

Questions 1 to 6 of the SAFEMANURE Interim Report

Question 1:

Do you agree with the guiding principles applied in this report?

Select YES or NO from the drop-down list YES

Additional comments:

Overview

ESPP welcomes the overall objective of the Safemanure report to move towards a Circular Economy for nutrients, whilst respecting the environmental protection objectives of the Nitrates Directive.

The current absence of **clear criteria defining when a fertilising production, manufactured from or partly from manure, ceases to be considered “manure, even in processed form” is a significant obstacle to the nutrient Circular Economy**, because it prevents recycling nutrient fertilisers competing on a level playing field with “chemical fertilisers” (Nitrates Directive art. 2(g)).

Overall ESPP considers that RENURE would contribute better to inciting nutrient recycling, and be more readily understandable by stakeholders and implemented by Member States, if coherence with the EU Fertilising Products Regulation and the Animal By-Products Regulation were improved.

The RENURE “Guiding Principles

The “guiding principles” of the Safemanure work are expressed lines 183-189:

- (i) respect of the Nitrates Directive objective of limiting agricultural nitrate pollution
- (ii) no “additional” environment or health effects
- (iii-a) technological neutrality
- (iii-b) practical & reasonable compliance costs
- (iii-c) enforceable & straightforward verification and monitoring

ESPP fully supports each of these five guiding principles, but considers that they are incomplete, as follows.

Failure to take into account the Nitrates Objective to specifically limit application of processed manure:

In ESPP’s opinion, this is incomplete. The Nitrates Directive in its recitals refers to (3) “**control the problem arising from intensive livestock production**” and states (10) “**it is necessary for Member States to ... implement action programmes in order to reduce water pollution from nitrogen compounds**” and (11) “**such action programmes should include measures to limit the land-application of all nitrogen-containing fertilizers and in particular to set specific limits for the application of livestock manure**”. The Directive then makes clear (Art. 2(g) that these specific limits apply to livestock manure “even in a processed form”.

The specific limits for manure spreading (Annex III, art.2), which are deliberately set lower than for other fertilising materials, thus appear in the Nitrates Directive to **correspond to two objectives: limiting eutrophication (as for other fertilisers) and controlling the problem arising from intensive livestock production.**

We note that the limits specified in Annex III, art. 2 must include the manure applied “by the animals themselves” and can be lower than 170 kgN/ha (this is the upper limit). In particular (art. 3) Member States “*may calculate the amounts referred to in paragraph 2 on the basis of animal numbers*”.

ESPP suggest that these Nitrates Directives texts should be explicitly cited in the “guiding principles” lines 183-189.

Please note that ESPP is not here indicating an opinion as to whether or not limiting spreading of “processed manure” or even raw manure (at lower levels than “chemical fertiliser”) does reduce water N pollution, we are simply reminding that the requirements of the Nitrates Directive must be respected.

Nitrogen dynamics and uptake criteria:

The Nitrates Directive indicates precise cases in which Member States can request from the European Commission authorisation to apply levels of manure (including in a processed form) higher than the 170 kgN/ha limit above (Annex III, art. 2(b)): “*long growing seasons, crops with high nitrogen uptake, high net precipitation in the vulnerable zone, soils with exceptionally high denitrification capacity.*”

This (implicitly) corresponds to the account taken by JRC of N leaching and N use efficiency (lines 218-222).

ESPP suggests that it should be explicitly stated in the guiding principles that (in order to reflect the Nitrates Directive Annex III 2(b)) the soil and crop N dynamics of RENURE materials should be comparable to HB-derived fertilisers, as reflected by comparable N leaching and N use efficiency.

Appropriate consideration of stabilised organic content

The proposed RENURE criteria directly (TOC/TN) or indirectly (MinN/TN = indirect limit to N-org which is related to TOC) suggest that “organic material” is negative. In reality, **return of organic carbon to soil has many positive effects**, both benefits for crop nutrient use and nitrogen losses (storage of nutrients linked to organic carbon) as well as other important positive impacts (water retention, CO₂ storage, soil health ...).

In order to take this into account, whilst respecting the Nitrates Directive objectives, ESPP suggests that the RENURE criteria should target the level of stabilisation of organic carbon in materials.

Processed materials for which only part of the input is manure

ESPP suggests that the guiding principles should be completed to specify how to deal with materials where only part of the N is manure-derived.

ESPP suggests that:

- Criteria should be adjusted to take this into account (this is specified in Box lines 301-302 ONLY for “*Haber-Bosch-derived N added during the manufacturing process*”. This should be widened to cover any non-manure N added during the manufacturing process (e.g. N₂-Applied plasma process, see our comments on lines 301-302)
- This should not be limited to “during the manufacturing process”. For example, if an anaerobic digester is taking as feed 50% manure and 50% green waste or food waste, then the digestate is post-processed, it should be clear that the mixing of input materials is covered, not only addition during post-processing
- ESPP considers however that this criterion is impractical and unenforceable, and should be replaced / made redundant by simply limiting the TOC/DM ratio
- For reasons of practicality, it should be specified that where the manure-derived N in a product is below a threshold, then the material should not be treated as “manure in a processed form” under the Nitrates Directive, that is should not be subject to RENURE criteria and not to specific spreading limits. We would suggest a threshold of 10%, in that below that level the manure content is unlikely to significantly modify the properties of the final product

This question of mixing manure with other inputs to digesters is a problem identified by stakeholders as an obstacle to regionally efficient nutrient recycling, largely because of lack of clarity as to the NVZ regulatory status of the resulting digestate (with mixed inputs including some manure), and it is important that it is addressed in the SAFEMANURE conclusions.

Definition art. 2(f) of “Chemical fertiliser”

ESPP notes that art. 2(f) of the Nitrates Directive defines a “Chemical fertiliser” as “any fertiliser which is manufactured by an industrial process”.

The Directive suggests (see Annex II.A6 and Annex III.1.3.ii) that a material which is a “chemical fertiliser” is not considered to be manure (even in a processed form).

The RENURE criteria should therefore include a specification that RENURE materials should be manufactured using a (controlled) industrial process.

Is the methodology for the assessment of processed manure materials and the development of the RENURE criteria in line with these guiding principles?

Select YES or NO from the drop-down list NO

Additional comments:

The methodology seems to have flaws in: objectives and in method - application.

Objectives – respect of the “guiding principles”:

Principle (i) respect of the Nitrates Directive objective of limiting agricultural nitrate pollution

This is not respected in that:

- **materials identifying as “pass” show <80% or <90% NUE compared to HB-derived fertilisers** (p51, fig 12, line 1758). This is confirmed by the conclusion of an “average 14-18%” lower long-term plant N uptake (lines 1791-1793). In agronomic terms this is a considerable difference. For a farmer it could mean 10%-20% lower harvest. For the environment, it could mean more nitrogen losses.
- biogeochemical modelling results seem to suggest **LOWER nitrate leaching in grassland from materials NOT respecting the proposed minN/N and TOC/N criteria**, and varying results in arable (in one of three scenarios (c), leaching from ‘pass’ materials is **average 10% higher than HB-derived fertilisers**) See graphs fig. 14 line 1824 page 54
- **the criteria allow some raw manure and many materials similar to manure to “pass”** (see it Fig35, page 136, line 3964 and our comment on lines 301-302)

Principle (ii) no “additional” environment or health effects

In the proposed RENURE criteria in Box lines 301-302, **odour is not addressed, NH₃ emissions during storage are not addressed and NH₃ emissions are addressed only by MS provisions** (see comments lines 254, 559, 1439).

