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Waste not, want not – towards an alternative source of fertilisers

Aleksandra Czarnik, Mary Dobbs, Joseph A. McMahon and Eirini-Evangelia Thomloui

1. Introduction

In June 2022, the European Commission launched a public consultation on a proposed Integrated Nutrient Management Action Plan (INMAP), which would, in its opinion, represent ‘a unique opportunity to consider nutrient cycles globally and provide a holistic and sustainable approach to nutrient management’.¹ This Action Plan had been anticipated in the previously announced Farm to Fork Strategy, which noted²:

The excess of nutrients (especially nitrogen and phosphorus) in the environment, stemming from excess use and the fact that not all nutrients used in agriculture are effectively absorbed by plants, is another major source of air, soil and water pollution and climate impacts. It has reduced biodiversity in rivers, lakes, wetlands and seas. The Commission will act to reduce nutrient losses by at least 50%, while ensuring that there is no deterioration in soil fertility. This will reduce the use of fertilisers by at least 20% by 2030. This will be achieved by implementing and enforcing the relevant environmental and climate legislation in full, by identifying with Member States the nutrient load reductions needed to achieve these goals, applying balanced fertilisation and sustainable nutrient management and by managing nitrogen and phosphorus better throughout their lifecycle.

The European Commission’s aim is not to eliminate fertilisers, which are a valuable input facilitating high quantity and quality yields, but to ensure their appropriate management. It is also worth highlighting at this point that a wide range of fertilisers exist and are used in the European Union (EU), including both chemically manufactured fertilisers and fertilisers derived from ‘organic’ material, for example, (animal)

¹ The announcement is available at Nutrients: Commission seeks views on better management (europa.eu).

² European Commission ‘A Farm to Fork Strategy for a fair, healthy and environmentally friendly food system’ COM (2020) 381, 6–7. It was also anticipated in the European Commission, ‘EU Biodiversity Strategy for 2030 – Bringing nature back into our lives’ COM (2020) 380, 14.

manure or slurry.³ The production, transport and use of all fertilisers pose environmental and human health challenges – but ceasing to use these, even if possible, would not necessarily negate all challenges, as, for instance, animal faeces would still exist. Nonetheless, changes could bring significant improvements. Ideally, just the right amount of the appropriate fertilisers from suitable sources should be applied in a tailored manner according to the land, crop, climate, season, and so on – thereby minimising resource use, pollution and waste.

Of course, the EU had already been active in this area, for example, through the Nitrates Directive (Council Directive 91/676/EEC),⁴ a series of Directives relating to water,⁵ nature conservation,⁶ air pollution⁷ and, more generally, the various environmental components of the Common Agricultural Policy (CAP). However, these regimes have been insufficient to-date to address existing environmental challenges – particularly those relating to nitrates and eutrophication – with fresh concerns arising regarding issues such as pharmaceuticals, ‘forever chemicals’ and increasing methane emissions.

In the wake of Russia’s invasion of Ukraine, with consequent increases in energy prices, attention has increasingly focused on the cost of fertilisers, especially

³ European Commission, ‘Fertilisers in the EU Prices, trade and use’, EU Agricultural Market Briefs, No 15 June 2019 <https://agriculture.ec.europa.eu/system/files/2019-07/market-brief-fertilisers_june2019_en_o.pdf>.

⁴ Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources [1991] OJ L375/1. The Directive has been amended by Regulation (EC) 1882/2003 of the European Parliament and of the Council [2003] OJ L284/1 and Regulation (EC) 1137/2008 of the European Parliament and of the Council [2008] OJ L311/1.

⁵ These include Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy (Water Framework Directive) [2002] OJ L327/1; Directive 2006/118/EC of the European Parliament and of the Council on the protection of groundwater against pollution and deterioration (Ground Water Directive) [2006] OJ L372/19; Council Directive 91/271/EEC concerning urban wastewater treatment (Urban Wastewater Treatment Directive) [1991] OJ L135/40; and Council Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (Sewage Sludge Directive) [1986] OJ L181/6.

⁶ Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds (Birds Directive) [2009] OJ L20/7; and Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) [1992] OJ L206/7.

⁷ For example, Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe [2008] OJ L152/1; Directive (EU) 2016/2284 of the European Parliament and of the Council on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC [2016] OJ L344/1; and Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions (integrated pollution prevention and control) [2010] OJ L334/17.

nitrogen fertilisers, and the security of supply chains.⁸ In this regard, the European Commission's announcement of the public consultation on the INMAP noted that other products such as animal manure, compost and sewage sludge are used as fertilisers in the EU, and it continued to suggest that there are other bio-products that could be better recycled.⁹ The proposed INMAP, it was suggested, would stimulate the markets for recovered nutrients. In a later European Commission Communication specifically on fertilisers, it opined that among the measures that could be taken to increase the resilience of EU agriculture was a reduction in external EU dependency on imported fertilisers. It continued: '[i]n the medium and long term, an important part of the solution to the challenges concerning the supply of fertiliser as well as the environment and the climate lies in supporting the transition to the sustainable use of fertilisers and the deployment of sustainable alternatives to mineral fertilisers'.¹⁰ And the most recent support has been through the European Commission's 2026 Fertiliser Action Plan.¹¹ Consequently, the European Commission's perspective, as reflected in the proposed INMAP and the Fertiliser Action Plan, seeks to shift the attitude and approach to fertilisers, from one of dichotomy to one of symbiosis; that is, from one where fertilisers are seen as a necessary evil – essential for food production, but with negative environmental and health impacts that need to be managed effectively – to one where certain fertilisers could simultaneously help address environmental and human health challenges.

This perspective is similarly reflected in the European Commission's circular economy plans of 2015 and 2020.¹² Both plans referred to the importance of reclaiming nutrients and addressing human waste and environmental concerns, and the 2015 plan expressly addressed the importance of reforming legislation on fertilisers.¹³ This laid

⁸ Indeed, the cost of fertilisers has led to a decrease in use in the EU and impacted the EU's own production of fertilisers <https://agriculture.ec.europa.eu/common-agricultural-policy/agri-food-supply-chain/ensuring-availability-and-affordability-fertilisers_en>. This impact has been exacerbated by the more recent war in the Middle East and related blockades.

⁹ European Commission, 'Nutrients: Commission seeks views on better management', News Article, 3 June 2022 <https://environment.ec.europa.eu/news/nutrients-commission-seeks-views-better-management-2022-06-03_en>

¹⁰ European Commission, 'Ensuring the availability and affordability of fertilisers' COM (2022) 590, 20.

¹¹ European Commission, 'Fertiliser Action Plan: Partnership for ensuring the availability, affordability and strategic autonomy in home-grown EU fertilisers' COM (2026) 310.

¹² European Commission, 'Closing the loop – An EU action plan for the Circular Economy, COM (2015) 614; and European Commission, 'A New Circular Economy Action Plan for a Cleaner and More Competitive Europe' COM (2020) 98.

¹³ Ibid, 13: the European Commission stated that it 'will propose a revised EU regulation on fertilisers, so as to facilitate recognition of organic and waste-based fertilisers in the single market and thus support the role of bio-nutrients in the circular economy'. In the 2020 Circular Economy Action Plan, the European Commission states that it will 'develop an Integrated Nutrient Management Plan, with a view to ensuring more

the ground for a new Fertilising Products Regulation,¹⁴ which directly addressed the circular economy and provided for some significant reforms, including those noted below.¹⁵ Yet, it is questionable whether the EU legislative reforms (planned and undertaken), including in the area of fertilisers, are adequate to fulfil these ambitions or the more general objectives of the proposed INMAP, including an improvement in the recycling of bio-nutrients.

