

## Response to peer review of expert judgement on the lower limit for project-specific calculations of nitrogen depositions

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### *General*

Several reviewers emphasise the importance of using the measurement detection limit to determine the calculation's lower limit (from an atmospheric science and philosophy of science perspective, but also from a legal and policy perspective), as well as safely setting the calculation's lower limit at 1 mol/ha/year (there is no 100% consensus on all points, but that is not to be expected given the value-laden nature of science – see the final expert judgement for a further explanation of value-ladenness).

### *PBL Netherlands Environmental Assessment Agency (Martijn Vink et al.)*

The PBL supports the expert judgement and offers a number of suggestions for further substantiation and communication. I now use the term 'theoretical detection limit' as an equivalent for 'calculation's lower limit', but do not make any suggestions for policy and legal aspects. Of course, for other purposes (outside of art 6.3 HD, that is, for art 6.1 HD and art 6.2 HD) calculations must be made to below the detection limit. This is already happening and can continue to happen, as I note in the context of a box on the difference between a calculation's lower limit and a threshold or limit value. I simply refer to the impact and legal analyses of the IPO study. The PBL also supports my original<sup>1</sup> impact and legal arguments.

### Specific points:

- The PBL indicates that the responsibility for cumulative effects of depositions below the calculation's lower limit cannot be placed with the individual initiators and advises to 'indicate that in that case, this responsibility will lie with the Member State in accordance with Article 6.2 of the Habitats Directive'. According to the PBL, it is important to continue to emphasise the difference between a calculation's lower limit (detection limit) and a threshold value. The expert judgement now states in a box on the difference between a calculation's lower limit and a threshold or limit value that in the context of art 6.2 HD the government remains obliged to prevent the deterioration of habitats; for more specific legal information I refer to the legal analysis of the IPO. In the expert judgement I do not make any further statement on the question of whether, as the PBL suggests, a system should be introduced to administer cumulative activities below the detection limit. I would like to point out here that, as the PBL also indicates, such a system already exists in the context of art 6.1 HD and art 6.2 HD (see also my comment below on the legitimate calculation below the detection limit in that context) and that even for the introduction of the maximum distance limit, no new system had to be introduced for the administration of cumulative deposits from activities beyond 25 km from different emission sources.

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<sup>1</sup> In this response, I use the phrase 'original' to refer to my August, September and October 2024 documents that were subjected to this peer review.

- The PBL recommends that the use of a 'safety margin' (factor 10) be substantiated with references indicating that safety margins also play a role in other domains (such as the handling of chemical substances in relation to human health). However, the reasoning behind this safety margin is specific – and not necessarily comparable with the domains mentioned by the PBL; in addition, the risk reasoning and reflections on the precautionary principle no longer appear in the definitive expert judgement and any possible confusion between a calculation's lower limit and a threshold value must be avoided. Instead of making a comparison with other domains, the expert judgement now spells out the reasoning. The empirical measurement detection limit must not fall below the theoretical detection limit, that is, the calculation's lower limit, in the coming years. Since the calculation's lower limit cannot be determined more precisely than to an order of magnitude, this logically leads to the use of a safety margin of a factor 10 compared to the current empirical measurement detection limit of 10 mol/ha/year. And so the further substantiation of the theoretical detection limit of 1 mol/ha/year requested by PBL has now been provided in the expert judgement.
- The PBL advises to use the term 'detection limit' instead of the term 'calculation's lower limit', because outside the context of art 6.3 HD, calculations must continue below the detection limit. However, the expert opinion concerns the use of the model in the context of permitting and for that purpose it is true that calculations below the calculation's lower limit do not play a role, in the sense that results below 1 mol/ha/year must be rounded to zero, just as is done for the current calculation's lower limit of 0.005. In the expert judgement, I do not offer advice on the nomenclature to be used in policy and permit granting, but I do introduce the term 'theoretical detection limit' as an equivalent of 'calculation's lower limit'. And I now note in the expert judgement: 'The calculation's lower limit for the use of a model in the granting of permits (art 6.3 HD) does not automatically apply when using a model for another purpose (such as in the context of art 6.1 and art 6.1 HD). To obtain estimates of the total deposition in the context of art 6.1 HD and art 6.2 HD, contributions below 1 mol/ha/year (and also all contributions beyond 25 km) remain included.'
- The PBL asks for more and more precise references in the substantiation of the empirical basis. Since only the measurement detection limit is relevant in the final expert judgement, I have added the corresponding references.
- The PBL notes that little recent literature has been cited, including on the critical loads. I have added more recent citations, where relevant. Since the definitive expert judgement does not mention critical loads, there is no need to cite any literature on this.
- The PBL states: 'An important observation that could perhaps receive more attention in the expert judgement is that a calculation's lower limit does not mean that the causal claims from the AERIUS instrument are not accurate. In earlier discussions, a calculation's lower limit sometimes seemed to be used as a synonym for the inaccuracy of the causal claims that AERIUS makes in general'. Strictly speaking, this falls outside the scope of the expert judgement, but I maintain the following observation in the expert opinion: 'Furthermore, TNO (2024) rightly points out that even with a scientifically substantiated calculation's lower limit, calculations of both relatively small and relatively large depositions at ha level can be uncertain by more than a factor of 2 to 3 (so: falsely certain in the calculation of the magnitude, even if there is