Furthermore, **phosphorus is identified as very important (line 1404-1420) but is absent from the proposed criteria in Box lines 301-302**

Principle (iii-a) technological neutrality

- this should be specified also as regards **Haber-Bosch** (see comments line 989, lines 301-302)
- take into account **processes combining manure scrubbing N with atmospheric N** (e.g. N₂-Applied see comments on Box lines 301-302)
- the assessment seems to be consider in an unbalanced and non-objective way “**mineral concentrates**”. These materials are not defined (three different definitions in the document lines 747, 1447, 1501), thus enabling high ambiguity regarding their characteristics, and yet they are one of the five materials modelled and indicated as “*one of the most represented in the database*” line 3374). The term “mineral concentrates” covers anything from liquid fraction of partly evaporated manure (filter press filtrate) to nano-membrane purified, that is materials with totally different environmental and agronomic characteristics. We suggest to refer to the SYSTEMIC (H2020 project) fact sheet on Mineral Concentrates <https://systemicproject.eu/downloads/#toggle-id-3> See comments on line 225.
- **struvite is not effectively assessed, biochar is excluded**: the assessment on the other hand does not effectively or completely ignores these technologies, because the resulting products are not considered (manure biochars) or not assessed in the modelling (struvite).

Principle (iii-b) practical & reasonable compliance costs

- this is not taken into account, in that **there is no recognised standard available for testing of “Mineral N”** whereas

this is necessary in the criteria proposed lines 301-302. Existing standards are only applicable to water soluble materials, so not to many RENURE materials, and even these methods may not give useable results (disparities in calculation methods, question of urea ...). See our detailed input line 2974.

Principle (iii-c) enforceable & straightforward verification and monitoring

- this is not taken into account. It is stated in the criteria (Box lines 301-302) that must be taken into account any **HB-derived N mixed into a material**, and ESPP's calculations suggest that addition of just 10% urea would enable average raw manure to pass the RENURE criteria proposed. But it is not clarified how MS can enforce and verify such addition of HB-derived N. No test method is proposed enabling to detect added HB-derived N

ESPP considers overall that the three last bullet points (3 of the five) in Box lines 301-302, requiring Member States actions specific to RENURE materials (application, NH3 emissions in application, storage) do not correspond to the guiding principles (iii-b) and (iii-c) “practical, enforceable, associated to reasonable compliance costs, and facilitate a straightforward verification and monitoring system”.

If RENURE materials require such constraints, it is because they are NOT respecting the fundamental Nitrates Directive objectives to “control the problem arising from intensive livestock production” and “in particular to set specific limits for the application of livestock manure”.

If RENURE materials do risk emissions higher than for HB-derived fertilisers (e.g. ammonia), then the **application specifications should be obligatory, not subject to regional variation**. For example, all RENURE materials with >1% or >3% TOC (or % non stabilised carbon) could be subject to obligatory injection (not surface application).

We suggest that the RENURE criteria should ensure that accepted materials are comparable to HB-derived mineral fertilisers, and so do not require any different constraints for storage, handling or application (beyond those applicable to all fertilising products in the relevant NVZ Action Plan). This would be conform to RENURE products being eligible for the FRP CE-Mark, and so being placed on the market without traceability (other than if applicable under the ABP Regulation).

ESPP suggests that **these guiding principles on enforcement, practicality and compliance costs would be best ensured by maximising coherence with other regulations, in particular EU FPR contaminant limits**.

Method and application

ESPP questions the following aspects of the methodology as presented in the interim report:

- **Literature review limited to articles only 2018 or later, and only Open Access**. See comments on line 1066. This excludes most of the relevant literature (**98.5% of identified papers were excluded** using these criteria), but these criteria are not pertinent, in that much directly relevant literature may be before this date or may be not Open Access. Also the search criteria for this literature review are not clear (see comment on line 1052).
- **However, the meta analysis (line 3360) in fact only uses 39 papers**. It is not clear how these were selected, nor how this selection corresponds or not to the literature review indicated above. It is not specified the relation between the 341 articles selected in the literature search and these 39 articles.
- The **numbers of data points appear to be contradictory**: In the meta analysis data for 171 different fertilisers was identified (line 3949), but the numbers of data points in Fig. 35 page 136 (185) and in table 10 line 3396 and fig12 line 1758(259, 450) exceed 171.
- The **meta analysis is highly skewed**, because over 50% of data points are either manure or solid/liquid separated manure (53/208) or digestate or solid/liquid separated (100/208). Other materials have only one data point (struvite, acidified manure).
- In the meta analysis, **no distinction is made between what sort of manure is found in the materials**, nor between composts/digestates produced only from manure or those produced from manure combined with other

inputs. In particular pig manure, veal manure, poultry manure have totally different characteristics and grouping them together may render any derived conclusions not meaningful.

- The meta analysis data (as discussed above) was finally used to select and define only five “simulated” manure-derived materials (line 1622). The proposed RENURE criteria are thus in fact **based ONLY on three “modelled” (simulated, hypothetical) materials = A, B and C = scrubbing salt, mineral concentrate and digestate liquid/slurry**. The chemical compositions of these modelled materials are indicated page 47, table2, lines 1640-1642.

To ESPP, it does not seem justified to base the criteria on only three hypothetical materials.

Question 2:

Should the proposed RENURE requirements be modified in order to ensure compliance with the proposed criteria? YES

Additional comments:

In order to **respect the fundamental objectives of the Nitrates Directive** (see above), ESPP considers that the proposed criteria (Box lines 301-302) should be modified to:

- Ensure that RENURE materials have **NUE and nitrate leaching risk NOT SIGNIFICANTLY DIFFERENT to HB-derived fertilisers: 10 -20% worse, as currently proposed, is not acceptable** (see p51, fig 12, line 1758, and p54, fig14, line 1824).
- **Criteria should ensure with certainty the exclusion of following materials: all raw manure, all manure fractions after simply biological or mechanical processing (e.g. filter press, evaporation), any mixture of mineral fertiliser with a significant fraction of raw manure.**
- **RENURE materials should be defined so that they do NOT require specific storage, handling or application limits or conditions** (should not be different to the conditions applicable to all fertilising products in the NVZ). That is, the RENURE criteria should be such that the last three (3/5) bullet points of Box lines 301-302 can be deleted. The three bullet points are contradictory to the guiding principles of enforceability, verification, monitoring.

We suggest that the optimal way to achieve this would be to simply **limit organic carbon content to ≤1% organic carbon** (% dry matter, excluding urea etc), that is coherent to the definition of “Mineral fertiliser” in the FPR 2019/1009 (Annex III, part II 4(a)). See further information in comments on Box lines 301-302.

In order to avoid confusion and facilitate implementation, we suggest to **align the contaminant limits for copper (Cu) and zinc (Zn) with those of the EU FPR**, for the relevant Product Function Category under which the RENURE product falls. Copper (Cu) and zinc (Zn) are micronutrients and the limits in the FPR were discussed at length and validated by EP and MS, taking this into account.

Have specific risks been omitted or incorrectly been assessed in this report? YES

Additional comments:

The proposed limit for mercury (Hg) is not justified by any data provided in the report, nor by expected elevated levels of mercury in manure, and should be removed (see comments line 1387, and Box lines 301-302).