This chapter seeks to examine whether it is time for the EU to regulate human waste itself (specifically faeces) as a fertiliser,¹⁶ thereby potentially providing one partial solution to the combined environmental, human health, supply chain and food security challenges. It reflects on the limitations of the existing regulatory regime for water (Section 2), before turning to the potential of classifying faeces-derived substances as fertilisers (Section 3). In conclusion, the chapter reflects on the potential ramifications of such a classification and whether it would adequately address some of the limitations of the existing regulatory regime.

2. Existing Measures to Ensure Good Water Quality

Environmental challenges and therefore the existing regime can be considered from multiple perspectives, for instance, whether examining specific sources of pollutants (for example, human faeces, production, transport and use of existing fertilisers; and livestock), types of pollutants (for example, excess nutrients, methane and other Greenhouse Gas (GHG) emissions, chemicals and pharmaceuticals) or the state (and therefore standards) of the environment.¹⁷ Across the EU (and still the case in the

sustainable application of nutrients and stimulating the markets for recovered nutrients. The Commission will also consider reviewing directives on wastewater treatment and sewage sludge, and will assess natural means of nutrient removal, such as algae', 12.

¹⁴ Regulation (EU) 2019/1009 of the European Parliament and of the Council laying down rules on the making available on the market of EU fertilising products [2019] OJ L170/1 (Fertilising Products Regulation).

¹⁵ Significantly, the 2019 Fertilising Products Regulation highlights the importance of organic fertilisers and expressly refers to the circular economy in Recital 1: 'promoting increased use of recycled nutrients would further aid the development of the circular economy and allow a more resource-efficient general use of nutrients, while reducing Union dependency on nutrients from third countries.' It replaced Regulation (EC) 2003/2003 of the European Parliament and of the Council relating to fertilisers [2003] OJ L304/1, and introduced key reforms, including the basis for organic fertilisers rather than focusing on mineral or chemical fertilisers.

¹⁶ Related issues arise regarding reclaimed water – including water that may have enhanced nutrient content, potentially to the degree of meriting falling within the concept of fertilisers (see, for instance, COM 2015 614, 11). However, this is beyond the scope of the discussion herein.

¹⁷ It is also possible to consider more specialised rules, for example, nature conservation laws relating to protected sites under the Natura 2000 Network, but such consideration

Aleksandra Czarnik, Mary Dobbs, Joseph A. McMahon, and Eirini-Evangelia Tsoukalidou · 1035315178
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UK, in the form of retained EU law), there is consequently a wide range of EU environmental laws that help address environmental concerns arising in this field. This section focuses primarily on the issue of extra nitrate levels and water pollution, as the main environmental harm consistently arising from fertiliser use and one meriting consideration of alternative fertilisers and practices. Key legislative examples include those regulating water quality generally, nitrate levels in water and the management of urban wastewater (as the main source of nitrates in water alongside agriculture).

2.1 The General Water Regime¹⁸ – The Water Framework Directive

Article 1 of Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the Water Framework Directive) sets out its purposes:¹⁹

The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which:

- (a) prevents further deterioration and protects and enhances the status of aquatic ecosystems, and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;
- (b) promotes sustainable water use based on a long-term protection of available water resources;
- (c) aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;
- (d) ensures the progressive reduction of pollution of groundwater and prevents its further pollution, and
- (e) contributes to mitigating the effects of floods and droughts ...

A core goal pursued by the Directive is a significant reduction in the pollution of groundwater and also water bodies more generally. This is reflected in Preamble (27) to the Directive, which indicates that the ultimate aim is ‘to achieve the elimination of priority hazardous substances and contribute to achieving concentrations in the marine environment near background values for naturally occurring substances’.

Article 13 of the Directive requires Member States to put in place a River Basin Management Plan, for which the environmental objectives are listed in Article 4. This is informed by Article 5’s obligations to undertake an analysis of the characteristics of the river basin district, a review of the environmental impact of human activity and an economic analysis of water use. Thus, within each river basin district, the Member States are required to establish a programme of measures to realise the objectives set in Article 4, considering the results of the information gleaned from the implementation

is again beyond the scope of our chapter and also only addresses a limited proportion of the landscape and issues.

¹⁸ For further discussion, see in this volume Chapter 10 by F Sindico and S Switzer.

¹⁹ Above n 5.

of Article 5. A list of basic measures is contained in Article 11 and, among these, Articles 11(3)(e) and (h) are the first Statutory Management Requirements (SMRs) of the CAP.²⁰ Annex VI:A of the Directive gives further details on the measures to be included within the Plan by referencing eleven other Directives.²¹

The Water Framework Directive requires all surface water and groundwater bodies to achieve 'good' status by 2027, with Annex X listing those pollutants that pose the greatest risk to the environment, which are to be monitored by the Member States. Further details are provided in Directive 2008/105/EC on environmental quality standards in the field of water policy,²² which lists environmental quality standards for those substances listed in Annex X in the form of annual average concentrations (to protect water against long-term pollution) and maximum allowable concentrations (to protect water against short-term pollution). Satisfaction of the environmental quality standards will ensure that the water is of good status, from the perspective of the Water Framework Directive.

2.2 Targeting Nitrates and Other Specific Pollutants

Complementing the Water Framework Directive and targeting the specific issue of nitrates, the Nitrates Directive requires the Member States to define Nitrate Vulnerable Zones (NVZs), that is, those zones in which, as a result of agricultural activities, the waters are eutrophic or could contain a concentration of more than 50 mg/l of nitrates.²³ The Member States are required to establish voluntary codes of Good Agricultural Practice to be implemented by farmers,²⁴ and compulsory action

²⁰ On the SMRs, see Annex III to Regulation (EU) 2021/2115 of the European Parliament and of the Council establishing rules on support for strategic plans to be drawn up by Member States under the common agricultural policy (CAP Strategic Plans) and financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD) [2021] OJ L435/1.

²¹ Among the eleven to be addressed are the Nitrates Directive (above n 4); the Urban Wastewater Treatment Directive (above n 5); the Sewage Sludge Directive (above n 5); the Birds Directive (above n 6), the Habitats Directive (above n 6); Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment (Environmental Impact Assessment Directive) [1985] OJ L175/40; Council Directive 91/414/EEC concerning the placing of plant protection products on the market (Plant Protection Products Directive) [1991] OJ L230/1; and Council Directive 96/61/EC concerning integrated pollution prevention and control (Integrated Pollution Prevention and Control Directive) [1996] OJ L257/26. Many of these have now been replaced by newer legislation, for example, Regulation (EC) 1107/2009 of the European Parliament and of the Council concerning the placing of plant protection products on the market [2009] OJ L309/1.

²² Directive 2008/105/EC of the European Parliament and of the Council on environmental quality standards in the field of water policy (Environmental Quality Standards Directive) [2008] OJ L348/84.

²³ Above n 4.

²⁴ *Ibid*, art 4.

programmes²⁵ to be implemented by farmers within these zones that limit the application of nitrogen from manure.²⁶ For instance, this includes limits on when nitrogen fertilisers can be spread, minimum storage requirements for manure, limits on the quantities that can be spread, the use of crop rotation and requirements for buffer zones between where fertilisers are spread and water courses. Every four years, Member States are required to report on: nitrate concentrations in groundwaters and surface waters, eutrophication of surface waters, assessment of the impact of action programmes on water quality and agricultural practices, revision of NVZs and action programmes and estimation of future trends in water quality.²⁷

Annex I of the Groundwater Directive²⁸ lists nitrates (and active substances in pesticides) as pollutants of EU-wide concern and sets out their quality standards, with Annex II listing a number of other pollutants (and pollution indicators) for which Member States have to consider setting national threshold values (standards). Good quality water is considered achieved whenever the concentrations of these substances do not exceed the standards set. The quality standards and the list of priority substances are regularly subject to review based on a risk assessment of the dangers posed by a substance to humans and the environment.²⁹ It is worth noting here that, under the Good Agricultural and Environmental Conditions (GAECs) that are an element of the cross-compliance in the CAP, GAEC 4 provides for the protection of river courses against pollution and run-off by requiring the establishment of buffer strips along water courses; such strips should be a minimum width of three metres within which the use of fertilisers and pesticides should be avoided.³⁰

Other EU measures supporting good quality water included Directive 91/271/EEC, the Urban Wastewater Treatment Directive,³¹ which targeted pollution by organic matter and nutrients such as nitrogen and phosphorus, which contribute to eutrophication. Under the Directive, Member States were required to take measures to reduce loads of these substances, in particular for sensitive areas subject to eutrophication according to the criteria in Annex II.³² A 2019 study indicated that the objectives of the Directive

²⁵ Ibid, art 5.

