European Sustainable Phosphorus Platform

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**ESPP input to UK House of Lords Environment and Climate Change Committee,
Call for Evidence on Nitrogen**

17th March 2025

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https://committees.parliament.uk/committee/515/environment-and-climate-change-committee/news/205099/environment-and-climate-change-committee-launches-new-inquiry-into-nitrogen/

We apologise for missing the submission deadline of 7th March: we were informed by our UK contacts of your consultation only on that date. We hope that this input will be of interest to you and of help in your Inquiry. We are at your disposal for any additional information or questions, and in particular we can transmit questions or requests for specific information to our network of companies, operators and experts.

As a European organisation, many references and numbers below are for Europe/EU. We do not have equivalent references or numbers for the UK, but the picture is generally transposable.

ESPP, the European Sustainable Phosphorus Platform, is a not-for-profit association based in Brussels, established in 2014, with today over 50 members from industry (waste and water treatment, mineral and organic fertilisers, chemicals, technology suppliers), national nutrient platforms, research and cities/regions. We are 100% funded by our members' fees.

The statutory aims of ESPP are to support sustainable use of phosphorus and recycling of phosphorus, nitrogen and other nutrient minerals.

ESPP organised in 2023 two international workshops to understand the status and potential of nitrogen recycling. Detailed summaries (validated by speakers) are in our SCOPE Newsletters n°s 145 and 148. We also published in 2023 an operational summary of literature relevant to N-recycling in our SCOPE Newsletter n° 147. (ESPP's SCOPE Newsletters are here www.phosphorusplatform.eu/ScopeNewsletter). Key messages from these workshops are summarised below.

We underline the importance of ensuring that recovered nutrients find a market, commercially (competition with 'virgin' mineral nutrients), in regulations and as regards product quality. See ESPP's proposals (developed with wide stakeholder consultation) for policies to facilitate nutrient circularity (input to the upcoming EU Circular Economy Act) and for "market pull" for recycled nutrients here www.phosphorusplatform.eu/regulatory

The **objective to reduce nitrogen losses by 50% is signed in the United Nations** COP15 Kunming-Montreal convention Global Biodiversity Framework, December 2022.

Reducing these losses can be combined with N-recovery (e.g. ammonia stripping/scrubbing from manure offgases, to produce e.g. ammonium sulphate fertiliser) or with improved recycling of N in wastes (reduce N losses from manure or digestates during field application, e.g. by acidification of manure or by injection into soil rather than surface spreading – so increasing the effective recycling rate).

The value of current reactive nitrogen losses in the agri-food system worldwide is around 420 billion € (at 2022 N prices), that is around ¾ of total world farming subsidies. (derived from Sutton et al. 2020 https://doi.org/10.1016/j.oneear.2020.12.016).

N recycling can reduce dependency on imports of fertiliser (e.g. urea) and of natural gas. At present, 1 billion € EU fertiliser imports indirectly subsidise Russia's war against Ukraine and the EU currently imports around one third of fertilisers from Russia, increased since the launch of Putin's war against Ukraine (because of high natural gas prices in Europe), leading to an existential crisis in the EU's fertiliser industry. See ESPP eNews 91. (ESPP eNews are available here www.phosphorusplatform.eu/enewshome).

N recycling can reduce farmers' dependency on purchased mineral fertilisers, susceptible to price variations.

Policies to develop N recycling, both N recovery from manures and agricultural digestates, and appropriate use of organic and organo-mineral fertilisers containing secondary N, should include **support to farmers** to cover additional costs (e.g. higher costs of green ammonia fertilisers) and investments.

Mineral N fertilisers could be produced entirely from "green ammonia" (produced from renewable electricity not natural gas). To achieve this at the EU level would cost an estimated 84 billion €, of which more than three quarters (64 bn€) is renewable electricity production capacity. See https://www.fertilizerseurope.com/decarbonising-fertilizers-by-2050/

The expected development of anaerobic digestion (AD) to produce renewable biogas, in particular from manures and food wastes, offers important opportunities to recover nitrogen. Ammonia is generated in the anaerobic conditions of AD and can be stripped/scrubbed from digester offgas or digestate processing offgas, so avoiding atmospheric ammonia emissions (which generate airborne particles and are limited under the UNECE Long-Range Transboundary Air Pollution Convention).

Where nitrogen is recovered from offgases (stripping/scrubbing, adsorption/release), the recovered product will **not significantly contain pathogens nor organic contaminants** (PFAS, pharmaceuticals, heavy metals, …) as these are not significantly released into offgases (at atmospheric or relevant low temperatures).