The discussion of **arsenic (As)** appears to require modification, see comments line 1391.

ESPP welcomes the position taken in the report, that **veterinary drugs (pharmaceuticals) are significantly present in manure, but that setting of requirements in RENURE products is not necessary**.

Question 3

Have you noticed any incorrect or obsolete techno-scientific information in the SAFAMANURE Interim Report that has an important influence on the proposed RENURE criteria?

Select YES or NO from the drop-down list **YES**

Additional comments:

It is our understanding, that the biogeochemical modelling (§6.1.2.1 and fig10) are based on the assumption that raw manure is applied at the end of the crop season, which is incorrect and contrary to the Nitrates Directive. See comment on lines 1610-1684

Question 4

Would you like to discuss other items of interest at the SAFEMANURE stakeholder meeting?

Select YES or NO from the drop-down list **YES**

Additional comments:

Stakeholder requests / suggestions are:

- To improve coherence between the RENURE criteria and EU FRP criteria (including STRUBIAS)
- It is recommended to consult all EU-funded (Horizon2020 and InterReg and LIFE, recent and ongoing) and other national funded projects which are looking at valorisation of manure nutrients, to request their input to the finalisation of the SAFEMANURE criteria and report: SYSTEMIC, Lex4Bio , EfficientHeat, NEFRETITI, Fertimanure, NoAW, Biowave-AD, ABC4Soil, Power, Nutricycle, Sumanu, DOP, Sto3Re, Teholanta, TURKISTEHO, Depurgan, BioEcoSim, ...

Question 6:

If the available resources allow such work, JRC might update the life cycle assessment as provided in section 6.3.7 based on the framework applied in Tonini et al. (2019). Therefore, we request manufacturers of candidate RENURE materials to contact JRC to coordinate a possible data exchange of LCA inventory data (e.g. energy/chemical demands). We request manufacturers to liaise directly via email (JRC-SAFEMANURE@ec.europa.eu).

No answers required in this template.

Part	Num.	Last	Typ	Comment	Proposed change	References
All	1	End	ED	Throughout the document replace “HB-based N” or “Haber Bosch fertilisers” by “chemical fertiliser N” or “chemical fertilisers” in order to be coherent with the Nitrates Directive.		
Line	168	NA	GE	See also 658. It is stated the need to evaluate impacts of RENURE on NH3 and NOx emissions. We support the objective to evaluate NH3 and NOx emissions.	Add reference to the sections where this is addressed (6.2.4.2 and lines 2096)	
Sect	183	194	GE	ESPP supports the “guiding principles” outlined but considers them incomplete, due to failure to take into account the Nitrates Objective to specifically limit application of processed manure: In ESPP’s opinion, this is incomplete. The Nitrates Directive refers to (3) “ <i>control the problem arising from intensive livestock production</i> ” and states (10) “ <i>it is necessary for Member States to ... implement action programmes in order to reduce water pollution from nitrogen compounds</i> ” and (11) “ <i>such action programmes should include measures to limit the land-application of all nitrogen-containing fertilizers and in particular to set specific limits for the application of livestock manure</i> ”. The Directive then makes clear (Art. 2(g) that these specific limits apply to livestock manure “ <i>even in a processed form</i> ”. The specific limits for manure spreading (Annex III, art.2), which are deliberately set lower than for other fertilising materials, thus correspond to two objectives: limiting eutrophication (as for other fertilisers) and controlling the problem arising from intensive livestock production. We note that the limits specified in Annex III, art. 2 must include the manure applied “by the animals themselves” and can be lower than 170 kgN/ha (this is the upper limit). In particular (art. 3) Member States “ <i>may calculate the amounts referred to in paragraph 2 on the basis of animal numbers</i> ”.	ESPP suggest that these Nitrates Directives objectives should be explicitly indicated in the “guiding principles” lines 183-189.	
Sect	183	194	GE	ESPP supports the “guiding principles” outlined but considers them incomplete, due to failure to take into account nitrogen dynamics and uptake criteria: The Nitrates Directive indicates precise cases in which Member States can request from the European Commission authorisation to apply levels of manure (including in a processed form) higher than the 170 kgN/ha limit above (Annex III, art. 2(b)): “ <i>long growing seasons, crops with high nitrogen uptake, high net precipitation in the vulnerable zone, soils with exceptionally high denitrification capacity.</i> ” This (implicitly) corresponds to account in the account taken by JRC of N leaching and N use efficiency (lines 218-222).	ESPP suggests that it should be explicitly stated in the guiding principles that (in order to reflect the Nitrates Directive Annex III 2(b)) the soil and crop N dynamics of RENURE materials should be comparable to HB-derived fertilisers, as reflected by comparable N leaching and N use efficiency.	

Sect	183	194	GE	<p>ESPP supports the “guiding principles” outlined but considers that they should be completed to specify how to deal with materials where only part of the N is manure-derived.</p> <p>ESPP suggests that:</p> <ul style="list-style-type: none"> - Criteria should be adjusted to take this into account (this is specified in Box lines 301-302 ONLY for “<i>Haber-Bosch-derived N added during the manufacturing process</i>”. This should be widened to cover any non-manure N added during the manufacturing process (e.g. N2-Applied plasma process, see our comments on lines 301-302) - This should not be limited to “during the manufacturing process”. For example, if an anaerobic digester is taking as feed 50% manure and 50% green waste or food waste, then the digestate is post-processed, it should be clear that the mixing of input materials is covered, not only addition during post-processing - For reasons of practicality, it should be specified that where the manure-derived N in a product is below a threshold, then the material should not be treated as “manure in a processed form” under the Nitrates Directive, that is should not be subject to RENURE criteria and should not be subject to specific spreading limits. We would suggest a threshold of 10%, in that below that level the manure content is unlikely to significantly modify the properties of the final product 	<p>Specify in the guiding principles: ratio for materials for which N is only partly manure-derived, threshold below which materials are not considered as “manure in a processed form”</p>	<p>https://n2.no/</p>
Line	210	NA	ED	<p>We suggest to here refer to “chemical fertilisers” (and specify in brackets Haber-Bosch), that is to use the same vocabulary as the Nitrates Directive (art. 2(f)). This would mean consistency with the Nitrates Directive, which is the base legal framework on which the whole Safemanure / RENURE discussion is based.</p>	<p><i>“between candidate RENURE materials and “chemical fertilisers” (N fertilisers as manufactured via the Haber-Bosch process) ...”</i></p>	
Line	225	NA	TE	<p>It is referred to “mineral concentrate” with no definition of what this means. There seem to be three different definitions in the document (lines 745, 1447, 1501).</p> <p>It seems that “mineral concentrates” can, as covered in the report, include simply liquid fraction of manure (e.g. after a filter press) which has been partly evaporated.</p> <p>This is regrettable in that “mineral concentrates” are the object of pressure to authorise their use in NVZs. Indeed “recovered mineral concentrates through reverse osmosis” are cited as top priority of the Member States in lines 743-745 (but this seems to be yet another different definition).</p> <p>The definition of what is meant by “mineral concentrate” in this report should be clarified, and should be referenced from the first uses of the term in the text, and also by including “Mineral concentrate” in the Glossary (page 105, line 3357).</p>	<p>Add a clear definition of “mineral concentrate” and refer to this when the term is used and in the Glossary. See our recommendations under line 1495.</p>	