²⁶ These codes and programmes created under Articles 4 and 5 of the Nitrates Directive are part of the second SMR in the CAP (above n 20).

²⁷ Above n 4, art 10 in conjunction with Annex V.

²⁸ Above n 5.

²⁹ See, for example, Directive 2013/39/EU of the European Parliament and of the Council as regards priority substances in the field of water policy [2013] OJ L226/1; and, more recently, Commission Implementing Decision 2022/1307 establishing a watch list of substances for Union-wide monitoring in the field of water policy pursuant to Directive 2008/105 [2022] OJ L197/117.

³⁰ GAECs are set out in Annex III to Regulation (EU) 2021/2115 (above n 20).

³¹ Above n 5.

³² Ibid. Thresholds for nutrient reduction are set in Annex I B, Table 2. See also Commission Directive 98/15/EC amending Council Directive 91/271 with respect to certain requirements established in Annex I thereof [1998] OJ L67/29. Aleksandra Czerwik, Mary Dobbs, Joseph A. McMahon and Eirini Evangelia Thomaidou - 9781035315178
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‘are mostly achieved when looking at the EU scale, although there are still regions and countries lagging behind and in need of stepping up the implementation’.³³ The separate evaluation of the Directive by the European Commission identified a number of challenges, including insufficient and uneven levels of governance.³⁴ In 2024, a ‘recast’ Urban Wastewater Treatment Directive was adopted to address the presence of more pollutants and to introduce stricter standards for nitrogen and phosphorus removal.³⁵

2.3 The State of the Environment and EU Objectives

Despite the EU’s credentials in environmental protection, the state of the environment across the EU is not a happy one. For instance, the latest European Commission Report on the Nitrates Directive noted that there has been an improvement in ground-water quality, but that since 2012, further improvements have slowed, leading to the conclusion that ‘the level of implementation and enforcement are still not sufficient to reach the objectives of the Directive, 30 years after its adoption and in spite of some progress’.³⁶ Two major contributors to nitrate levels are those of agriculture and urban wastewater, posing major governance challenges for countries across Europe.³⁷ This is exemplified by Ireland’s Environmental Protection Agency’s maps of water pollution, where the highest nitrate levels geographically correspond to the prevalence of intensive farms (in the south east, especially) and major urban conglomerations.³⁸ Alongside this, biodiversity and climate change crises persist, with the need, for instance, to reduce GHG emissions (including methane emissions from agriculture), reduce energy usage (especially from non-renewable sources) and diversify agriculture. These challenges are exacerbated by an increasing human population (increasing food needs and creation of human waste), lack of energy security and unstable food

³³ A Pistocchi *et al*, *Water quality in Europe: Effects of the Urban Wastewater Treatment Directive. A Retrospective and Scenario Analysis of Dir. 91/271/EEC* (JRC Science for Policy Report, Luxembourg 2019) 83.

³⁴ European Commission, ‘Evaluation of the Council Directive 91/271/EEC of 21 May 1991, concerning urban waste-water treatment’ SWD (2019) 700. See also Court of Auditors, Special Report 12/2021, *The Polluter Pays Principle: Inconsistent application across EU environmental policies and action*.

³⁵ Directive (EU) 2024/3019 of the European Parliament and of the Council concerning urban wastewater treatment (recast) [2024] OJ L2024/3019.

³⁶ European Commission, ‘Report from the Commission to the Council and the European Parliament on the implementation of Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources based on Member State reports for the period 2016–2019’ COM (2021) 1000, 1. See also, for instance, A Musacchio *et al*, ‘EU Nitrates Directive, from Theory to Practice: Environmental Effectiveness and Influence of Regional Governance on its Performance’ (2020) 49 *Ambio* 504.

³⁷ For example, OECD, *Diffuse Pollution, Degraded Waters: Emerging Policy Solutions*, OECD Studies on Water (OECD Publishing, Paris 2017) <https://www.oecd-ilibrary.org/environment/diffuse-pollution-degraded-waters_9789264269064-en>

³⁸ Environmental Protection Agency, ‘Water Quality in 2022’, *An Indicators Report 2023* <<https://www.epa.ie/publications/monitoring--assessment/freshwater-marine/Water-Quality-2022-Indicator-Report-Web.pdf>> 6–8.

supply chains (including availability of fertiliser imports). Transforming agriculture in a suitable manner is a wicked problem that needs a multi-pronged, adaptive, holistic approach.³⁹

The European Green Deal is a multifaceted roadmap to foster a sustainable future for the EU, and it encompasses the foundations for a range of other policies, including biodiversity, Farm to Fork and the circular economy. An important element of the Green Deal is a focus on 'a fair, healthy and environmentally friendly food system', elements of which had already been addressed in the European Commission publication of its Farm to Fork Strategy. As noted above, included within that strategy were plans to reduce nutrient loss by 50 per cent while ensuring no deterioration in soil fertility and to reduce the usage of fertilisers by 20 per cent by 2030. The National Strategic Plans, which now form a central element of the CAP, will have to address how to meet the need to reduce the excessive use of nutrients, such as nitrogen and phosphorus in the environment. These aspects of the National Strategic Plans will be used by the European Commission to 'develop with Member States an integrated nutrient management action plan to address nutrient pollution at source and increase the sustainability of the livestock sector', which would address, for example, the 'recycling of organic waste into renewable fertilisers'.⁴⁰ Likewise, the abovementioned European Commission Report on the Nitrates Directive concludes 'the first necessary actions to address and prevent nutrient pollution from agriculture need to be undertaken through a higher level of compliance with the Nitrates Directive',⁴¹ before identifying the way forward as including the INMAP that would build on the Zero Pollution Action Plan.

Yet, despite being flagged by the EU in documents such as the Farm to Fork Strategy, the Biodiversity Strategy and the 2020 Circular Economy Action Plan (CEAP), having been consulted upon in 2022, and having been the subject of a 2023 JRC report, the INMAP remains to be fully developed and published. The INMAP is essential if environmental challenges are to be addressed and the EU's more ambitious goals and objectives are to be achieved. As noted repeatedly by the EU,⁴² enhanced compliance

³⁹ For further discussion, see, for example, L Petetin and M Dobbs, *Brexit and Agriculture* (Routledge 2022), especially Chapters 5 and 6.

⁴⁰ Farm to Fork Strategy (above n 2) 7. The INMAP is likewise mentioned briefly in European Commission, 'A New Circular Economy Action Plan for a Cleaner and More Competitive Europe' (above n 12). It has also been the subject of a JRC report intended to inform its development: B Grizzetti et al, *Knowledge for Integrated Nutrient Management Action Plan (INMAP)*, EUR 31487 EN (Publications Office of the European Union, Luxembourg 2023).

⁴¹ Above n 36, 12.

⁴² For example, the EU's call to evidence on the INMAP, available at <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12899-Nutrients-action-plan-for-better-management_en>.

with existing policies and laws is valuable, but insufficient.⁴³ Novel approaches are required to meet the enhanced ambitions.

