

EPNB-22, Dessau, Nov 5-6, 2024

Participants in Dessau

Markus Geupel
Wilfried Winiwarter
Monika Suchowska-Kisielewicz
Inga Grinfelde
Horst Fehrenbach
Bettina Schächli
Judith Reutimann
Tim Hermann

Participants online

Audric Vigier
Filip Moldan
Ika Djukic
Julia Tanzer
Kazuya Nishina
Kentaro Hayashi
Laurence Loyon
Sabine Banzhaf
Sophie Bogler
Ulli Dragosits
Anna Ehrler

Note: Presentation slides and other relevant files have been made available via a web link provided by the German Umweltbundesamt – see <https://www.clrtap-tfrn.org/epnb> for details

Day 1 – Update of Annexes to Guidance Document

Welcome (Markus)

Introductory presentation (Wilfried) sharing information about

- WGSR workplan, specifying EPNB contributions
- Leuven informal meeting of WGSR delegates, presentation by Markus, preview of chairs' report
- Aims of EPNB-22

Review & revision of the NNB Guidance Document and its technical annexes (Bettina Schächli and colleagues, with discussions and feedback by EPNB experts).

- Harmonization of Annexes – Annex 0 / General issues (Judith)
- Harmonization of Annexes – Annexes EF, AT (Bettina)
- Harmonization of Annexes – Annexes AG, HS (Sophie)
- Harmonization of Annexes – Annexes MP, FS, HY (Judith)
- Harmonization of Annexes – Annex WS (Horst)
- Reporting Template (Anna)
- Visualization Tool (Audric)

[Discussion items and decisions noted by project team for finalization of documents – see minutes by the project team added at the end of this document]

Day 2 – EPNB activities

National contributions to EPNB (presentations)

- Nitrogen Budget in Latvia: Advancing Modelling and N₂O Isotope Research (Inga Grinfelde, LV)
Uses a hole-in-the-pipe model to quantify farm N fluxes
- N budgets from Polish mixed dairy farm – the DairyMix project (Monika Suchowska-Kisielewicz, PL)
Presents approach to use N-related indicators (NUE, N surplus) to better understand farm operations and nutrient circularity such as in (profitable) biogas plants
- NNB for Sweden (Filip Moldan, SE)
Sweden now has almost completed N-budget in their “piecemeal” approach, and input-output fits of pools are quite reasonable.
- Update of the German Nitrogen Budget (Markus Geupel, DE)
2015-2020 5th budgeting period since 1995. For some (sub-)pools notable differences between output and inputs, sometimes due to poor information of N contents, are not fully resolved – to overcome differences for some sectors budget closures have been forced by attributing N-quantities to e.g. denitrification or N-leaching-fluxes, when there was sufficient scientific justification.

Tour-de-Tables (brief comments by experts)

- Ulli: Scotland now has published a third annual report; also UK (DEFRA) have commissioned harmonization of the method and data used for the UK OECD Soil Nutrient Balance with the data used and produced by the UK Agricultural Emission Inventory. There is in principle interest in a wider UK nitrogen budget within Defra and elsewhere (without commitment).
- Kazuya presents an overview of a Japanese update. JP used the CHANS model (Gu et al., EST 2013) to assess the time period 1961 – 2020.
- Ika: AT completed its first national report. Current work builds on this towards a peer-reviewed paper, a factsheet/brochure, developing N indicators as in DESTINO, and initiating a national N dialogue.
- Laurence: The French Environment ministry published on results of assessing N planetary boundaries; agriculture is well covered, but other sectors also will be needed to go into budget.