				<p>This is essential because much of the analysis in the sections on data and on modelling (e.g. table 7, line 1696, page 83; table 6, line 2611, page 79; table 5, line 2414, page 74, etc, ...) and indeed the conclusions from the JRC measurement campaign (line 2406, page 73). One of the five materials “modelled” in the biogeochemical modelling was a “mineral concentrate” (line 1628, page 46).</p> <p>Indeed it is stated lines 3374-3375 that “mineral concentrates are the most represented in the database” for the meta analysis.</p> <p>If there is no clear, consistent definition of what is a “mineral concentrate” then it is difficult to interpret results, information or conclusions relating to them.</p> <p>We suggest to refer to the SYSTEMIC (H2020 project) fact sheet on Mineral Concentrates https://systemicproject.eu/downloads/#toggle-id-3 (2019) which defines a mineral concentrate (from manure) as having undergone three steps: solid-liquid separation, particle removal (e.g. DAF, flocculation, filter press ...) and finally reverse osmosis membrane separation. We suggest to re-sort /re-select all data indicated as concerning “mineral concentrates”, then redo all analysis and rewrite all resulting conclusions if necessary, limiting to this definition (that is, exclude all materials vaguely presented as mineral concentrates which have not undergone this three step treatment chain).</p>		
Line	235	NA	GE	<p>The statement "risks are mostly minimal or absent ..." is only true if the RENURE criteria exclude materials with significant levels of organic carbon. According to ESPP's calculations, this is not currently the case, see comment lines 301-302</p>	<p>"if organic carbon content is very low, then risks are mostly minimal or absent ...</p>	<p>See JRC STRUBIAS report which concluded that C-org should not exceed 3% DM in precipitated phosphate salts.</p>
Line	241	NA	GE	<p>The JRC report notes the documented significant presence of pharmaceuticals in manure and in processed manure products (such as digestates), e.g. tetracyclines, sulphonamides and fluoroquinolones 0.01 to 23 mg/kg wet weight in the EU (Spielmeyer 2018). JRC note (conclusions, p3) that fixing limit values for veterinary drugs would have the benefit of inciting their removal in manure processing, but nonetheless concludes that fixing limits would not be appropriate, given the absence of evidence of risks to soil, plants or health.</p> <p>ESPP welcomes the position taken in the report, that veterinary drugs are significantly present in manure, but that setting of requirements in RENURE products is not necessary.</p>	<p>No change</p>	

Line	248	NA	GE	The proposed limits for Cu, Hg, Zn are stated here with no justification. On the contrary, it is stated line 235 that "risks are mostly minimal or absent" - to our understanding this applies to all the contaminants cited line 234, that is including metals. See comments and explanations for lines 301, 1387, 1717	Either remove the limits for Hg, Cu, Zn . Or add an explanation / justification of these limits	
Line	254	255	GE	It is stated, correctly: " <i>mitigating NH3 losses and odour nuisance was relevant for a number of RENURE materials</i> ", but this not transposed into the proposed RENURE criteria lines 301-302, where odour is not addressed and NH3 emissions are addressed only by MS provisions. (see also lines 1439, 559)		
Box	301	NA	GE	The proposed RENURE criteria directly (TOC/TN) or indirectly (MinN/TN = indirect limit to N-org which is related to TOC) suggest that "organic material" is negative. In reality, return of organic carbon to soil has many positive effects , both benefits for crop nutrient use and nitrogen losses (storage of nutrients linked to organic carbon) as well as other important positive impacts (water retention, CO ₂ storage, soil health ...). In order to take this into account, whilst respecting the Nitrates Directive objectives, ESPP suggests that the RENURE criteria should target the level of stabilisation of organic carbon in materials. Measurement methods do exist (see for example Riva et al., 2016, \$2.5) but we do not know if standardised methods are available for all types of RENURE candidate material. This would require verification.	Replace the TOC/TN criteria with a limit to "non stabilised" organic carbon content	Riva et al. 2016 (already in report references at line 4739)
Box	301	NA	GE	The proposed limits for Cu, Hg, Zn are not justified. The proposed limit for mercury is the same as in the EU Fertilising Products Regulation FPR (for both organic and mineral fertilisers). For copper and zinc it is lower than in the FPR (for mineral fertilisers, 800 and 1500 mg/kgDM Cu and Zn). Cu and Zn are micronutrients. This was discussed at length during both the EU FPR discussions and JRC STRUBIAS and is managed by FPR PFCs and labelling. Hg appears not to be a problem (it is not mentioned in the section on metals, \$5.3.5, page 40, lines 1387-1402) and/or has not been analysed (line 1717) and it is difficult to see why high or problematic levels of Hg might be found in manures.	ESPP suggests to delete the limit for Hg. For Cu and Zn, we suggest to align with the FRP limits for the relevant Product Function Category under which the RENURE product falls.	
Box	301	302	GE	It is proposed that MS should " <i>take the necessary provisions so that the timing and application rates of RENURE ...</i> ".	ESPP suggests that MS should be ensuring this, in any case, for all applications of manures, processed manures and mineral fertilisers, in NVZ. We suggest to explain here	

					what (if any?) ADDITIONAL measures are expected of MS specifically for RENURE, and why?	
Box	301	302	GE	In the proposed RENURE criteria, it is proposed that MS should " <i>take the necessary provisions to prevent and minimise NH3 emissions during RENURE application ...</i> ". There is no mention of odour in the proposed criteria. Both odour and NH3 emissions are identified as important objectives of manure processing in lines 255, 559, 1439.	Add to the RENURE criteria limits on odour and on NH3 emission during the product's normal storage and use.	
Box	301	302	GE	It is proposed that MS should " <i>take the necessary provisions to prevent and minimise emissions to air ... appropriate storage conditions of RENURE ...</i> ". ESPP suggests that RENURE materials should have emissions to air which are NOT significantly different from mineral fertilisers. This is probably not the case at present, in that raw manures, liquid fractions of manures (see Fig35, page 136, line 3964), or a mixture of 90% manure / 10% urea (see ESPP excel file submitted) pass the proposed Min-N – TOC – TN criteria.	The RENURE criteria should be modified so that emissions to air are NOT significantly different from mineral fertilisers. It should then be stated here that RENURE should be subject to the same provisions to limit emissions to air as put in place by MS in NVZs to limit NH3 emissions.	
Box	301	302	GE	Phosphorus is identified as very important (§5.3.6, page 40, lines 1405-1420) yet no RENURE criteria are proposed, and P is not mentioned at all in the RENURE proposed criteria.	Add to the RENURE criteria that application should not result in a phosphorus excess, that is there should be a balanced phosphorus budget (total application ≤ offtake in crops)	
Box	301	302	GE	It is stated: " <i>the ratios should be adjusted for any Haber-Bosch-derived N added during the manufacturing process.</i> This should not limit to "HB N fertilisers" but should address mixing of any mineral or inorganic fertiliser	Modify "HB-derived N" to "non-manure derived N". Note that ESPP considers that this criterion is impractical and unenforceable, and should be replaced / made redundant by simply limiting the TOC/DM ratio	
Box	301	302	GE	See comment on line 183. It should be specified that where the manure-derived N in a product is below a threshold, then the material should not be treated as	Add this clarification into the	