One step already taken by the EU is permitting the use of animal manure/slurry to be spread on land,⁴⁴ and even recognised as a fertiliser/fertiliser input, subject to criteria,⁴⁵ without automatically categorising it as waste. The manure/slurry tends to be stored, for example, in silos, potentially transported to different farmlands, and then spread on agricultural land as a fertiliser – something that is a well-established agricultural practice. However, while this in principle reflects the ideas of circularity and sustainability, in practice, it cannot be said to be addressing the issues of water pollution (or excessive methane emissions). This is despite controls on spreading, for example, at specific times of the year, and requirements regarding storage and handling. As flagged above, agriculture remains a core source of nitrate pollution (and GHGs), whether from mineral fertilisers, manure or otherwise – with run-off from the land being of particular concern. This has been exacerbated by other changes, such as the removal of hedgerows and buffer zones. Too much fertiliser, in the wrong place, at the wrong time. Simultaneously, discharges from urban wastewater are on the increase – including untreated discharges directly into rivers or the sea.

Yet, this also might provide the insight and impetus to undertake a novel and potentially necessary approach. There is a clear need to reduce livestock numbers⁴⁶ and increase the level of horticulture, focusing on regenerative, sustainable and resilient agriculture.⁴⁷ However, a common refrain is that agriculture still needs fertiliser and livestock provides that necessary input. A potential, partial solution is ‘simply’ to reduce the number of livestock and replace fertiliser derived from livestock waste (and

⁴³ See, for instance, Musacchio *et al* (above n 36), highlighting that nitrate contamination in Lombardy remains a significant issue even with full implementation of the Nitrates Directive (contamination has stabilised, but is still ongoing) and also that more effective and innovative, adaptive governance is required.

⁴⁴ For example, Regulation (EC) 1069/2009 laying down health rules as regards animal by-products and derived products not intended for human consumption (Animal By-products Regulation) [2009] OJ L300/1, art 13(f).

⁴⁵ Ibid, Article 3(22). In accordance, for instance, with CMC10 and CMC 15 under the Fertilising Products Regulation (above n 14). Depending on the CMC, criteria can include complying with the relevant ‘end point’ set under the Animal By-Products Regulation.

⁴⁶ For example, P Smith, D Reay and J Smith, ‘Agricultural Methane Emissions and the Potential for Mitigation’ (2021) *Philosophical Transactions of the Royal Society A* 379:20200451: the authors discuss the potential impact through dietary change and that, ‘[s]ince enteric fermentation dominates agricultural CH₄ emissions, any transition away from ruminant livestock will reduce CH₄ emissions’. They likewise discuss a range of other mitigation measures, including changing feeding practices.

⁴⁷ For further discussion, see in this volume, Chapter 7 by R Williams and C Reynolds. More generally, see, for instance, Petetin and Dobbs (above n 39), Chapter 4.

mineral or synthetic fertiliser) with fertiliser derived from human waste,⁴⁸ since the human waste will continue to exist irrespective and can provide an alternative source of nutrients. This could reduce the overall quantity of nutrients entering the environment, as well as reducing methane emissions and reducing energy usage (depending on the processing of the human waste and subsequent management). This turn towards fertilisers derived from human waste reflects the EU's ambitions of improved nutrient management and a circular economy, as indicated within both the 2015 and 2020 circular economy plans and also the proposed INMAP. However, such a solution brings numerous challenges – initially regulatory, but also a range of very practical pitfalls.

3. New Direction – Human Faeces in Agricultural Production?

Human waste could come in various forms (faeces and/or urine, mixed with or separated from other substances, contaminated, treated or untreated). It further has the potential to be considered as different substances, including 'waste', water, fertiliser or something else entirely. This section considers the EU regulatory frameworks that could facilitate the application of human faeces (including where previously mixed with urine/previously part of urban wastewater)⁴⁹ to agricultural land, generally and as a fertiliser.

3.1 Sewage Sludge in Agriculture

One product of wastewater treatment whose use may be seen as consistent with the new direction set out in the European Green Deal, the circular economy plans and the proposed INMAP is sewage sludge. The use of this product is controlled by Directive 86/278, the Sewage Sludge Directive, the aim of which is stated to be to regulate 'the use of sewage sludge in agriculture in such a way as to prevent harmful effects on soil, vegetation, animals and man, while encouraging its correct use'.⁵⁰ Article 2(a) (i) defines this product as including 'residual sludge from sewage plants treating domestic or urban waste waters and from other sewage plants treating waste waters of a composition similar to domestic and urban waste waters' with agriculture being defined in Article 2(c) as 'the growing of all types of commercial food crops, includ-

⁴⁸ This applies where the nutrient types are of a similar nature and will not be possible in the context of some animal waste.

⁴⁹ Frequently, urine as well as human faeces in urine or wastewater pre-treatment are initially regulated under the Urban Waste Water Treatment Directive. Treated urban waste water could also fall within both Regulation (EU) 2020/741 of the European Parliament and of the Council on minimum requirements for water reuse (the Water Reuse Regulation) [2020] OJ L177/32) (once wastewater has been adequately treated) and potentially the fertiliser legislation (for example, if it contains sufficient levels of nutrients; see, for instance, COM 2015 614, 11), but consideration of this is beyond the scope of this chapter.

⁵⁰ Above n 5, art 1.

ing for stock-rearing purposes'. Such sewage sludge would therefore frequently derive from mixes including human faeces. The Directive then details how farmers may use sewage sludge as a fertiliser and outlines a series of measures to ensure the protection of humans, animals, plants and the environment.

For example, the Annexes to the Directive set limit values on the concentrations allowed in soil of various heavy metals, which may be toxic to plants and humans; concentrations of heavy metals exceeding these values in sewage sludge may not be used.⁵¹ Sewage sludge, which is untreated, may be used in farming if it is injected or worked into the soil but normally the sewage sludge must be treated before being used. Treatment involves biological, chemical or heat treatment, long-term storage or any other appropriate process which makes the sewage sludge significantly less likely to ferment, thus reducing the health risks associated with its use.⁵² However, sewage sludge may not be used in certain circumstances and these are set out in Article 7 as being:

- (a) grassland or forage crops if the grassland is to be grazed or the forage crops to be harvested before a certain period has elapsed. This period, which shall be set by the Member States taking particular account of their geographical and climatic situation, shall under no circumstances be less than three weeks;
- (b) soil in which fruit and vegetable crops are growing, with the exception of fruit trees;
- (c) ground intended for the cultivation of fruit and vegetable crops which are normally in direct contact with the soil and normally eaten raw, for a period of 10 months preceding the harvest of the crops and during the harvest itself.

It is up to the national authorities to ensure that the use of sewage sludge does not exceed the legal limits, and this requires keeping up-to-date records derived from the sampling and analysis of sewage sludge and the soil on which it is used.⁵³ Reports from Member States are to be sent to the European Commission every three years, and these are used in its report on the use of sewage sludge in EU farming.

The latest evaluation of the Directive reveals that its use in agriculture represents between 30 per cent and 50 per cent of the total sewage sludge in the EU, with the remainder being incinerated, composted or going to landfill.⁵⁴ There is uncertainty about the finding that there has been a decrease in the level of heavy metals in such sludge since the Directive came into force, as it was noted that many Member States have adopted more stringent requirements than those set out in the Directive, and

⁵¹ Ibid, Annex IA sets concentration limits for heavy metals in the soil, Annex IB sets concentration levels for heavy metals in sludge, and Annex IC sets the maximum annual quantities of heavy metals that may be added to the soil. The heavy metals are cadmium, copper, nickel, lead, zinc, mercury and chromium.

⁵² Ibid, art 6.

⁵³ Ibid, Article 10.

