (FAO, DG Agri, IFA, ...) and effects-related stakeholders. (CAFE, TFIAM)
- utilize the knowledge, concepts, etc. developed within science-driven initiatives and projects. (INI/NitroEurope IP/ACCENT/COST729/ESF-NinE etc.) (EMEP, WGE, TFIAM)

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- develop a monitoring framework for a holistic approach to nitrogen (following the nitrogen fluxes and establishing systems for biomonitoring). (EMEP, WGE)
- develop integrated assessment approaches (e.g. based on RAINS/GAINS) to include the wider scope of N effects. (TFIAM, CIAM, COST729)
- include agri-food chain in the development of "soft" measures. (CAFE)
- identify combinations of specific receptors that are unique to nitrogen effects. (science community, FP 7)

Appendix II

Task Force on Integrated Assessment Modelling and COST 729 Action

Workshop on Integrated Assessment Modelling of Nitrogen

28-30 November 2007, IIASA, Laxenburg, Austria

Nitrogen is important to many environmental effects. In some cases nitrogen emissions are the key driver of effects (e.g. terrestrial and coastal eutrophication, nitrous oxide emissions), while in many other situations nitrogen represents a key contributor exacerbating a wider problem. In this way, the central role of nitrogen can appear hidden, even though it actually underpins many transboundary pollution problems.

Currently there is no international Convention or other agreement that addresses all the interlinked effects of nitrogen. By contrast, there is an apparent split, where different aspects of the nitrogen cycle are considered separately in different regulatory frameworks. This separation has led to several antagonisms between different nitrogen priorities and policies. At the same time, many of the known and potential synergies are currently missed by the existing approaches dealing directly or indirectly with the problems of excess nitrogen.

Nitrogen is also a multi-source problem, including emissions from a wide range of combustion (energy and industry), transport, and other sources. However, the importance of agricultural activities is particularly highlighted, including the spatial interaction between agricultural and natural areas. The danger of pollutant swapping when controlling individual nitrogen sources is large and has been demonstrated in past years.

With this background, at the Gothenburg Workshop “Air pollution and its relations to climate change and sustainable development - Linking immediate needs with long term challenges” (12-14 March 2007), which addressed among other topics the future of the CLTRAP it was agreed that an approach is needed to address the nitrogen issue in a holistic way. A framework, driven primarily by the need to deal with the different environmental effects, could consist of the following elements:

1. Quantifying the **effects** (on humans, ecosystems, other societal values, materials)
2. Identification or development, and use of appropriate **indicators** for the different effects
3. Identification or development of methods to quantify **nitrogen budgets/balances** and research results available
4. Relating the above to overall spatial and temporal **emissions** from various sources. Determining the spatial and economic **effectiveness of nitrogen abatement measures** in a multi-media and multi-effect context on the European scale

In particular, the use of regional nitrogen budgets (including e.g. assessment of nitrogen surpluses in agricultural systems) forms a new element for the Convention, while elements of the others are already in place, but need to be further developed in relation to a holistic nitrogen approach.

The main objective of this workshop is to explore the possibilities for a holistic approach of nitrogen, the framework that is needed for such an approach, the integrated assessment modelling approaches that are available to include nitrogen and to define the necessary future developments. The developments will be directed towards a proposal for a possible integrated nitrogen approach within the revision of the Gothenburg Protocol. The following topics will be addressed:

- Effects of nitrogen and the indicators for the effects, including thresholds
- Emission of reactive nitrogen to the environment
- pollutant swapping issues
- Multi-media transport of nitrogen
- the possibilities of source-receptor modelling
- Effects of nitrogen and the indicators for the effects, including thresholds
- Integrated Assessment Modelling: development of tools for nitrogen assessment
- Policy options for integrated nitrogen abatement
- National experiences with Integrated Assessment Approaches for nitrogen
- How broad should/can IAM-N be?
- European Nitrogen Assessment

The workshop will start with a joint lunch and will end two days later after lunch (4 half-day sessions).