				“manure in a processed form” under the Nitrates Directive, that is should not be subject to RENURE criteria and should not be subject to specific spreading limits. We would suggest a threshold of 10%, in that below that level the manure content is unlikely to significantly modify the properties of the final product	criteria Box lines 301-302	
Box	301	302	GE	ESPP considers overall that the three last bullet points (3 of the five) in Box lines 301-302, requiring Member States actions specific to RENURE materials (application, NH3 emissions in application, storage) do not correspond to the guiding principles (iii-b) and (iii-c) “ practical, enforceable, associated to reasonable compliance costs, and facilitate a straightforward verification and monitoring system”. If RENURE materials require such constraints, it is because they are NOT respecting the fundamental Nitrates Directive objectives to “control the problem arising from intensive livestock production” and “in particular to set specific limits for the application of livestock manure”.	We suggest that the RENURE criteria should ensure that accepted materials are comparable to HB-derived mineral fertilisers, and so do not require any different constraints for storage, handling or application (beyond those applicable to all fertilising products in the relevant NVZ Action Plan). This would be conform to RENURE products being eligible for the FRP CE-Mark, and so being placed on the market without traceability (other than if applicable under the ABP Regulation).	
Box	301	302	GE	If RENURE materials do risk emissions higher than for HB-derived fertilisers (e.g. ammonia), then the application specifications should be obligatory, not subject to regional variation.	Modify criteria to make application requirements obligatory, not subject to regional variation.	
Box	301	302	GE	In order to reduce atmospheric ammonia losses, all RENURE materials with >1% or >3% TOC (or % non stabilised carbon) could be subject to obligatory injection (not surface application). This would be conform to the conclusions of Riva et al. 2016, who conclude “ <i>the correct use of digestate and derived products required their injection into the soil avoiding, ammonia volatilization into the air and preserving fertilizer value</i> ”	Add such application requirements to the RENURE criteria as obligatory.	Riva et al., 2016 Sci. Total Environment 547 (2016) 206–214
Box	301	302	GE	The current proposal is NOT technologically neutral: it is stated: “ <i>the ratios should be adjusted for any Haber-Bosch-derived N added during the manufacturing process.</i> This should be modified to take into account processes which chemically combine manure-derived N with atmosphere-derived N, for example the (e.g. N2-Applied process which uses a plasma reactor to split the N2 and O2 molecules in air into N and O atoms and generate nitrogen oxides, which are then reacted with ammonia in manure or digestate to form ammonium nitrate.	Modify “HB-derived N” to “non-manure derived N”. Note that ESPP considers that this criterion is impractical and unenforceable, and should be replaced / made redundant by	https://n2.no/

					simply limiting TOC.DM.	
Box	301	302	GE	<p>We suggest that the proposed Min-N / Total N / TOC criteria fail the SAFEMANURE project objectives, and fail to respect the Nitrates Directive overall principles:</p> <ul style="list-style-type: none"> - MinN/TN ≥ 90% <u>or</u> TOC/TN ≤ 3 <p>By our calculations (see excel sheet supplied as annex), a material consisting of 90% raw manure+ 10% HB-derived urea would pass the TOC/TN criterion and 60% raw manure/40% urea would pass the MinN/TN criterion (data for manure taken from p65, table 3, line 2137).</p> <p>We are aware that such a material would be excluded by the addition proviso “<i>ratios should be adjusted for any Haber-Bosch-derived N added during the manufacturing process</i>” (see also “RENURE criteria proposal 6” line 2959, page 91) however this example aims to show that a material which is essentially the same as raw manure could pass the criterion, which is contradictory to the principles of the Nitrates Directive.</p> <p>Additionally, it would be very difficult for MS authorities to control and prevent fraud if addition of just 10% urea to a raw manure enables it to pass RENURE criteria. How could such fraud be detected?</p> <p>Of concern, it appears from Fig35, page 136, line 3964, that at least one raw manure and 5 out of 6 liquid fractions of manure pass the TOC/TN < 3 criterion. Furthermore, it appears here that over one quarter of digestate slurry, over one quarter of digestate liquid fraction and some composts also pass this criterion.</p> <p>This is confirmed by literature, for example Nahm citing Miner 2000 “<i>Depending on how the manure has been stored or treated, up to 50 to 90% of the total N found in the manure applied to cropland may be in the form of ammonia (Miner et al., 2000)</i>” (in abstract and page 79 of Nahm).</p> <p>It is also confirmed by the SYSTEMIC fact sheet 2018 where the data indicated for average fattening pig slurry, liquid fraction, would also pass the proposed TOC/TN criterion.</p> <p>Thus both the JRC report’s own data, and literature, suggest that raw manure could pass the proposed RENURE criteria. ESPP suggests that this is totally contradictory to the Nitrates Directive, contradicting both the Directive’s fundamental objectives and to its legal text.</p> <p>ESPP suggests that the optimal way to achieve this would be to simply limit organic carbon content to ≤1% organic carbon (% dry matter, excluding urea etc), see Excel file supplied as above, that is coherent to the definition of “Mineral fertiliser” in the FPR 2019/1009 (Annex III, part II 4(a)).</p>		<p>Excel sheet supplied “<i>ESPP calcul manure mineral TC Min-N 17_12_19</i>”</p> <p>Evaluation of the nitrogen content in poultry manure, K. Nahm, 2003, World's Poultry Science Journal, 59:1, 77-88 https://doi.org/10.1079/WPS20030004</p> <p>Managing Livestock Wastes to Preserve Environmental Quality, J. Miner et al., 2000 Iowa State University Press</p> <p>Systemic Fact Sheet “Mineral Concentrate” 2018 https://systemicproject.eu/wp-content/uploads/2018/06/Factsheet-product-Mineral-Concentrate-FINAL-</p>

				<p>We note that to pass this TOC ≤1% DM criteria, a maximum of 2-3% manure could be mixed into mineral fertiliser, that is a negligible amount, representing neither a realistic way to “get rid of” manure N, nor a significant impact on NUE or leaching.</p> <p>Also, and importantly, there is no recognised standard to test “Mineral N” in some RENURE materials so that the proposed criteria are in any case inapplicable (in any material where part of the mineral N is not water soluble), see comments on line 2974,</p>		22052018.pdf
Box	301	302	ED	<p>[if this criterion is maintained, despite our comments] is incoherent to have one ratio as a % and the other as an integer value, we propose to modify to:</p> <p>- <i>MinN/TN ≥ 90% or TOC/TN ≤ 300%</i></p>	<i>MinN/TN ≥ 90% or TOC/TN ≤ 300%</i>	
Box	301	302	GE	<p>ESPP notes that art. 2(f) of the Nitrates Directive defines a “Chemical fertiliser” as “any fertiliser which is manufactured by an industrial process”.</p> <p>The Directive suggests (see Annex II.A6 and Annex III.1.3.ii) that a material which is a “chemical fertiliser” is not considered to be manure (even in a processed form).</p> <p>The RENURE criteria should therefore include a specification that RENURE materials should be manufactured using a (controlled) industrial process.</p>	<i>Add a criteria specifying manufacturing in a controlled, industrial process</i>	
Line	339	NA	ED	<p>It is referred to the “Fertilisers Regulation” (2003/2003). This should be completed with the new name of the new Regulation “Fertilising Products Regulation” (2019/1009) = FPR</p>		
Line	390	NA	ED	<p>"Some of the materials resulting from manure show a low degree of resemblance to livestock manure". This statement does not lead anywhere. It should be clarified how this related to RENURE.</p>	"The objective of the project is to identify materials resulting from processed manure which resemble chemical fertilisers and have a low resemblance to manure"	
Line	401	NA	GE	<p>It is stated that the RENURE criteria enable "a clear differentiation between livestock manure, processed livestock manure, RENURE and chemical fertilisers". According to ESPP's calculation (see lines 301-302) this is not true. In any case, this statement is unclear: it should be clarified that the criteria split into two classes of materials: manure & processed manure versus RENURE & chemical N fertilisers.</p>	"... clear definition between, on the one hand, livestock manure and processed livestock manure, and on the other hand, RENURE and chemical fertilisers"	
Fig 1	405	NA	TE	<p>This figure is incorrect, according to ESPP's calculations (see lines 301-302). A material consisting of 90% raw manure +10% mineral fertiliser can be RENURE.</p>	The figure should be modified to include an overlap between manure and chemical fertiliser	