⁵⁴ SWD (2023) 157, 53.

there have been negative unintended effects from its implementation.⁵⁵ It also noted that changes need to be made to the Directive to monitor the impact of ‘organic compounds, pathogens, pharmaceuticals, nanomaterials and microplastics in sewage sludge’.⁵⁶ As for the future of the Directive, sludge management will be influenced by, amongst other things, the outcomes of the revisions of the Urban Wastewater Treatment Directive and the Soil Monitoring Law.⁵⁷

3.2 Sewage Sludge and other Human Waste as an EU Fertiliser?

In the context of the European Green Deal (and its related policy documents), and informed also by the recent price rises for fertilisers and challenges in ensuring a secure supply chain, the question arises as to whether sewage sludge and other human waste could be developed for use as a fertilising product under the recent Fertilising Products Regulation.⁵⁸ The Regulation, which, *inter alia*, harmonises the conditions for the EU marketing of all products used in agriculture that are not already covered by other EU legislative acts, offers the following definition of a fertilising product in Article 2(1):

... a substance, mixture, micro- organism or any other material, applied or intended to be applied on plants or their rhizosphere or on mushrooms or their mycosphere, or intended to constitute the rhizosphere or mycosphere, either on its own or mixed with another material, for the purpose of providing the plants or mushrooms with nutrient or improving their nutrition efficiency.

It is worth noting from the outset that the new 2019 Regulation has taken significant steps to promote the circular economy and to enable the authorisation of EU

⁵⁵ Ibid, 53. These included the presence of antimicrobial genes and microplastics in the soil, possible emissions of ammonia, methane and nitrous oxide, as well as of other contaminants which it can contain, and which are not regulated by the Directive.

⁵⁶ Ibid, 56. For further discussion, see also European Commission, ‘Support to the evaluation of the Sewage Sludge Directive Exploratory study – final report’ (Publication Office of the EU, Luxembourg 2022) <<https://data.europa.eu/doi/10.2779/582221>>.

⁵⁷ See Directive (EU) 2025/2360 of the European Parliament and of the Council on soil monitoring and resilience (Soil Monitoring Law) [2025] OJ L2025/2360; and European Commission, ‘EU Soil Strategy for 2030: Reaping the benefits of healthy soils for people, food, nature, and climate’ COM (2021) 699, 4–5. See also Directive (EU) 2026/805 of the European Parliament and of the Council amending Directive 2000/60/EC establishing a framework for Community action in the field of water policy, Directive 2006/118/EC on the protection of groundwater against pollution and deterioration and Directive 2008/105/EC on environmental quality standards in the field of water policy [2026] OJ L2026/805.

⁵⁸ Above n 14. A number of Commission Delegated Regulations have amended this Regulation, for example: Commission Delegated Regulation (EU) 2021/1768 [2021] OJ L356/8; Commission Delegated Regulation (EU) 2021/2088 [2021] OJ L427/140; Commission Delegated Regulation (EU) 2022/1171 [2022] OJ L183/2; Commission Delegated Regulation (EU) 2022/1519 [2022] OJ L236/5; and Commission Delegated Regulation (EU) 2023/409 [2023] OJ L59/1.

organic fertilisers (derived from biological material), including from manure and sewage, but such opportunities are not limitless. Any product that complies with the Regulation's requirements can be characterised as an EU fertilising product and thus benefit from the EU rules on the free movement of goods.⁵⁹ The core requirements are listed in Article 4(1) and entail: (a) falling within the relevant Product Function Category (PFC) listed in Annex I; (b) falling within the relevant Component Material Categories (CMCs) listed in Annex II; and (c) being labelled in accordance with Annex III.⁶⁰ Compliance with these requirements creates, in the words of Article 13, a presumption of conformity.

Turning first to the PFCs, and considering the Green Deal, perhaps the most relevant of the seven PFCs listed in Annex I is PFC 1, fertiliser, which is divided into organic, organo-mineral and inorganic. Whilst organic and organo-mineral are subdivided into solid and liquid, inorganic is subdivided into straight solid inorganic macronutrient fertiliser, compound solid inorganic macronutrient fertiliser and liquid inorganic macronutrient fertiliser.⁶¹ Part II of Annex I sets out further requirements relating to each PFC. For instance, for organic fertiliser, these include a requirement to contain organic carbon and nutrients of solely biological origin. Limit values are set for various contaminants, including arsenic, lead, and mercury, with higher limit values being set for copper and zinc. Limits are also set for the presence of *Salmonella* and *E. coli*. Biuret, which is toxic to plants, may not be present in organic fertilisers, though limit values are set for it in organo-mineral and inorganic macronutrient fertilisers.

The contaminant limit values are much stricter than those set in the Sewage Sludge Directive, and the contaminants targeted here vary significantly from those targeted, for example, under the Water Reuse Regulation.⁶² Notably, there is a general restriction for all PFCs regarding 'residues' of 'pharmacologically active substance[s]', which would include antibiotics and hormones – requiring the examination of further legislation to identify what is or is not permitted and at what levels. The Annex also outlines nutrient requirements. Thus, a solid organic fertiliser may contain one or

⁵⁹ Fertilising Products Regulation, art 3(1). Article 3(3) provides: '[t]his Regulation shall not prevent Member States from maintaining or adopting provisions for the purpose of protecting human health and the environment which are in compliance with the Treaties, concerning the use of EU fertilising products, provided that those provisions do not require modification of EU fertilising products which are in compliance with this Regulation and do not influence the conditions for making them available on the market'.

⁶⁰ Article 15 of the Fertilising Products Regulation requires that EU fertilising products undergo one of the four Conformity Assessment procedures listed in Annex IV to ensure compliance with the Regulation, the choice being dependent on the product's assigned PFC and CMCs and higher-risk products being subject to stricter assessments involving a Notified Body. See also Article 13 on the presumption of conformity.

⁶¹ Ibid. Also in this category are inorganic micronutrient fertilisers (that is, straight inorganic micronutrient fertilisers and compound inorganic micronutrient fertilisers).

⁶² Above n 49.

more primary nutrients of nitrogen, phosphorus pentoxide or potassium oxide, with a specific nutrient content being set for each; different nutrient contents are set for these primary nutrients in liquid organic fertiliser. Consequently, depending on the precise consistency and make-up of the faeces/sludge and eventual product, including nutrient contents and contaminants, there is the potential for it to fall within one of the fertiliser PFC subdivisions.

Turning to the fifteen CMCs, sewage sludge is referenced as a component material, for example, in CMC12,⁶³ ‘precipitate phosphate salts and derivatives’ and CMC13,⁶⁴ ‘thermal oxidation materials or derivatives’.⁶⁵ In both instances, the reference to this material reads as follows: ‘wastewaters and sewage sludge from municipal wastewater treatment plants, other than animal by-products or derived products within the scope of Regulation (EC) No 1069/2009’.⁶⁶ It could be tempting to argue that human faeces and therefore sewage sludge are animal by-products or derived products, since humans are animals and faeces are a natural by-product (under the ordinary, not legislative, meaning) of our existence. However, human faeces are excluded from the scope of the Animal By-products Regulation,⁶⁷ and therefore the exclusion noted for CMC12 and CMC13 does not apply to sewage sludge derived from mixes containing human faeces. So, sewage sludge could be a component material for fertiliser,

⁶³ Inserted by Commission Delegated Regulation (EU) 2021/2086, amending Annexes II and IV to Regulation 2019/1009 for the purpose of adding precipitated phosphate salts and derivatives as a component material category in EU fertilising products [2021] OJ L427/120.

⁶⁴ Inserted by Commission Delegated Regulation (EU) 2021/2087, amending Annexes II, III and IV to Regulation 2019/1009 for the purpose of adding thermal oxidation materials and derivatives as a component material category in EU fertilising products [2021] OJ L427/10.