Next steps in EPNB work (general discussion chaired by Wilfried)

- Annexes to guidance document: Bettina and team will update draft annexes and excel template according to the discussions held. A final version will be produced by January 2025 and shared with the EPNB, along with a documentation of the main changes. EPNB experts will have the opportunity to check before endorsing via e-mail in a circular decision. The outcome of that circular decision will be communicated to TFRN (“TFRN bureau” consisting of TFRN co-chairs and expert panel chairs), for further handling to submit to WGSR (according to workplan) in February 2024.
- Guidance Document: Small changes will be required (changes in sub-pools and treatment of molecular nitrogen) for consistency with the Annexes. Markus and Wilfried will prepare a draft

of these small updates to share as an online document with the EPNB for feedback (early January) and endorsement together with the Annexes.

- Extended Summary of Guidance Document & Annexes will be prepared by Markus and Wilfried, same timeline as Guidance Document.
- Call for Data will be prepared by Markus and Wilfried, same timeline as Guidance Document.
 - Detailed framework will be defined after acceptance
 - Reporting time frame for countries: 2 years from acceptance by WGSR/EB. Interim aims will be defined (such as: kick-off meeting 12 months after acceptance of a national project to elaborate N budgets)
 - Data requirements as defined by the reporting template; data should be reported for 2023 or the most recent available year. Providing data for more than one year is welcome and possible with the template provided. Indicatively, if exercise is successful, it can be repeated after five years, with shorter periods of course welcome.
 - Support to parties is provided via material prepared by the EPNB (guidance document and annexes; reporting template; visualization tool). Furthermore, EPNB considers to organize training workshops as part of future sessions after acceptance of Call for data.
 - Submission and storage of results: There is agreement with CEIP that they would be willing to collect and host N budget data (i.e., initially, collecting and storing the Excel reporting templates).
 - Evaluation: quick analysis can be done by EPNB using the graphics function provided in the templates. A report of the outcome of call-for-data, including country comparisons, is strongly recommended but subject to funding.

To-do's:

Wilfried to check with TFRN co-chairs list of national focal points (for future distribution of call-for-data)

Wilfried to check with Mark Sutton availability and future of visualization tool (if to be mentioned in call-for-data)

Ika to check internally at CEIP if initial agreement on data hosting can be maintained, or if there needs to be renewal of the agreement

Ika to check with Austrian ministry on their possibility to support a glossy brochure (policy brief as announced in the work plan) – given that a version of such a glossy brochure is just being developed for Austria in German language, with internal graphical support by the Austrian Federal Environment Agency.

Wilfried to inform TFRN bureau on the general procedure of call-for-data, and on the expected adoption of GD and Annexes via a circular decision

Work plan 2024/25 will be upheld, no changes:

(a) Revised Guidance document on national nitrogen budgets submitted for consideration to WGSR and Executive Body in 2025

(b) Extended summary for policymakers based on revised Guidance document

(c) Policy brief based on revised Guidance document and extended summary for policymakers to engage with parallel activities

(d) Call for data to Parties in 2025, encouraging them to make use of reporting template on national nitrogen budgets with analysis of results in 2025–2026

AOB

To support the development of the policy brief (Workplan 24/25, item c), there was agreement that collection of “use cases”, i.e. examples for which N budgets were found useful, helps to support the cause of N budgets. All experts were invited to submit such “use cases” to Markus and Wilfried who will collect and compile them.

Also, the scientific publication of results is identified as a means to strengthen the case of N budgets. Further to material already published, both Austria and Scotland are preparing for such scientific exploitation. With the new guidelines almost ready, it is considered useful to also allow for an overview/method publication. Wilfried agrees to lead such a publication, aiming for getting this included in a special issue of ERL on environmental N pollution (deadline end of March). Some coordination of publication activity will be essential to avoid overlaps and benefit from cross-activities.