					(blend), part of which is "RENURE"	
Line	428	NA	GE	It is stated that the RENURE criteria should be " <i>clear, practical and enforceable ...</i> ". We agree with this statement. However, we think that this is not the case for the organic N / total N criteria due to the absence of testing method applicable for some materials. Also, this contradicts line 2946 which states: " <i>It must be avoided that RENURE criteria ... shall be met through the simple dilution and mixing of manure or manure fractions with HB N fertilisers</i> " as per our comments to lines 301-302.		
Line	658	NA	GE	See also 168. It is stated the need to evaluate impacts of RENURE on NH3 and NOx emissions. We support this statement.	Add reference to the sections where this is addressed (6.2.4.2 and lines 2096)	
Line	743	NA	GE	It is stated that the " <i>top priority</i> " identified by MS was " <i>scrubbing salts</i> " and " <i>recovered mineral concentrates through reverse osmosis</i> ". These are two totally different materials and should not be grouped together.	Separate into two different bullet points: scrubbing salts, membrane concentrates	
Line	743	NA	GE	It is stated that one of the two top priorities is " <i>recovered mineral concentrates through reverse osmosis</i> ". This is unclear, because, to our understanding, (a) not all membrane concentrates use reverse osmosis and (b) there are materials called by producers "mineral concentrates" generated by other technologies (centrifuges, filters ...).	Clarify the category "mineral concentrates": limit to materials where separation is by a membrane intended to prevent crossing of organic molecules, but not limit to "reverse osmosis" membranes.	
Line	746	NA	ED	We regret that struvite, an inorganic product and potentially a Mineral Fertiliser (under the FPR definition), is classed with liquid fraction of digestate, and not as a higher priority with other inorganic products. Also, we suggest to refer to "precipitated phosphate salts" (as per STRUBIAS).	Separate in the list into two bullet points: precipitated phosphate salts, liquid digestate.	
Line	890	NA	TE	It is referred to "mineral concentrate" with no definition of what this means. There seem to be two different definitions in the document (lines 1447, 1501). See also comments for line 225.		
Line	917	NA	TE	See line 2974. It is indicated that there is no international standard for measurement of "mineral N". This is confirmed by the experts we have consulted and by the information provided in the report (line 2974, page 92) which refers to standards which are only applicable in solution.		

Line	935	937	GE	See comments on lines 301-302		
Line	940	941	TE	This refers to §13.3.5, but it is here specified (line 4110) that this is based ONLY on 112 samples from 35 biogas plants, that is concerns ONLY digestate. This partial sampling may explain why the criteria fail for other materials: mineral fertilisers such as struvite, raw manure, etc are not taken into account (see comment on lines 301-302)		
Para Box1	989	990	GE	It is referred to “ <i>Haber Bosch N fertilisers</i> ”. This should be adjusted because mineral N fertilisers can be produced by other processes. Despite that Haber-Bosch is today the dominant route, the report should be technology neutral and should not exclude other possible routes, such as plasma (see reference). Indeed, it is specified in the report line 894 “ <i>a technological neutral stance is desirable</i> ” and similarly in line 2958, 3159. The title of Box1 refers to “ <i>Haber-Bosch N fertilisers</i> ”. This should be corrected (here and elsewhere) to add the word derived: “ <i>Haber-Bosch derived N fertilisers</i> ”. Note also comments on line 210 to refer to “chemical fertilisers” throughout the document (use the Nitrates Directive vocabulary)	Specify that Haber-Bosch derived N fertilisers are the main route today but that other routes are possible, and that HB derived N fertilisers are taken as an example.	“Plasma Assisted Nitrogen Fixation Reactions”, B Patil et al., in “Alternative Energy Sources for Green Chemistry” 2016 https://doi.org/10.1039/9781782623632-00296
Line	1052	1064	GE	It is specified that the literature search targeted “nitrogen and pollutants”, “health and environment” and technologies, but there is no information concerning whether it targeted manure? Processed manure? Manure from which type of livestock? Manure use in fertilisation?	Add description of what themes / words were used in the literature search to target the relevant topic = manure and processed manure.	
Tbl1	1066	1072	GE	It seems that the literature search was limited ONLY to articles available with “open access” and only to articles 2018 and after. This enabled to reduce from 22 948 articles to 341 articles, that is eliminating more than 98.5% of the initially found articles. However, the criteria used for this massive elimination are not relevant: <ul style="list-style-type: none">- Although there is ongoing technological progress in manure processing technology, the large majority of relevant literature is probably pre-2018- Open access is not a scientific selection criteria. Even today, a large proportion of quality science is published on a pay-purchase basis. Note: the number of articles used in the meta analysis, page 107, line 3360, is smaller again, now only 39. It is this meta analysis which apparently led to the selection of just five materials for biogeochemical modelling (line 1621, page 46), of which one was the apparently undefined material “mineral concentrates” (see	Specify in table 1 how many articles were eliminated because of date (2018 or later) and how many were eliminated because not Open Access.	

				comments on line s 255 and 1495).		
Line	1307	NA	GE	ESPP welcomes the position taken in the report, that veterinary drugs are significantly present in manure, but that setting of requirements in RENURE products is not necessary.	No change	
Line	1387	1402	GE	In section 5.3.5 page 40 on “ <i>Metals</i> ” mercury (Hg) is not mentioned at all. There is therefore no justification for its inclusion as a limit in line 301. Arsenic is mentioned (line 1391)		
Line	1391	NA	GE	It is indicated that “ <i>Metal and metalloid inputs from livestock manure are heavily influenced by the quantities of copper (Cu) and zinc (Zn) (and to smaller extent arsenic, (As) added to animal feed added as a growth promotor, especially in the past.</i> ” The reference to the past should be removed. RENURE is not intended to process manure from the past. For arsenic, there is no reference, neither here, nor anywhere else we could find in the report. For arsenic, this seems to be incorrect. To our understanding, arsenic is not (today) used as a growth stimulator but comes as an impurity in other feed additives, either mineral or based on seaweed or fish processing materials (see Adamse et al. 2017).	Add references justifying this statement. Remove words “in the past” and refer to current situation. Adjust conclusions (proposed RENURE criteria) as a consequence	Cadmium, lead, mercury and arsenic in animal feed and feed materials – trend analysis of monitoring results, Adamse et al., 2017 https://doi.org/10.1080/19440049.2017.1300686
Sect	1404	1420	GE	Phosphorus is identified as very important in application of manure and processed manures. This should be translated into criteria concerning phosphorus application in the RENURE criteria lines 301-302		
Line	1423	1430	GE	It is stated that 30-40% of EU manure is deposited directly during grazing. However, it is likely that the proportion is significantly lower some Nitrogen Vulnerable Zones where livestock production is concentrated and livestock spend less (or no) time outside. SAFEMANURE is mainly relevant to NVZs	Specify different for NVZs if possible	
Line	1439	1441	GE	It is stated, correctly: “ <i>Other objectives of manure processing may be the reduction of emissions to the atmosphere (NH3, odours, greenhouse gases, etc.)</i> ”, but this not transposed into the proposed RENURE criteria lines 301-302, where odour is not addressed and NH3 emissions are addressed only by MS provisions. (see also lines 254, 559)		
Line	1445	1447	GE	It is here (line 1501) defined what is meant by the term “Mineral concentrate”. A “mineral concentrate” is here defined as follows “The N present in the liquid fraction can be concentrated through evaporation, scrubbing or filtration methods to produce		