⁶⁵ Sewage sludge is referenced in a number of other CMCs, that is, CMC3 – compost; CMC5 – digestate other than fresh crop digestate; CMC14 – pyrolysis and gasification materials; and CMC15 – recovered high-purity materials. In each instance the reference provides for the inclusion of: ‘living or dead organisms or parts thereof, which are unprocessed or processed only by manual, mechanical or gravitational means, by dissolution in water, by flotation, by extraction with water, by steam distillation or by heating solely to remove water, or which are extracted from air by any means, *except*:’ (i) materials originating from mixed municipal waste; (ii) sewage sludge, industrial sludge or dredging sludge; and (iii) animal by-products or derived products within the scope of Regulation (EC) No 1069/2009 (emphasis added). This reference is also in CMC12(1)(e) and 13(1)(a).

⁶⁶ Fertilising Products Regulation, CMC12 (1)(a) and CMC 13(1)(e).

⁶⁷ Article 2(2) of the Animal By-products Regulation (above n 44) expressly excludes some animal by-products from the scope of the Regulation, including: (k) excrement and urine other than manure and non-mineralised guano. Article 3(20) then states that “manure” means any excrement and/or urine of farmed animals other than farmed fish, with or without litter’. As humans are not ‘farmed animals’, their excrement/faeces cannot be deemed manure and are therefore outside the scope of the Regulation.

although it remains quite restrictive, reflected in the titles of the two CMCs, and, as previously noted, it will require greater treatment as the contaminant limit values in the Fertilising Products Regulation are lower than those in the Annexes to the Sewage Sludge Directive.

If sewage sludge is capable of being a component material, the further question arises as to whether human faeces, before it becomes sewage sludge, can also be capable of being a component material. The answer to this question depends in part on the classification of human faeces. Does it, for example, fall within the scope of Directive 2008/98 – the Waste Framework Directive?⁶⁸ If it does, then it may be excluded from falling within an existing CMC. For example, under CMC₁, entitled ‘virgin material substances and mixtures’, the following are excluded:⁶⁹

- (a) waste within the meaning of Directive 2008/98/EC;
- (b) substances or mixtures which have ceased to be waste in one or more Member States by virtue of the national measures transposing Article 6 of Directive 2008/98/EC;
- (c) substances formed from precursors which have ceased to be waste in one or more Member States by virtue of the national measures transposing Article 6 of Directive 2008/98/EC, or mixtures containing such substances;
- (d) by-products within the meaning of Directive 2008/98/EC ...

Article 3(1) of the Waste Framework Directive defines waste as ‘any substance or object which the holder discards or intends or is required to discard’, focusing the discussion on ‘the holder’ and the concept of ‘discarding’, and these have proven to be both complex and contested. Although meriting further investigation, in particular when applied to faeces or other human waste that is actively sought as a valuable ingredient/component by a party creating fertiliser, it seems highly likely that human faeces are waste for the purposes of the Waste Framework Directive. This is because the individuals who create the faeces are the initial ‘holders’ and intend to (and indeed are typically required to) discard the faeces. Even if they can sell their faeces, this is not the cause of the creation of the faeces⁷⁰ – they would be created irrespective of any potential payment and desire of the party creating fertiliser. A potential argument that the faeces are by-products (and therefore not waste) is limited due to the restrictive criteria in Article 5 of the Waste Framework Directive,⁷¹ but also does not necessitate examination here, as they are likewise excluded from CMC₁. Finally, it is worth

⁶⁸ Directive 2008/98/EC of the European Parliament and of the Council on waste [2008] OJ L312/3.

⁶⁹ It is, however, worth noting that various *products recovered from* waste, including precipitated phosphate salts and ammonium salts, can themselves be component materials under CMC₁.

⁷⁰ By contrast, the CJEU considered that where farmers actively sought high-quality soil from a company, leading to its excavation, the soil was not deemed to be waste: Case C-238/21 *Porr Bau* ECLI:EU:C:2022:885.

⁷¹ Criteria include that ‘the substance or object is produced as an integral part of a production process’ and ‘can be used directly without any further processing other than normal industrial practice’. This would beg the question of whether humans eating
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noting that something that was once waste (including faeces) may undergo a recovery operation and cease to be waste, including if it is contained within an EU fertilising product (in accordance with Article 19 of the Fertilising Products Regulation). On the other hand, this is of no comfort for CMC₁, due to the express exclusion of substances or mixtures that have ceased to be waste in accordance with Article 6 of the Waste Framework Directive. Consequently, irrespective of whether faeces are deemed waste at some point (highly likely) or are a by-product (unlikely), CMC₁ could not apply.

Another possible CMC is CMC₃, ‘compost’, which is defined as being obtained through aerobic composting of exclusively one or more of the listed input materials. One of these allowed input materials is biowaste within the meaning of the Waste Framework Directive, resulting from separate biowaste collection at source. Yet, human waste is not considered biowaste as defined by Article 3(4) of the Waste Framework Directive. CMC₃ also includes ‘living or dead organisms or parts thereof, which are unprocessed or processed only by manual, mechanical or gravitational means, by dissolution in water, by flotation, by extraction with water, by steam distillation or by heating solely to remove water, or which are extracted from air by any means’. Faeces clearly derive from and could arguably be deemed a ‘part’ of ‘living or dead organisms’. However, CMC₃ expressly excludes: materials originating from ‘mixed municipal household waste’, ‘sewage sludge, industrial sludge or dredging sludge’, and ‘animal by-products or derived products’ falling within the scope of the Animal By-Products Regulation.⁷² The definitions from the Waste Framework Directive are relevant here, with, for example, municipal waste being defined as:⁷³

- (a) mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics, biowaste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture;
- (b) mixed waste and separately collected waste from other sources, where such waste is similar in nature and composition to waste from households.

Municipal waste does not seemingly include urban wastewater or faeces (or indeed sewage sludge). Likewise, as with sewage sludge considered regarding CMC₁₃, faeces are not animal by-products or derived products within the *scope* of the Fertilising Products Regulation.

Consequently, while CMC₃ expressly excludes sewage sludge, it would appear that there is the potential in principle for CMC₃ to encompass faeces that were collected separately and never part of urban wastewater or the resulting sewage sludge, provided that they have been processed according to the process and specifications outlined. However, this is at best a tenuous argument and unlikely to hold sway in

and the metabolism of food counts as a ‘production process’ and whether there is currently a ‘normal industrial practice’ for using human faeces as fertiliser.

⁷² See text above n 67.

⁷³ Above n 68, art 3(2)(b).

practice – something that has become all the more apparent in light of an on-going study into the Fertilising Products Regulation, discussed briefly below.

Apart from the possible categorisation of human waste to an existing CMC or the amendment of an existing CMC to include human waste, a new CMC could also be introduced, using Article 42 of the Regulation, specifically designed for human waste, including a list of processes allowed and possible novel requirements set to ensure safety for humans and the environment. This would ensure greater legal certainty. It would also reflect the EU's objectives outlined in documents such as the Green Deal, the circular economy plans, the Farm to Fork Strategy, the new Fertiliser Action Plan and the commentary on the proposed INMAP, while also helping to ensure a more appropriate, tailored CMC. A tailored CMC would allow for considerations not merely of the primary sources and acceptable, applicable processes, but also the potential presence of significant contaminants and how these should be addressed. Even though contaminants are largely addressed within the provisions on PFCs, CMCs must not lead to PFC contaminant limits being breached and some contaminant limits are seen independently in CMCs. For example, CMC₃ has limits for glass, plastic, metal and PAH₁₆, and CMC₁₅ has a range of limits, including for *Salmonella* and *E. coli* (where the relevant PFC does not have limits). Thus, for instance, a new CMC could include references to heavy metals, pharmaceuticals (including antibiotics and hormones), salination, diseases, human pathogens, and so on. This is of particular significance considering issues such as the potential for the development of antimicrobial resistance and spread of pathogens that affect humans, with the EU approaches under the Urban Wastewater Treatment Directive and Water Reuse Regulation, as well as the recent revisions to EU water legislation, providing valuable insights. In developing such a CMC, the European Commission would also need to reflect on what processes and, specifically, treatments were permitted or excluded, since a range might be required to address potential pathogens and other contaminants. Yet, flexibility would need to be embedded in such a CMC to avoid stagnation and limiting green innovation, while maintaining environmental and human health standards. Considerable data has been, and continues to be, developed across numerous projects and localities, with support from groups such as the European Sustainability Phosphorous Platform (ESPP), which could be used to feed into the design of any such CMC, while also learning from approaches to substances such as processed animal manure.⁷⁴ In light of the potential to add specific criteria regarding human health and the environment, as well as the resulting legal certainty, it might likewise be sensible to create a specific CMC for sewage sludge. Further, the European Commission could also decide to adjust the PFCs in a complementary fashion if appropriate, for example, adjusting minimum and maximum nutrient requirements, organic carbon content and pathogen limits.