a decent chance that the deposition can be distinguished from zero). This confirms the previous judgement of the Hordijk (Advisory Committee on Measuring and Calculating Nitrogen 2020) and Petersen (Audit Committee RIVM Centre for Environmental Quality 2024) Committees that AERIUS Calculator is not fit for its current purpose in permitting.' This observation concerns art 6.3 HD (see also the reviews by Hordijk and van Wezel). However, I support PBL's plea to continue using AERIUS in the context of art 6.1 HD and art 6.2 HD; it is suitable for that purpose.

- The PBL supports my risk argument. Given the criticism of this argument from many other reviewers, this risk argument is no longer included in the expert judgement.

#### *Fleur Onrust (Six Legal)*

Onrust supports the expert judgement in the sense that, legally, false certainty cannot be counted on in the context of granting permits and she advises to increase the insightfulness and traceability of the expert judgement. I have not included my own legal analyses in the expert judgement (because they are outside my expertise) and have clarified the line of reasoning and terminology.

#### Specific points:

- Regarding the use of concepts, Onrust criticises the use of the concepts 'assessment threshold' and 'calculation's lower limit' as equivalents. I no longer refer to an 'assessment threshold' in the expert judgement. My expert judgement only concerns a 'calculation's lower limit', not a threshold value or another limit value that has been established on the basis of ecological underpinnings, for example. I use the same definition of the 'calculation's lower limit' as Onrust: a lower limit from the (atmospheric) modelling sciences below which no causal relationship can be demonstrated between the entered emission and the calculated deposition. Below this lower limit, model results cannot be distinguished from zero from a scientific point of view and are therefore rounded to zero. The term 'calculation's lower limit' is also used by me and others for the current lower limit of 0.005 mol/ha/year, which, although not scientifically substantiated, works the same (calculations below the lower limit are rounded to zero) and has the same legal consequences (see next bullet).
- According to Onrust, it is not possible to attribute possible significant consequences to the activity for depositions below the calculation's lower limit. Onrust further writes: 'With a calculation's lower limit, accumulation is not an issue. Precaution is also not an issue because the value below the calculation's lower limit cannot be attributed to the plan or project and therefore no causal relationship exists. The depositions below the calculation's lower limit are not included in a preliminary test or appropriate assessment of a plan or project or in a mitigating measure and are also not included in the granting of a permit for a plan or project in any other way, such as with the distance limit of 25 km. As a result, the accumulation test does not apply to depositions below an arithmetic lower limit.'
- Onrust points out the importance of a clear and traceable motivation. I have now integrated various parts of the position paper and the notes (this only concerns a few sentences) into the expert judgement and added further text to make the motivation for the calculation's lower limit of 1 mol/ha/year clearer and more traceable. One of the matters that has now been explained more clearly in the expert judgement is how the calculation's lower limit of 1 mol/ha/year follows from the modelling scien-