Potential for recycling of organic nitrogen in waste streams is considerable, potentially replacing mineral N fertiliser consumption and reducing losses. Estimates range from potential of 20 – 45% of mineral fertiliser use. See detailed references in SCOPE Newsletters n° 148 page 2.

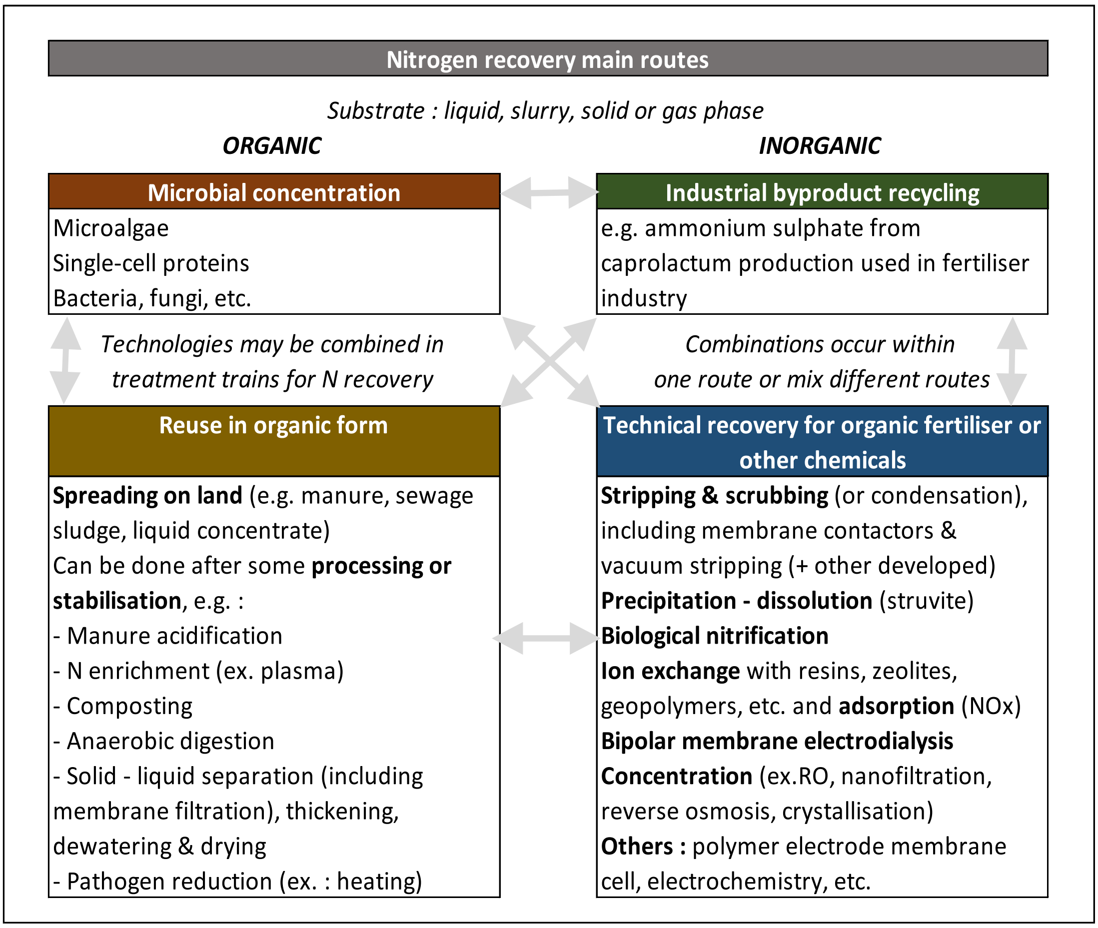
Potential for N-recovery from urban waste water treatment is quantitatively less important than from manure and attention needs to be paid to possible impacts on waste water treatment works energy consumption or on treatment biological processes (N and P removal).

In the EU, the potential for N-recovery from urban wastewater will be assessed by 2033 under art. 30 and preamble 38 of the **recast EU Urban Waste Water Treatment Directive 2024/3019** of 27th November 2024 https://eur-lex.europa.eu/eli/dir/2024/3019/oj

Key messages from the above cited international workshops and science summary on N-recovery:

- A wide range of different N-recovery and N-recycling routes are today available. Most are fully technologically operational (several to many full-scale installations operational for some time). Obstacles to widespread implementation are not technical, but economic and logistic.