⁷⁴ As noted, the authors are part of Horizon Europe project, P2GreeN. P2GreeN are members of the ESPP. Other related projects include ones such as zirkulierBAR, with others such as ReNuzCycle examining recycled fertilisers more generally (including from sewage sludge). Input regarding faeces was provided from several sources to the NMI project noted below, as reflected in their reports. Alexandra Carrick, Mary Dobbs, Joseph A. McMahon, and Eirini-Evangelia Panagoulou. Published online by Cambridge University Press. Downloaded from https://www.elgaronline.com/ at 09/29/2026 10:11:23PM via Open Access. Chapter 9 is available for free as Open Access from the individual product page at www.elgaronline.com under a Creative Commons AttributionNonCommercial-NoDerivatives 4.0 International (https://creativecommons.org/licenses/by-nc-nd/4.0/) license. https://creativecommons.org/licenses/by-nc-nd/4.0/

This is not quite the end of the story, as Article 4(2) of the Fertilising Products Regulation also makes it clear that '[f]or any aspects not covered by Annex I or II, EU fertilising products shall not present a risk to human, animal or plant health, to safety or to the environment'. This provision acts as a catch-all, complementing the criteria in Article 4(1) outlined above. Consequently, evidence of a potential fertiliser's safety (for example, via sampling and risk assessments) would need to be provided, both regarding aspects listed in Annexes I and II for the relevant PFCs and CMCs (under Article 4(1)) and also on a general level (under Article 4(2)). In this respect, it would be important to take into account more general environmental and human health legislation and guidance documents, including legal standards outlined in EU legislation⁷⁵ and, for example, the standards created by relevant international organisations, such as those recognised in the World Trade Organization's Agreement on Sanitary and Phytosanitary Measures.⁷⁶

It is worth highlighting that the EU water regime requires Member States to monitor a wide range of substances, with lists of priority substances,⁷⁷ including the use of 'watch lists', and consider whether the priority substance lists need to be amended (or the approach thereto).⁷⁸ The priority substance lists were most recently updated in March 2026, via a Directive amending the Water Framework Directive, the Groundwater Directive and the Environmental Quality Standards Directive. The 2026 Directive added a wide range of further substances to the priority lists, including antibiotics

⁷⁵ For example, within the General Food Law (Regulation (EC) 178/2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety [2002] OJ L31/1) and related legislation and soft law.

⁷⁶ Namely, the FAO/WHO Codex Alimentarius Commission for food safety; the World Organisation for Animal Health (previously the Office International des Epizooties (OIE) for animal health and zoonoses and the FAO International Plant Protection Convention for plant protection.

⁷⁷ This includes under Annex X of the Water Framework Directive, available via the consolidated version: <<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3AA02000L0060-20141120>>. The main lists are now found within the Environmental Quality Standards Directive, as amended: Directive 2008/105/EC of the European Parliament and of the Council on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council [2008] OJ L348/84.

⁷⁸ For example, T Backhaus, 'Commentary on the EU Commission's Proposal for Amending the Water Framework Directive, the Groundwater Directive, and the Directive on Environmental Quality Standards' (2023) 35:22 Environmental Sciences Europe. The Environmental Quality Standards Directive 'watch list' was amended in 2025 by Commission Implementing Decision (EU) 2025/439 establishing a watch list of substances for Union-wide monitoring in the field of water policy pursuant to Directive 2008/105/EC of the European Parliament and of the Council [2025] OJ L2025/439.

and ‘forever chemicals’.⁷⁹ This may become legally relevant in evaluating any substances that might be spread or used on the land or otherwise enter the water system. It also highlights the increasing awareness that a wide range of substances may not be regulated effectively currently but can still have a significant impact on the environment and may be regulated further in the future, for example, further pharmaceuticals (including antibiotics and hormones)⁸⁰ and micro-plastics. This mirrors the revisions to the Urban Waste Water Treatment Directive. Further, although not a ‘substance’, aspects such as organic material bearing the potential to transmit diseases are of considerable significance to the environment and human health. Additionally, this 2026 Directive is also intended to enhance the legal framework more generally and ‘ensure dynamic and up-to-date information on water status’.⁸¹ The relevance for fertilisers and for the subject matter of this chapter is that such issues could be integrated into any new PFC or CMC, while also falling within Article 4(2) of the Fertilising Products Regulation.

4. Conclusion

Water across the EU remains contaminated, including with high nitrate levels sourced primarily from agriculture and urban wastewater. Simultaneously, populations are increasing, agricultural production is essential, and the existing regimes are clearly

⁷⁹ Directive 2026/805 of the European Parliament and of the Council amending Directive 2000/60/EC establishing a framework for Community action in the field of water policy, Directive 2006/118/EC on the protection of groundwater against pollution and deterioration and Directive 2008/105/EC on environmental quality standards in the field of water policy [2016] OJ L2026/805.

⁸⁰ The June 2023 Council Recommendation on stepping up EU actions to combat antimicrobial resistance in a One Health approach [2023] OJ C220/1 noted in Recital 18 that ‘[t]he application of sewage sludge and manure as fertilisers on agricultural soil may lead to the development of AMR [anti-microbial resistance] through the spread of antimicrobial resistant bacteria and antimicrobial resistance genes in the environment, further contaminating the food chain. While more data and the refining of existing data are necessary, it is recommended to introduce prudent manure management practices’. Recommendation 5 encouraged Member States to develop ‘integrated systems for the surveillance of AMR ... encompassing human health, animal health, plant health, food, wastewater and the environment (in particular water and soil)...’. The use of human faeces in agriculture would add a new perspective and risk the development of AMR to antibiotics used for humans, through creating a circular loop of drugs and not simply nutrients. If the faeces could be treated to remove the antibiotics in some fashion, this could potentially reduce overall antibiotics in the environment and thereby reduce AMR.

⁸¹ Proposal for a Directive of the European Parliament and of the Council amending Directive 2000/60/EC establishing a framework for Community action in the field of water policy, Directive 2006/118/EC on the protection of groundwater against pollution and deterioration and Directive 2008/105/EC on environmental quality standards in the field of water policy COM 2022, 540, 2.

inadequate to address the challenges – even where implementation obligations are largely fulfilled. The proposed INMAP reflects these and other challenges, highlighting the need for transformative change and embedding circularity.

This chapter primarily considered the potential for human faeces to be authorised as an EU fertiliser, reflecting the notion of circularity. It acknowledged the existing potential for sewage sludge to be used to a limited extent under the Sewage Sludge Directive and also as a fertiliser (linked to CMC₁₂ or ₁₃), before turning to faeces that have never been part of urban wastewater and therefore not deemed to be residual sludge. The main issue for categorisation is not that of PFCs, but of CMCs. The challenge here is largely that the policy-makers clearly did not consider this possibility when designing the fertiliser legislation and, further, the language in the Fertilising Products Regulation and other related legislation varies and is opaque. Specific issues arise regarding references to something being within the meaning of legislation in some cases and within the scope in other cases. Beyond gripes over the opacity, there is the question of whether faeces here is waste, an animal (or other) by-product or something else, or perhaps was once waste but has ceased to be waste. It appears likely that the faeces would be likely to be deemed originally waste and, even if arguably an animal by-product, not within the scope of the Animal By-products Regulation – leading to the potential applicability of CMC₃, but with sufficient uncertainty and restrictions that a new CMC might be the preferable option in the long-term if suitable fertilising products can be derived that contribute positively to the environment and human health.