ces and is not a policy choice. It involves an order-of-magnitude argument about where a causal relationship can no longer be demonstrated: the calculation's lower limit of order 1 mol/ha/year is a factor of 10 below the current measurement detection limit of order 10 mol/ha/year – this is now being further scientifically substantiated, also on the basis of the peer review, and the term 'choice' is avoided, to avoid the impression that this is a policy choice rather than an expert judgement. It is also made clear that it is not stated that the deposition of project-specific emissions must be empirically detectable in measurements. Furthermore, the justification of 1 mol/ha/year is no longer presented as the lower end of a range of 1 to 35 mol/ha/year; this is because the latest state of knowledge about the lowest measurement detection limit is now used as the starting point for the above-mentioned scientific order-of-magnitude reasoning. It was already clear from the text that the application range of the model is limited by the calculation's lower limit. I now discuss which scientists have a consensus about this application range – that is to say, I substantiate the presence of scientific support, using scientific articles, reports and this peer review. This makes it clearer that the application of the calculation's lower limit of 1 mol/ha/year is based on the best scientific information.

- Onrust points out that giving an expert judgement on what the magnitude of the calculation's lower limit should be (my answer: 1 mol/ha/year), is not yet part of the formulated question. This has now been adjusted.
- As for Onrust's remark about the literature on philosophy of science, the expert judgement clarified which of my publications are official publications of the RIVM and the PBL and more references from other authors were added. The peer review showed that the content of my publications represents the scientific consensus in philosophy of science. A single point of criticism, on a previously chosen formulation about epistemic versus non-epistemic values, has been incorporated (see also the discussion of the reviews by de Regt, van Dis and Romeijn below).
- As far as legal literature is concerned, Onrust notes that this is outside my expertise. I have therefore not included references to case law (in the Netherlands and Germany) and other legal sources or my own legal arguments in the final expert judgement. Onrust states that what applies to the distance limit also applies to a scientifically substantiated calculation's lower limit (see above, second bullet). The answer to Onrust's question whether the German value of 21 mol/ha/year indeed functions as a calculation's lower limit is affirmative (see the review by Backes, below).
- Onrust's comment on how to take into account 'uncertain emissions' is relevant but in my view falls outside the scope of my expert judgement.

*Chris Backes (Utrecht University)*

Backes does not rule out that the expert judgement will lead to acceptance of a calculation's lower limit of 1 mol/ha/year by the Administrative Law Division of the Council of State, but he does not consider it 'self-evidently likely'. However, it seems that in that opinion Backes mainly refers to a threshold value and not to a calculation's lower limit, and the Council of State ruling that he gives as an example that the Council of State might not accept a lower limit dates from before the PAS came into effect. Moreover, no supported scientific substantiation has previously been presented to the Council of State. But this is beyond my expertise. That is why I have not included my own legal analyses in the expert judgement (because they are beyond my expertise) and have clarified the line of reasoning and terminology.

Specific points:

- Backes notes that the description of German legal practice is incomplete with regard to the existence of two threshold values for depositions that are higher than the calculation's lower limit. However, my presentation was not incorrect and the reported incompleteness had no consequences for the original expert judgement (21 mol/ha/year does indeed function as a calculation's lower limit). I have now not included references to case law (in Germany and the Netherlands) and other legal sources or my own legal arguments in the final expert judgement (see also review Onrust, above).
- Backes further notes that the BVerwG ruling from 2019 was not the last in a series of rulings on this topic and also that this ruling (although correctly interpreted in the original expert judgement) is not uncontroversial in German legal practice and literature. Although 21 mol/ha/year still applies as a calculation's lower limit, there has been discussion as to whether this should not have been 7 or 3.5 mol/ha/year (see Ch.W. Backes, Duitse grenswaarden, 'Abschneidewerte' en 'Bagatellschwellen': pakken de Duitsers het stikstof-probleem slim en effectief aan of maken zij er een potje van? [German limit values, 'Abschneidewerte' and 'Bagatellschwellen': are the Germans tackling the nitrogen problem smartly and effectively or are they making a mess of it?], *Tijdschrift voor Omgevingsrecht en Omgevingsbeleid*, 2021 (2), 165–174 [In Dutch]). In 2019, BVerwG stated that 21 mol/ha/year should also be used in the future and not a lower value.
- Backes notes that references and current knowledge about the legal situations in Flanders and Denmark are lacking. In my original expert judgement, I based myself on RIVM (2021) and TNO (2022), among others. Because the legal situations abroad can only be considered in their full context and this is not necessary to obtain more information about the scientific substantiation of a calculation's lower limit in the Netherlands, references to foreign countries have largely been removed (for example, there is no longer any reference to Flanders and Denmark). It remains important, of course, to refer to foreign studies that make statements about the measurement detection limit and its scientific relevance for a calculation's lower limit.
- The majority of the questions that Backes raises in his review relate to a threshold value and not to a calculation's lower limit. Since the final expert judgement now makes it clear that it is only about the (atmospheric) modelling sciences substantiation of a calculation's lower limit, there is now no need in the expert judgement to discuss further case law, including that of the Court of Justice of the EU, by avoiding ambiguity about threshold value or arithmetic lower limit, not including ecology and the risk argument in the overall argumentation and avoiding legal arguments.
- As regards the risk argument, Backes notes that art 6.3 HD contains a specific, very strict, version of the precautionary principle, whereby the text and case law of the ECJ are decisive. Therefore, neither the risk argument nor the underlying general reflections on the precautionary principle appear in the final expert judgement.

*Henk de Regt (Radboud University Nijmegen)*

de Regt supports the philosophical underpinning of the expert judgement, with a comment (like the other two philosophers of science) on the way I indicated hierarchy between epistemic and non-epistemic values in science; I have adjusted that.

Specific points:

- The reference mentioned by de Regt to the recent overview of the philosophy of science literature on models (Knuuttila et al. 2025), which supports the line of the expert judgement, has been added.
- de Regt criticises the suggestion that non-epistemic values are ‘subordinate’ to epistemic values and that mixing should not take place. He confirms that he agrees with what I was mainly concerned with, namely finding a responsible (and transparent) balance between epistemic and non-epistemic values. I have adapted the text (the role of non-epistemic values in science, although important, I now qualify as ‘limited’ to certain aspects of science; here I follow the reference to Douglas 2023 suggested by de Regt). In response to the reviews of the other philosophers of science (van Dis and Romeijn) I have added even more references on values in science. Various non-epistemic and epistemic values are mixed, and I am looking for a balance in which, in addition to the precautionary principle, the non-epistemic (legal) desire plays an important role in the epistemic value of detectable causality and thus also in the epistemic value of measurability (in theory).
- de Regt advises further quantification of the risk argument; however, this risk argument is no longer included in the expert judgement.
- According to de Regt, the reference to the Petersen Committee (2024) could not be found in the bibliography. I have therefore changed ‘the Hordijk (2020) and Petersen (2024) Committees’ to ‘the Hordijk (Advisory Committee on Measuring and Calculating Nitrogen 2020) and Petersen (Audit Committee RIVM Centre for Environmental Quality 2024) Committees’.

*Janneke van Dis (Utrecht University)*

van Dis supports the philosophical underpinning of the expert judgement, with a comment (like the other two philosophers of science) on the way I indicated hierarchy between epistemic and non-epistemic values in science; I have adjusted that.