				<p>a mineral concentrate”. This definition could thus include simply liquid fraction of manure which has been partly evaporated.</p> <p>This definition is different from the definition lines 1495-1502 where it is specified that a “mineral concentrate” must be after a membrane (micro-, ultra- or nano-filtration) and from the definition lines 744-745 (“<i>through reverse osmosis</i>”)</p> <p>See comments on lines 255, 890</p>		
Line	1495	1502	GE	<p>It is here (line 1501) defined what is meant by the term “Mineral concentrate”.</p> <p>However, this definition is not clear. Does it mean “microfiltration”, “ultrafiltration” or “nanofiltration”. All three terms occur in this paragraph. Presumably they are not the same? And presumably the small level of filtration (nano) will give a product which is more “mineral” and less “organic”? is this the same as the definition lines 744-745 (“<i>through reverse osmosis</i>”)</p> <p>Furthermore, this definition is totally different from the definition lines 1446-1448</p> <p>See comments on lines 255, 890</p>	<p>Provide a clear definition of “mineral concentrate”.</p> <p>This should probably specify (as here, but contrary to lines 1445-1447) “after membrane” and should also specify a maximum pore size of the membrane (that is, not simply a belt press filter).</p>	
Line	1557	1565	GE	<p>39 studies were used in the meta analysis. How were these found and identified. See comments on line 3361.</p> <p>It is indicated line 1560-1561 that “<i>more comprehensive facts on the available data and methodology are presented in section 11 and 12</i>”. However, we did not find this information concerning the finding, identification and selection criteria for the 39 studies.</p>		
Sect	1610	1684	GE	<p>Section 6.1.2.1 (including Fig10) indicates that untreated manure is often applied at the end or after the plant growing season. Stakeholder feedback suggests that this incorrect (in terms of farm practice) and that such practice would be contradictory to the Nitrates Directive (application after crop growth will mean no plant uptake until the next crop, so high risk of N loss to the environment.</p>	<p>Comment from S. Klages, Germany: the whole setup for modelling needs revision because the basic scenario is not representative.</p>	
Tbl2	1640	1642	TE	<p>The characteristics of the hypothetical “simulated” materials used for the biogeochemical modelling do not correspond to the real data (“average”) presented in table3 page 65, lines 2137-2138. This is detailed in the excel sheet supplied. Some examples are below:</p> <ul style="list-style-type: none"> - Scrubbing salts – TOC/TN: <ul style="list-style-type: none"> - real data = 0% - modelled (A) = 0.1 - Mineral concentrate – TOC/TN <ul style="list-style-type: none"> - real data = 1.8 	<p>The biogeochemical modelling should be based on real data.</p>	<p>Excel sheet supplied “<i>ESPP calcul manure mineral TC Min-N 17_12_19</i>” (already sent to JRC 27/11/19)</p>

				<ul style="list-style-type: none"> - modelled (B) = 1.3 - Digestate liquid – MinN/TN - real data = 46 – 60% - modelled (C) = 75% 		
Fig12	1755	1757	TE	<p>There is no information provided on the breakdown of the 195 (TN/N) and 85 (TOC/N) “pass” materials.</p> <ul style="list-style-type: none"> - Are they in fact largely the SAME materials (passing both criteria)? Or are there differences - What type of materials are they: scrubbing salts, mineral concentrates, manure slurries ... ? 	Provide the breakdown of this figure of pass/fail numbers by different types of RENURE material (raw or solid/liquid separated manures, digestate or solid/liquid separated digestate, mineral concentrates (see comments on lines 255, 890), processed materials (struvite, scrubber salts ...), other (compost, pellets)	
Fig12	1758	NA	GE	<p>Materials identifying as “pass” for the proposed RENURE criteria show <80% NUE or <90% NUE compared to HB-derived fertiliser, and in some cases even slightly below 80% NUE. In agronomic terms this is a considerable difference. For a farmer it could mean 10%-20% lower harvest. For the environment, this could mean higher nitrogen losses.</p> <p>This is confirmed lines 1791-1793: long-term reduction in annual plant N uptake of 14-18% for RENURE materials compared to HB N fertilisers.</p>	Modify RENURE criteria so that “pass” materials provide NUE not significantly different from HB-derived N fertilisers.	
Fig12	1758	NA	TE	Here Fig 12 page 51, there are 450 data points for mineral N and 259 data points for total N. Why is this not the same numbers as p136, line 3964, and page 108, lines 3996-3998 which show 185 data points for mineral N and 122 for total N.	Explain and justify differing numbers of data points	
Line	1791	1793	GE	It is concluded a long-term reduction in annual plant N uptake of 14-18% for RENURE materials compared to HB N fertilisers. This considerably lower and is presumably reflected in similar losses of productivity for the farmer and possibly increased risks of N losses to the environment. This is contradictory to the Nitrates Directive objective.	Modify RENURE criteria so that “pass” materials provide NUE not significantly different from HB-derived N fertilisers.	
Fig14	1824	1838	GE	Page 54: The biogeochemical modelling results here seem to suggest LOWER nitrate leaching in grassland from materials NOT respecting the proposed minN/N and TOC/N criteria (all three grassland scenarios a, b and c). For the arable scenarios, results are variable, but in one out of three scenarios (c), leaching from ‘pass’ materials is average 10% higher than HB-derived fertilisers		