Notes by Wilfried Winiwarter (Laxenburg, Nov.8, 2024)

Minutes of the meeting

30. Oktober 2024

Client Umweltbundesamt Deutschland (UBA)

Date 5. November 2024

Place Hybrid meeting: Umweltbundesamt Dessau and online

Participants **Participants in Dessau:** Markus Geupel, Wilfried Winiwarter, Monika Suchowska-Kisielewicz, Inga Grinfelde, Horst Fehrenbach, Bettina Schäppi, Judith Reutimann, Tim Hermann

Participants online: Audric Vigier, Filip Moldan, Ika Djukic, Julia Tanzer, Kazuya Nishina, Kentaro Hayashi, Laurence Loyon, Sabine Banzhaf, Sophie Bogler, Ulli Dragosits, Anna Ehrler

EPNB Meeting in Dessau, Discussion of the Annexes to the Guidance Document on National Nitrogen Budgets

Notes for day 1, part 2

These minutes contain the most important discussion points, conclusions and follow-up tasks concerning the review and revision of the NNB Guidance Document and its technical annexes ([03_INFRAS_Guidance.pdf](#), Bettina Schäppi and colleagues, with discussions and feedback by EPNB experts).

Harmonization of Annexes – Annex 0 / General issues (Judith)

Suggested approach to N₂

- Only consider N₂ flows that are connected to a process that converts N₂ to N_r and vice versa.
- The pool of N₂ is the atmosphere (AT)

Feedbacks:

- Wilfried explained that all other N₂ flows are excluded because they are too large.
- Filip noted that it is a challenge for mass balance calculations to include N₂ flows from the atmosphere, as it primarily consists of N₂
- Ulli emphasized the importance of N₂ in the analysis.
- Wilfried pointed out that the atmosphere is the most obvious pool to account for N₂.

Conclusion: The proposed approach to N₂ is accepted.

Stock Changes

Two options on how to approach stock changes:

- calculation by mass balancing of (sub-)pools
- direct quantification – but approaches for quantification are mostly missing

Feedbacks:

- Ulli stated that balancing is challenging when quantifying N flows.
- Markus mentioned that some denitrification pools in agriculture and wastewater were calculated by balancing the pool.
- Wilfried agreed with the approach, suggesting that discrepancies could be assigned to denitrification if justified.
- Filip emphasized that it is not necessary for all elements to balance perfectly.
- Bettina noted that quantification of stock changes are optional in the initial approach, and therefore no approaches to quantification of stock changes are described in the Annexes, (except for the pool FS).
- Ulli questioned whether budgets could be fully closed; if gaps remain unexplained, these should be acknowledged in the documentation.

Conclusion: keep general approach to stock change quantification, with balancing being an option, but point out that this must be done in combination with a qualitative check/explanation for the stock changes.

Land Use Changes

Approach: when land use changes, N flows automatically change (e.g. emissions from land use changes). The stocks are not quantified.

Discussion:

- Filip highlighted the potential scale of land use changes (e.g., forest increase in Denmark) and suggested more information on N flows in soils. He recommended to include quantifying N flows related to soil movement, as it may be relevant for some countries, but mention that quantification is not mandatory but optional.
- Julia noted that if emissions from land use changes are included, they do lead to the mentioned additional flows, but budgets would only add up, if in addition, stock changes are accounted for.

Conclusion: Agreement to indicate a way for simplification while still accounting for possible soil movements and stock changes.

Harmonization of Annexes – Annexes EF, AT (Bettina)

EF

Presentation of the main N-flows, feedback, and open questions to discuss (see slides).

Feedback and discussion:

- Biofuel flow from AG to EF is missing and will be added.
- For N-flows from fuel combustion: the larger share of N stems from N₂, so emission factors should be used to determine emissions (rather than N content of fuels). The emission factor for reactive forms of N from fuel combustion is usually provided in high precision.
- Ulli mentioned that N bound to fuel is so gigantic in Scotland that it had to be excluded from the N-budget (but the number is reported). N content in fuel is very uncertain.
- Filip: the approach of using the emission factors is ok, but when it comes to fuel import, the N-content of fuel is relevant. In Sweden, fuel provides for the biggest N import.
- NH₃ as a fuel (for shipping) should be added (MP-EF), even though currently the relevance is small. Japan has already introduced NH₃ combustion in ships.