Specific points:

- In line with processing the comments by de Regt and Romeijn, I have added the references suggested by van Dis to Harding (1991) and Longino (1995, 2001) on the (fluid) separation between epistemic and non-epistemic values.
- van Dis observes that the limits to what can be measured are seen in the expert judgement as determining the calculation’s lower limit and that this is not a principle prescribed by science but a choice that also has socio-political and legal aspects. She continues: ‘perhaps a defensible choice, but not on the basis of science alone’. The expert judgement now addresses more explicitly the role of the non-epistemic (legal) desire to allow the epistemic value of detectable causality to play an important role and thus also the epistemic value of measurability (in theory).
- van Dis advises further clarification of the risk event in the risk argument; however, this risk argument is no longer included in the expert judgement.

*Jan-Willem Romeijn (University of Groningen)*

Romeijn comments (as do the other two philosophers of science) on the way I indicated hierarchy between epistemic and non-epistemic values in science; I have adjusted that. He is

also critical of the lack of insight into deliberation and other views; I now provide more context in the expert judgement itself.

Specific points:

- Romeijn suggests adding several references: in line with the references on values suggested by the other two philosophers of science, I have added the reference on values. I have not added any references on the relationship between science and policy practice and the precautionary principle (in order to let the expert judgement be as 'bare' as possible about the scientific substantiation itself; for example, the risk argument and the discussion on the precautionary principle have been deleted).
- Romeijn questions the fact that a lower limit depends on the limit below which a model does not function properly, partly because the latter limit is a contingent matter. In the expert judgement I emphasise that you have to choose a safe value, so a factor of 10 below the current empirical measurement detection limit of 10 mol/ha/year (a contingent fact). For what you have to do with the ecological risks caused by a cumulation of depositions below the lower limit I refer in a box in the expert judgement to art 6.1 HD and art 6.2 HD and to the legal analysis of the IPO study.
- In response to Romeijn's criticism of the lack of insight into the deliberation and other visions (which can be characterised by different 'tracks' to arrive at a calculation's lower limit, see the expert judgement) I have added more information about the process followed. Through references and the peer review itself, a fairly complete picture now emerges of the diversity of visions and how the deliberative process – which actually took place, in the scientific sounding board of the IPO study and this peer review – proceeded.

*Reinoud Kleijberg (Kleijberg Ecology)*

Kleijberg is particularly critical of the risk argument but supports that in the case of false certainty in atmospheric sciences, calculations below the calculation's lower limit should be rounded to zero. However, the risk argument is no longer included in the expert judgement.

Specific points:

- Kleijberg comments on the way in which the *Guidance for Determining Significance* (Natura 2000 Support Centre 2010) was used in the original expert judgement. This reference is not part of the final expert judgement.
- Kleijberg supports the argument that there should be a calculation's lower limit: 'In general, I can agree with this argument. Calculation results that are so uncertain that they cannot be distinguished from '0' may not be used in policy and permit granting. The latter in particular is also important because not issuing permits for activities with very small increases in deposition wrongly violates the interests of initiators, this often has major consequences for society (construction, energy transition) and leads to investing in expensive measures whose necessity has not been scientifically established.'
- Kleijberg does not rule out that there are arguments for the reasoning from the original expert judgement that a deposition contribution below 1 mol/ha/year has no more than a small effect on Natura 2000 areas from an ecological-scientific point of view, but he sees a lack of sufficient specific arguments (such as those he himself

uses in analyses for permits). This is no longer relevant because no ecological arguments are used in the final expert judgement.

#### *Leen Hordijk*

Hordijk writes: 'I agree with the comments on the scope of application and the relationship with detection limits.' In doing so, he supports the scientific basis of the expert judgement. However, he disagrees with the continued use of the AERIUS Calculator in permitting (as does van Wezel). I have maintained my supporting comment on this in the final expert judgement.