Line	1925	1927	GE	It is indicated that the RENURE criteria are in fact based ONLY on three “modelled” (simulated, hypothetical) materials = A, B and C = scrubbing salt, mineral concentrate and digestate liquid/slurry . The chemical compositions of these modelled materials are indicated page 47, table2, lines 1640-1642.	The logic of basing criteria on only three “modelled” (not real) materials is not justified.	
Line	1925	1927	GE	The report is not technology neutral, because struvite is not included in the modelled materials, and biochar is not considered anywhere.	Struvite and manure biochar should be assessed.	
Tbl3	2137	2138	TE	It appears that the real data presented in table3 page 65, lines 2137-2138 do not correspond to the definition of the “modelled” materials used by JRC for the biogeochemical modelling (indicated page 47, table2, lines 1640-1642.). See comments on line 1640.	The biogeochemical modelling should be based on real data.	Excel sheet supplied “ <i>ESPP calcul manure mineral TC Min-N 17_12_19</i> ”
Line	2946	NA	GE	It is here stated: <i>“It must be avoided that RENURE criteria ... shall be met through the simple dilution and mixing of manure or manure fractions with HB N fertilisers”</i> . See comments lines 428 and 301-302		
Line	2974	NA	GE	<p>There is no recognised measurement standard for “Mineral N”.</p> <p>It is indicated line 2977 that <i>“No methods are available for the determination of mineral N in candidate RENURE N materials that contain a solid fraction (e.g. struvite).”</i></p> <p>Indeed the three ISO standards here cited for assessing Mineral N (ISO 11732 = ammonium N, ISO 13395 = nitrite and nitrate, ISO 23696 = nitrates) are only applicable in water. The standard cited for Organic N (ISO 10695) is also only applicable in water. These methods are therefore not applicable to various RENURE materials, such as struvite, and probably most organic materials where part of the organic and mineral N may not be water soluble.</p> <p>Acid treatment could be used to dissolve (and so render detectable by the above standard methods) the mineral N in struvite and probably in other materials, but the type of acid (pH) would have to be defined material by material, to ensure dissolution but avoid converting organic N to mineral N, or loss of N to air.</p> <p>Additionally, the three standards for mineral N do not cover all forms of mineral N (only ammonium, nitrite and nitrate), in particular not urea, which is – presumably – treated as ‘Mineral N’ (despite its carbon content, as in the FPR). And the standard cited for Organic N (ISO 10695) specifically only analyses (in water) for 12 specific organic nitrogen compounds, NOT for total Organic N.</p> <p>Indeed, it is indicated line 3001 that <i>“DG GROW has also requested the European</i></p>		

				<p><i>Standardisation to develop a method for the determination of the organic N content.”</i></p> <p>Thus, the proposed Mineral N:Total N criterion is not at present measurable for some RENURE materials, with methods available today.</p> <p>This is confirmed by replies from experts we have consulted:</p> <ul style="list-style-type: none"> - Jean-Philippe BERNARD, Chambre d'agriculture de la Charente-Maritime, France, after consulting AUREA laboratory: <i>“they don't think it's possible to test the mineral N in struvite with the standard methods”</i> - Lars Stoumann Jensen, University of Copenhagen, confirms that acidic extraction would be necessary to dissolve N from struvite before using standard testing methods - One struvite-producing company indicates that they measure mineral N in struvite as follows, that is with non standard methods not those indicate in the report: Referring to your question please find herewith the answers as follows how Ostara is measuring mineral N in struvite. We measure it according to the AFPC Protocols: sample is riffled, then the sample is dried at less than 40°C, moisture (ground) is analysed, ammonia nitrogen is measured by EPA Method 350.1 - A waster company (Spain) underlines that calculation of Mineral N by addition of nitrate – nitrite and ammonium is likely to lead to disparities from calculation by subtraction of Organic N from Total N, because of different analytic methods. - O. Schoumans, Wageningen UR, indicates that Mineral N measurement give underestimates because of N associated to colloids and small particles 		
Sect	3357	NA	ED	<p>Please complete the “Glossary”. This should include:</p> <ul style="list-style-type: none"> - FPR = Fertilising Products Regulation 2019/1009 - SAFEMANURE = title of the document – explained in line 378 - Mineral Concentrate = needs to be better defined, see comments line1501 <p>The glossary should also include ALL abbreviations used in the document, for example (there are probably others)</p> <ul style="list-style-type: none"> - ENG - explained page 2 - DG ENV – used but not explained page 2 		
Sect	3361	3378	GE	<p>It is indicated that the meta analysis is based on 39 studies. There is however no information as to how these were selected nor where they came from. We note that the same criteria as for the literature search (see comment lines 106) are clearly not applied, in that many of the studies are pre-2018 and/or not Open Access.</p>	<p>Please explain the methods and criteria used to find (literature search) and select the 39 studies used in the meta analysis.</p>	

Tbl10	3396	3398	TE	Why does the number of pairwise comparisons (between RENURE materials and HB N derived fertilisers) exceed the number of distinct fertilisers in the meta analysis (specified as 208, line 3950)	Explain and justify differing numbers of data points	
Tbl10	3396	3398	TE	Page 108: Why are numbers of data points different from Fig 12, line 1758 – see comment on line 1758	Explain and justify differing numbers of data points	
Tbl11	3428	3430	TE	Stated number of fertilisers in meta analysis (208) appears to contradict numbers in §6.2.1 lines 1752-1764 page 51 and in table 10, lines 3396-3398? Apparently the meta-analysis is based on a second and separate literature search, cf. page 120, §12.1.2(b) and (c) lines 3680-3701	Explain and justify differing numbers of data points	
Tbl11	3428	3430	GE	Of the 208 manure-derived fertilisers from the meta analysis, 53 are raw manure or manure fractions and 100 are digestate or digestate fractions. Most of the products considered have on the other hand very few data points: acidified manure = 1, struvite = 1, pellet = 3.	The results derived from the meta analysis should be corrected to adjust for the sample bias	
Tbl11	3428	3430	GE	In the meta analysis, no distinction is made between what sort of manure is found in the materials , nor between composts/digestates produced only from manure or those produced from manure combined with other inputs. In particular pig manure, veal manure, poultry manure have totally different characteristics and grouping them together may render any derived conclusions not meaningful. The meta analysis classes all “mineral concentrates” together. This is not meaningful due to the absence of clear definition for these materials. See comments on lines 255, 890, 1447, 1501.	Specify and separate in the meta analysis between materials from different types of manure (pig, cattle, poultry) and between digestates/composts with 100% manure input and those with part input of other materials (biomass, food waste ...)	
Sect	3671	3701	TE	In §12.1.2 a “Literature Search” for the meta-analysis is described. The relation is not explained to the 22 948 papers found in the literature search described §6.2.1 lines 1752-1764 page 51 and in table 10, lines 3396-3398. It is not specified how many papers were initially found for this literature search, before sorting by the indicated selection criteria (§12.1.2(c)). It is not specified what as the date limit for this literature search. Presumably is was not the same as for the other literature search (most of the papers used for the meta analysis are pre-2018 and not Open Access) It is indicated that three data bases were used for this literature search. Does this mean that the papers provided by stakeholders and Member States (on request from JRC) were not analysed?	Specify date range for literature search. Specify how many papers were initially found. Specify if papers were provided by stakeholders and MS? How many? Were any of these included in the “selected” 39 papers? Specify what is the overlap between this and the other	

					literature search?	
Line	3949	NA	TE	It is stated line 3949 that TOC:TN was provided for 171 distinct fertilisers. Why do ratios for only 122 appear in Fig35 lines 3961-3968 page 136?	Explain and justify differing numbers of data points	
Line	3950	NA	TE	It is stated line 3950 and in table 11, lines 3428-3430 (page 110) that a total of 208 fertilisers were “ <i>taken up in the meta-analysis database</i> ”. How can it thus be possible that there are 450 and 259 data in the “meta analysis results” in §6.2.1 lines 1752-1764 page 51? How can it thus be possible that there are up to 468 “pairwise comparisons” (between RENURE materials and HB N derived fertilisers) in table 10, lines 3396-3398? Does this mean that some fertilisers are counted three or more times?	Explain and justify differing numbers of data points	
Fig35	3963	3964	TE	Page 136: Why are numbers of data points different from Fig 12, line 1758 – see comment on line 1758	Explain and justify differing numbers of data points	
Fig35	3964	NA	-	See comments on lines 301-302		
Line	4110	NA	TE	See comments on line 940		