AT

Presentation of the main N-flows, feedback, and open questions to discuss (see slides).

Feedback and discussion:

- How relevant are the other secondary N compounds? Bettina: As they form in the atmosphere, they are only relevant for import and export of N by air and for deposition. They are considered less relevant as compared to other reactive forms of N. Atmosphere itself is a “black box” and we do not need to account for all the processes that occur there.
- Markus: Such N forms are already included in deposition flows, quantified by use of the data from the EMEP model.
- Ulli mentioned that besides EMEP, national information should be preferred whenever available.
- Agreement that secondary N compounds need to be considered where relevant.

Harmonization of Annexes – Annexes AG, HS (Sophie)

AG

Presentation of the main N-flows, feedback, and open questions to discuss (see slides).

Question: there is a lack of data for important N flows. The land balance / soil balance approach, for which data are available, misses important flows such as N in feed and animal

products (which would be captured by the farm gate approach). Are there additional data sources that could be considered to quantify these N flows?

Feedback and discussion:

- Ulli: feedipedia is a large database with N contents of feed (note: this is already mentioned in the Annex AG).
- Markus adds that in Germany, good data are available for animal products and feed, reported by the agricultural ministry due to reporting obligation under the fertilizer regulation. He will look up if good default values were used there, which could be a reference for the NNBs.
- Discussion of biofuel inputs. Should a flow of biofuel substrate be added, which accounts for organic waste (MP-AG)? Horst suggests splitting biofuel production: the biofuel in AG is fuelled only by agricultural substrates (manure, fuel crops, crop residues); biofuel from waste should be included in the WS pool. (Note: discussion was taken up again in the Annex WS and summarized under “conclusions”).

HS

Presentation of the main N-flows, feedback, and open questions to discuss (see slides).

No substantial discussion: relevant waste flows from HS were discussed in the session on Annex WS.

Harmonization of Annexes – Annexes MP, FS, HY (Judith)

MP

Presentation of the main N-flows, feedback, and open questions to discuss (see slides).

Questions: MP database – do quantities of goods match data? Are important industries missing?

Feedback and discussion:

- Kazuya explains the additional N flow (EF-MP.TR) that should be considered: ammonia is a fuel for shipping and also used as fuel in industry sector. NH₃ is an energy carrier with low energy density and therefore used for transporting hydrogen. It is already used in Japan.
- Bettina explains that the previous two sub-pools were merged because internal flows in the MP pools are difficult to quantify, since only little information is available on intermediate products that contain nitrogen and in which industries they are used.

FS

Presentation of the main N-flows, feedback, and open questions to discuss (see slides).

Feedback and discussion:

- Question if the stock change quantification should be kept in the Annex FS or if a reference to an external document explaining the method would be preferred.
- Agreement (Ika, Wilfried) that the stock change quantification should be kept in the Annex FS.
- Question, if there's leaching and/or runoff from the sub-pools. This was not specified in previous Annex FS. Such flows are expected to strongly depend on ecosystems and location/climate; however, a general approach should be provided.
- Suggestion of Filip is accepted: he explains that the general pathways between FS to HY (coastal, groundwater, surface) is by leaching to groundwater then it flows further into surface and coastal water. Runoff at the surface should be renamed to "overland flow" instead, to avoid misunderstandings.

HY

Presentation of the main N-flows, feedback, and open questions to discuss (see slides).

Feedback and discussion:

- Inga confirms that transboundary N flows are very important. There's no standardized data to quantify that.
- Ulli: Fish landing (food from the sea) should be looked at further. Aquaculture has a feed input and excretions, which are not reflected in any flow currently; and there is exchange with freshwater. Ulli will support the project team (Bettina and colleagues) regarding the inclusion of aquaculture.
- Filip adds that in Sweden aquaculture is included in agriculture.
- Filip asks where to set the boundaries to the Rest of the world in coastal waters: what is the advice, where is the boundary, national coastal boarder, exchange with the outer ocean?
- Markus: we should quantify the input into coastal waters. Exchanges with the open sea are hard to quantify.
- Wilfried: no need to balance the N flows of the coastal waters

Conclusions: the project team will further specify the flows that were subject to discussion.