#### Specific points:

- The frequent use of the term 'assessment threshold' in the original expert judgement is confusing according to Hordijk (see also Onrust above). I no longer refer to an 'assessment threshold' in the expert judgement.
- Hordijk states: 'A calculation's lower limit is only defensible as a policy decision. As long as the deposition is calculated at hectare level, the use of AERIUS remains not fit for purpose; whether there is a threshold of 0, 1 or 32 mol per hectare.' In other words: science should not sanction the continued use of AERIUS in its current form (with then a calculation's lower limit of 1 mol/ha/year); it is up to policy to continue using AERIUS, against scientific advice. In the final expert judgement, I do not pay any extra attention to this compared to the original expert judgement. Hordijk's wish for more attention to the spatial unit that must be used in calculations (now: hexagons of 1 ha) falls outside the scope. The most important point here is that to the extent that AERIUS continues to be used in the way it is used now, false certainty decreases due to the use of a scientifically substantiated calculation's lower limit, a substantiation that Hordijk does not criticise in itself.
- Hordijk has difficulty with a mere reference to art 6.1 HD and art 6.2 HD for what to do with the ecological risks caused by a cumulation of depositions below the lower limit. This falls outside the scope of the definitive expert judgement, but I do mention it in a box.
- Hordijk criticises the risk argument for not paying attention to the duration of exposure; however, this risk argument is no longer included in the expert judgement.

#### *RIVM National Institute for Public Health and the Environment (Thomas van Goethem et al.)*

The RIVM emphasises 'that science can provide elements for deriving a calculation's lower limit . . . . The final choice for such a value is, however, a policy decision.' What RIVM does not see here (and in previous publications) is the need and possibility to arrive at a balanced and supported expert judgement (see further explanation in the final expert judgement). The RIVM's remark 'that a lower limit based on a measurement detection limit depends on the accuracy of measurement methods, which are continuously improving' has been included in the final expert judgement in substantiating what is a 'safe' value.

#### Specific points:

- The RIVM states: 'However, the TNO report (Meijer and van Loon, 2024) from last August shows that there is no scientifically substantiated calculation's lower limit that arises from model-based considerations.' However, TNO (2024) is incorrectly quoted here. It only refers to the fact that a scientifically substantiated lower limit had not



yet been found in the actual research conducted. TNO (2024) only investigated 'track 1' and 'track 2'. 'Track 3' has not been investigated. My – more widely supported (including by van Loon, one of the two authors of TNO 2024, see below) – expert judgement shows that 'track 3' does indeed yield a scientifically substantiated calculation's lower limit via the concept of the theoretical detection limit that arises from model-based considerations (see the final expert judgement).

- RIVM criticises the concept of 'noise' from TNO (2022). The final expert judgement does not refer to this and does not use the associated 'track 2' (which TNO 2024 does).
- The RIVM states: 'If a contribution is smaller than the detection limit, this does not mean that this contribution is not there.' However, in the context of art 6.3 HD, it is about being able to detect a causal relationship between emission and deposition (in theory); this does not mean that depositions below 1 mol/ha/year should not be included in the context of art 6.1 HD and art 6.2 HD. In the final expert judgement, I therefore write about this: 'To obtain estimates of the total deposition in the context of art 6.1 HD and art 6.2 HD, contributions below 1 mol/ha/year (and also all contributions beyond 25 km) remain included.'
- The RIVM criticises the chance part of the chance x effect risk argument: 'When adding a source, the chance is not small, but 100%; after all, you are adding emissions.' The RIVM disregards the fact that the chance statement was about the chance of detecting a causal relationship between emissions and deposition (and that chance is small below 1 mol/ha/year). But this is no longer relevant because the risk reasoning has been deleted.
- The RIVM addresses the discussion about false certainty above the calculation's lower limit, but going into this in more detail falls outside the scope of the expert judgement. I have maintained the contested remark (also supported in the reviews of Hordijk and van Wezel) in the expert judgement, especially because this was an important conclusion of both the Hordijk Committee and the Audit Committee of the RIVM Centre for Environmental Quality, chaired by me.