- Technologies today operational to recycle reactive N from waste streams include e.g. using waste streams to feed biomass production (algae, duckweed, microbial protein), N-recovery from separately collected urine, manure N stabilisation or local processing to organic fertilisers, recovery of ammonium sulphate solution or production by ammonia stripping from offgases (from manure, from anaerobic digesters), stripping of nitrogen oxides from industry or combustion offgases, production of ammonia gas for industry use (e.g. by adsorption from waste liquors or offgas followed by desorption as ammonia gas). See table below – more detailed information and N-recovery operator mapping are summarised in SCOPE Newsletter n° 145.



Main routes of nitrogen recovery

- Nitrogen recycling offers synergies with reductions of nitrogen losses (to water, to air), phosphorus recycling (an EU Critical Raw Material EU 2024/1252), soil health, LCA and greenhouse emissions reduction, and food security (reducing dependence on imported natural gas).

- In particular, ammonia emission avoidance from livestock (stable air, manure storage, anaerobic digestate), to reduce air particles (generated by ammonia) and to respect National Emissions

Ceilings Directive and the Gothenburg Protocol to the UNECE Long-Range Transboundary Air Pollution Convention (LRTAP), is often implemented by ammonia stripping, offering the possibility for N-recovery.

- Nitrogen recycling from anaerobic digestates (ammonia stripping / N-recovery) offers synergies with Renewable Energy Directive (RED II 2023/2413): significant development of biogas production, in particular from manure, will mean increased opportunity (and need) to strip ammonia offgas.

- Potential for recycling of organic nitrogen in waste streams is considerable, potentially replacing mineral N fertiliser consumption and reducing losses. Estimates range from potential of 20 – 45% of mineral fertiliser use. See detailed references in SCOPE Newsletters n° 148 page 2.

- A proviso is that a significant part of secondary organic nitrogen is already today recycled, but more or less effectively. In particular, there are around 7 – 9 Mt-N/y in livestock manures in Europe, compared to around 11 MtN/y applied in mineral fertilisers and 3 MtN/y in imported animal feeds (such as soy).

- Most manure is today applied to land, but the real N recycling is variable, depending on losses in stables, in storage, in processing or in application, and on whether or not the manure is applied according to crop needs (agronomic dose, right time of year …).

- Increased recycling of organics wastes to processed organic or organo-mineral fertilisers offers considerable potential to reduce N losses and to improve crop N use. This offers LCA benefits, synergy with phosphorus recycling, benefits for soil health and carbon storage, and is today embraced by the mineral fertilisers industry, see conclusions of 1st, 2nd and 3rd Summits of the European Organic Fertiliser Industry (SOFIE) in SCOPE Newsletters n°s 150, 146 and 130.

- N recovery from ammonia offgases from organic wastes (stables, manure storage, anaerobic digestion) reduces ammonia emissions (which continue to exceed EU National Emissions Ceilings (NEC Directive reporting status EEA 2019). Stripping to recover ammonia salt solutions is well-known technology, widely implemented, see SCOPE Newsletter n° 145. The recovered ammonia solutions can be stored and efficiently used as a fertiliser locally. Industrial recycling is however difficult because of water content (low value, high transport costs), unless waste heat is available to enable evaporation to dry product. See analysis in SCOPE Newsletter n° 148 page 7.

- Technologies exist to recover ammonia from such organic waste offgases in the form of ammonia gas but are currently at the R&D phase, in particular adsorption to e.g. zeolites or ionic liquids, then release as ammonia gas. The feasibility of collecting, purifying and compressing such released gas at small scale (similar scale to biomethane from anaerobic digestion) appears to be a research gap (e.g. impacts of water, other impurities, costs of compression, process lifetime and robustness, logistics). See SCOPE Newsletter n° 148.

- N losses (in particular, ammonia) can be reduced, so simultaneously increasing the proportion of reactive N effectively recycled to crops, by appropriate storage of manures, by improved application of organic fertilising materials (e.g. injection rather than surface spreading of digestate) and by stabilisation (e.g. by acidification see slurry acidification update in ESPP eNews n°27 and eNews n°02 and ESPP nutrient recycling technology catalogue (www.phosphorusplatform.eu/TechCatalogue) or by on-farm plasma treatment see N2 Applied in SCOPE Newsletter n° 145 or by use of additives see GasAbate N+ in ESPP eNews n°70). (ESPP eNews are available here www.phosphorusplatform.eu/enewshome).