Harmonization of Annexes – Annex WS (Horst)

Presentation of the new Annex WS, main N-flows, feedback, and open questions to discuss (see slides).

The participants emphasize that they are happy to see the result of last Annex.

Summary of the main aspects of WS:

- Recycling flows are not part of WS
- Wastewater from industry has lower N content
- Sewage systems losses might be significant. Leaching from sewage system occurs with overflow during excessive rainfall (if no separate drainage systems exist).

Feedback and discussion:

- Monika: Circular economy/re-use of waste: we should not only focus on the current situation, but also on future developments and this current trend might become more important and is developing quickly.
- Horst: Circular economy/recycling is reflected in flows from HS to MP, and not in WS.
- Tim Hermann: it's not very clear where to account for N flows with organic waste, digestate and compost (see conclusion on the biofuel discussion below).
- Kazuya disposal food waste in wastewater is a problem in certain places (e.g. Japan), that will gain in importance if not tackled.
- Some details are relevant, too much simplification is dangerous.

Conclusions and general remarks on the Annexes

Many experts pointed out that they are happy about the revision and harmonization and that it's good to see that the guidelines have further developed.

Biofuel from agriculture vs. waste: Conclusions from the biofuel discussions on Annex AG and WS: biogas plants should be accounted for in both pools. Plants treating waste and agricultural substrate are usually not the same and can be strictly separated given that UNFCCC reporting is also separate for waste plants (composting of organic waste) and agricultural plants (biofuel production from agricultural substrates such as manure, fuel crops, crop residues).

Simplification: Filip points out that simplification of flows by adding them up to larger flows is good to a certain extent, but it should also not be too simplified, because often flows cannot be gathered in aggregated form. So, if the flow has to be detangled and then be summarized again, it would take more time and not add to quality.

Communication of changes: A summary of the changes in the annexes should be made available at the end together with the changes in the guidance document.

Definitions of N loss and N waste should be in line with the guidance document for integrated N management by Marc Sutton. Markus will send the link to the publication.

There are policy-relevant outcomes of N loss considerations: the connection to external costs should be made, to add content to the political discussion.

Reporting Template in Excel (Anna)

Anna presents the Excel template with its various functions.

All flows defined by the Annexes for the NNB are already included in the template. The Excel has several tabs that are updated automatically based on the flow inputs. They show input-output tables, N balances over pool and sub-pools and indicators such as NUE, Nr loss and N waste.

There are several graphs that can be generated automatically.

It is easily possible to include also new flows. The tool is quite flexible and can be adapted by a medium-skilled Excel user. The tool is not intended for direct comparisons between countries.

Visualization Tool in R (Audric)

Audric presents the R-tool with the interactive visualisation. The R tool shows the NNB structure (pools and flows), with the sizes of N flows reflected in the size of the arrows between the pools. While the Excel template can be used for the initial level of data visualization, with R tools can be used for detailed analysis. Data can be imported for individual sessions, but the central database will not be modified. The tool will be further developed once the Excel template is finalized (January 2025).

Feedback: The R-tool is a very good improvement. Flexibility in the R-tool is valuable.

Discussion: Key topics discussed included approaches for handling stock changes, categorizing of nitrogen flows with colour codes, displaying and uncertainties; further time series and comparisons between countries:

- Time series could be generated in different ways. Japan presented a model-based approach to generate time series over several years. For the NNBs, it is probably easier to collect annual data (and not averages over several years), because emission data are published annually.
- Comparison between countries is currently not possible the R tool. Markus pointed out that first the collection of comparable data needs to happen, then a further development of the tool could be discussed. The R tool would be better suited than the Excel template for comparisons across countries.