*Emiel van Loon (University of Amsterdam)*

van Loon, one of the two authors of TNO (2024), supports the expert judgement, but asks for further substantiation for choosing 'track 3'. I provide this further substantiation indirectly in the sense that tracks 1 and 2 have not led to a scientifically substantiated and supported calculation's lower limit and track 3 does yield this, and directly with a scientific reason, namely the importance of theoretical detectability. In addition, track 3, in terms of scientific substantiation of a calculation's lower limit, has already been successfully completed in various EU countries.

Specific points:

- I have incorporated van Loon's comment that TNO (2024) did not exclusively investigate track 1: both track 1 and track 2 were investigated in the research conducted (and track 3 is mentioned in the discussion of TNO 2024, as I already observed in the notes on my original expert judgement).
- van Loon suggests four references that support the Guidance for Uncertainty Assessment and Communication; I have added all four of these to the expert judgement. N.B. The RIVM and Utrecht University (the makers of the Guidance) participated with

authors in Walker et al. (2003) and that reference naturally has a prominent place in the RIVM guidance. And the RIVM guidance is referred to in the articles on the EFSA guidance.

- van Loon notes: 'I find 1 mol/ha/year responsible in the sense that the model is certainly not more accurate than that. But I suspect that this is still an underestimation of the model uncertainty.' The 1 mol/ha/year is a safe value below the measurement detection limit. No other arguments about model uncertainty have been taken into account than the theoretical detection limit (below which model results are in any case too uncertain to detect a causal relationship between emission and deposition). So I do not make any statements about other aspects of model uncertainty, such as the suitability of the AERIUS Calculator, other than what I wrote earlier (i.e., that the AERIUS Calculator is not fit for purpose, in line with the Hordijk and Petersen Committees and TNO 2024). See also the reviews by Hordijk and van Wezel.

*Annemarie van Wezel (University of Amsterdam)*

van Wezel has no fundamental criticism of the expert judgement and supports that there is a lower limit in the model. However, she gives the same comment as Hordijk: AERIUS Calculator, also with a calculation's lower limit of 1 mol/ha/year, is not suitable for the purpose of granting permits. I have maintained my supporting comment on this in the final expert judgement.

Specific points:

- van Wezel confirms the theoretical detection limit: 'As also stated in the expert judgement, 1 mol/ha/year is already a downward extrapolation of the resolution of the measurements.'
- van Wezel criticises the risk argument from the perspective of ecological risks; however, this risk argument is no longer included in the expert judgement.

*Jan Duyzer*

Duyzer supports het expert judgement.

Specific points:

- Duyzer supports the scientific argumentation and working with orders of magnitude. For example, he writes: 'A lower limit is important and necessary, but arriving at a scientifically substantiated magnitude is not easy (the difference between 0.5, 1 or 2 mol/ha/year cannot be made).'
- He writes: 'A choice for a lower limit equal to 1 mol/ha/year, a factor of 10 lower than the lower limit mentioned in TNO2024, seems well defensible and a safe choice.' I note here that the lower limit of 10 mol/ha/year from TNO (2024) can be regarded as a lower limit of the uncertainty of the total deposition but has the same value as the measurement detection limit. It is important to keep in mind that I refer to the measurement detection limit and not to uncertainty in the total deposition in the scientific substantiation of the calculation's lower limit. That is why I have no longer explicitly included the range 10–100 mol/ha/year from TNO (2024) in the expert judgement (to avoid possible confusion about this).

*Hans Erbrink*

Erbrink support the expert judgement.