However, even if permitted and a range of hurdles regarding environmental and human health criteria are met, the facilitation of using human waste as fertiliser is not a panacea for addressing water pollution and excess nitrates entering the environment. Its added benefits are contingent on a number of elements, or it risks simply falling into similar pitfalls as with animal manure. Faeces-derived fertiliser is equally susceptible to poor management, including excessive quantities or levels being spread, being spread at the wrong time or location, lack of buffer zones, degraded soil or land leading to leachate and so on – research and good agricultural and environmental practices are essential to address existing contamination and to limit and avoid future contamination.⁸² However, if livestock numbers are reduced in future, besides leading to reduced methane emissions, the overall production levels of nitrogen from animal waste and human waste will be reduced – leading to lower levels overall in the environment.⁸³ Further, livestock manure is already on the farms and must be managed in

⁸² For example, Bijay-Singh and E Craswell, 'Fertilizers and Nitrate Pollution of Surface and Ground Water: an Increasingly Pervasive Global Problem' (2021) 3 SN Applied Sciences. 518. This applies similarly to GHG emissions from the spread of fertilisers: P Mielcarek-Bocheńska and W Rzeźnik, 'Greenhouse Gas Emissions from Agriculture in EU Countries – State and Perspectives' (2021) 12(11) Atmosphere 1396.

⁸³ Similar arguments can be made if the availability of human waste-derived fertiliser reduced the reliance on synthetic nitrogen fertilisers, both through once more reducing overall nitrate levels and in light of the energy and resources required to create
 Alexandra Czarnik, Mary Dobbs, Joseph A. McMahon, and Irini-Evangelia
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some fashion, and, even when transported to a different farm/location for spreading, it does not go through the same processing or testing (including measuring of nitrates and phosphates) that would likely apply to human waste-derived fertilisers. Human waste-derived fertiliser is less likely to be purchased, transported and applied to land unless it is considered to be of benefit to that specific land and crop.

This links to the issue of precision farming, which uses ‘digital techniques for the monitoring and optimising’ of ‘agricultural production processes’.⁸⁴ These digital techniques utilise various data inputs from satellites, ground sensors, and even drones. For instance, a network of sensors is capable of collecting and analysing data and feeding it back directly to the farmer through an app, indicating the moisture of the soil or allowing for the analysis of nutrients.⁸⁵ This can enable tailored management of the land, for example, determining the level of irrigation or nature of fertilisation that might be beneficial, or indeed whether a different crop should be planted. The EU has already recognised the potential of precision agriculture, noting that the loss of biodiversity in agricultural areas as well as pollution from nitrates can be at the very least curbed through ‘more precise and sustainable farming, which draws more strongly on knowledge and (digital) technology – to produce jointly more private goods and environmental public goods with lower levels of input use and negative externalities’.⁸⁶ Consequently, applying precision farming in conjunction with a shift towards human waste-derived fertilisers might help address multiple environmental and health concerns simultaneously, while enhancing the efficiency and productivity of agricultural production. The practical feasibility of this remains to be seen, including whether suitable fertilisers could be created and made available efficiently, whether sufficient monitoring and sampling would facilitate evaluating appropriate fertiliser loads, and whether such fertilisers would be acceptable to farmers and the resulting products acceptable to consumers. It also then begs the question of how issues such as labelling should be addressed and the relationship with organic production, considering that those interested in organic farming/produce might simultaneously face extra hurdles in using such products and be the most amenable to its use if it has significant green credentials.

and import such fertilisers: for example, S Menegat *et al*, ‘Greenhouse Gas Emissions from Global Production and Use of Nitrogen Synthetic Fertilisers in Agriculture’ (2022) 12 Scientific Reports 14490; and E Walling and C Vaneekhaute, ‘Greenhouse Gas Emissions from Inorganic and Organic Fertilizer Production and Use: A Review of Emission Factors and Their Variability’ (2020) 276 Journal of Environmental Management 111211.

⁸⁴ M Kritikos, ‘Precision agriculture in Europe – Legal, social and ethical considerations’ (European Parliament Research Service Study PE 603.207) <[https://www.europarl.europa.eu/RegData/etudes/STUD/2017/603207/EPRS_STU\(2017\)603207_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2017/603207/EPRS_STU(2017)603207_EN.pdf)>.

⁸⁵ J Bacenetti *et al*, ‘May Smart Technologies Reduce the Environmental Impact of Nitrogen Fertilization? A Case Study for Paddy Rice’ (2020) 715 Science of the Total Environment 136956.

⁸⁶ European Commission, ‘Recommendations to the Member States as regards their strategic plan for the Common Agricultural Policy’ COM-2020-846. Alexandra Czarnik, Mary Dobbs, Joseph A. McMahon, and Eirini-Evangelia Antoniou 1751035315178 elgaronline.com/ at 09/29/2026 10:11:23PM via Open Access. Chapter 9 is available for free as Open Access from the individual product page at www.elgaronline.com under a Creative Commons AttributionNonCommercial-NoDerivatives 4.0 International (<https://creativecommons.org/licenses/by-nc-nd/4.0/>) license. <https://creativecommons.org/licenses/by-nc-nd/4.0/>

Overall, if the EU are serious about INMAP, there is a need for transformative change to deliver its objectives. The Fertilising Products Regulation's own Preamble and the preceding 2015 circular economy plan indicate some support for fertilisers derived from human waste and the need to address waste, but the (limited) inclusion of sewage sludge is only a partial step in this direction. Facilitating the authorisation of human waste-derived fertiliser more broadly, which would enable its sale and use across the EU (and influence its availability externally), would be a key step in achieving this – provided that suitable criteria were imposed for the fertiliser and that good agricultural and environmental practices were applied to its use.⁸⁷ However, this would open up numerous other issues to be considered, such as acceptability, labelling and the relationship with organic production. The environmental and human health credentials, if and when established, would also play an important role in these issues.

Policy developments and research continue at pace. Thus, there is an ongoing review of the Fertilising Products Regulation,⁸⁸ as well as the Nutrient Management Institute's study⁸⁹ on the potential to amend or add new CMCs. The existing limitations of the Fertilising Products Regulation, in its approach, implementation and existing CMCs, have been repeatedly highlighted. Human excreta have been considered within the NMI study as potential CMCs, but with mixed and generally unfavourable reception to-date. As part of our research for a Horizon Europe project, P2Green, we have engaged extensively in this process, with our most recent contribution being to co-design and submit a CMC on human excreta that is currently under consideration with NMI. This potential CMC proposes to include, urine, yellow water, faeces and blackwater, subject to various conditions including undergoing relevant hygienisation processes and meeting relevant criteria such as those relating to pathogens, and with express links to the contaminants specified in Table 3 of the Urban Wastewater Treatment Directive – thereby ensuring that any future updates to that Directive would also lead to updates in the CMC.

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⁸⁷ See Chapter 8 in this volume by C Bradshaw on food waste for consideration of unintended consequences flowing from flawed policy design.

⁸⁸ For instance, see <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/14365-Fertilising-Products-Regulation-evaluation_en>.

⁸⁹ All of NMI's reports are available here: <<https://circabc.europa.eu/ui/group/36ec94c7-575b-44dc-a6e9-4ace02907f2f/library/78f825aa-5272-44fo-9126-f1b2598f650>>.
Alexandra Czernik, Mary Dobbs, Joseph A. McMahon and Eirini Evangelia
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