Specific points:

- Erbrink's use of the word 'significant' differs from how it is used in terms of ecological consequences in the context of the Habitats Directive. I have removed the risk argument and remain entirely within the context of atmospheric science, but I do look specifically at one aspect of Erbrink's notion of 'significance', namely whether you can detect a contribution in the sense of being able to establish a causal relationship between emission and deposition. In Erbrink's words: 'what is no longer significant with measurements should also be considered as not significant in model results.'
- Erbrink offers a valuable reflection on the impact of short-term emissions. However, this is beyond the scope of my expert judgement.
- Erbrink offers the following important observation: 'The 'Effectiveness Study AERIUS Calculator 2022' states that the AERIUS instrument was set up for [the] PAS and not for separate permit granting. . . . One reads: 'In addition, the documentation studied shows that AERIUS – the entire toolbox – was originally developed to support the PAS. After the 2019 ruling by the Council of State, AERIUS Calculator – one of the tools from the toolbox – was converted and further developed to support, in particular, the process of applying for and granting permits for projects and initiatives involving nitrogen emissions. A thorough recalibration and thus redefinition of the needs for new 'tools' to support the development and implementation of nitrogen policy – of which permit granting is a part – has not taken place.' *This recalibration should also have examined the scope of application more closely.*' (I have italicised Erbrink's conclusion: this is the crux of the problem. In the expert judgement I make a similar observation.)
- Erbrink supports 1 mol/ha/year as a calculation's lower limit: 'I agree with the choice of a value of 1 mol/ha/year. This is the lowest value indicated for the bandwidths that AP mentions. AP also uses the argument that, if a model value is immeasurably small, it should be seen as insignificant. This argument is also used in the countries surrounding us, but in fact has no general validity. After all, some substances in the emissions of installations are not (or not yet, or poorly) measurable in the outside air. In that case, a model instrument that has been tested on measurable substances is a good solution. However, for ammonia and NO<sub>2</sub>, it applies that these substances are measurable to a reasonably low level. As stated earlier in the previous, the terms large/small and high/low require a reference. Low should then be seen as low in relation to the noise (random variations) in the concentrations/depositions.' In the final expert judgement, the reasoning no longer includes a bandwidth, but I argue that 1 mol/ha/year is a safe value.

*Willem Asman*

Asman approaches the issue narrowly from only the model as mathematics and not from the need to arrive at an expert judgement, in which measurements must also be included (as explained in TNO 2024). He also has his own definition of the calculation's lower limit and has not taken note of any report that has been referred to.

Specific points:

- Asman points out that empirical detection of deposition due to emission further than 500 m from the source is not really possible. However, the expert judgement concerns theoretical detection, where the model may be used up to the theoretical detection limit.
- Asman warns that the empirical measurement detection limit is subject to change. That is also the reason to set the value of the theoretical detection limit in the expert judgement for safety a factor of 10 below the current order of magnitude of the empirical measurement detection limit.
- Asman points out the danger of comparing between countries. In this respect, the definitive expert judgement is more limited and precise.
- Asman describes interesting issues around dry deposition. However, these do not need to be addressed in the expert judgement.

*UK Joint Nature Conservation Committee (Khalid Aazem et al.)*

The JNCC mainly assumes that the expert judgement concerns a threshold value and not a calculation's lower limit. In particular, more information is requested about the Dutch situation, which is understandable given the specificity of the documents provided. The JNCC does not distinguish between art 6.3 HD and art 6.1/6.2 HD.

Specific points:

- The JNCC wonders whether a calculation's lower limit is even possible or whether any limit always concerns a threshold value. In that sense, the criticism is understandable that whatever you choose as scientific argumentation for a scientific lower limit, such as measurability (in theory), you should always look at cumulation, etc. For this, the expert opinion refers to the legal analysis of the IPO study. The JNCC also wants to know more about impact (see impact analysis of the IPO study).
- The JNCC states: 'It is agreed that a threshold should be necessarily precautionary however 1 mol/ha/y remains only partially justified. Solely basing thresholds on measurability has been found to be unsound in other courts and remains open to challenge because it does not account for the Habitats Directive requirement for 'in-combination' assessment alongside assessment alone for plans and projects.' Here, however, a threshold value is again assumed (and a calculation's lower limit, or maximum distance limit, is considered legally untenable) and the current legal state of affairs in the Netherlands and Germany is ignored. After all, no cumulative test is required outside the scope of application where calculation is no longer permitted.