European Sustainable Phosphorus Platform
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**8th April 2016 - ESPP RESPONSE to:**
**EU Consultation on preparation of Horizon2020 WP 2018-2020 on Climate Action, Environment, Resource Efficiency and Raw Materials**

The European Sustainable Phosphorus Platform **brings together industry, knowledge institutes and public establishments to promote and implement phosphorus sustainability** in Europe, including partners from the following sectors

- Water and waste treatment
- Fertilisers and soil amendments, animal feeds, food and beverage industry
- Phosphate mining, processing and chemicals industries
- Technology suppliers, knowledge institutes
- Partner networks: composts, digestates, manure management, R&D networks …
- Nutrient / phosphorus Platforms: Netherlands, Flanders, Germany, Networks:
- Farmers' organisations, organic farming, environmental and consumer NGOs
- Local / regional authorities

Phosphorus (and nutrient) management is a meeting point for a number of **EU policies and objectives**:

- Jobs in the circular economy, in particular distributed rural employment,
- Farmers' incomes / competitivity
- Sustainable production and consumption (UN Sustainable Development Goal 12)
- EU water / environment policy
- International export potential for technology and know-how
- Food security
- Critical raw Materials
- Renewable biomass energy
- Geopolitics, in particular Mediterranean region (Morocoo, Tunisia key phosphate producers)

## Q1: Challenges

We would suggest the following as important challenges H2020 should address in the 2018-2020 work programme:

- **Sustainability of waste water treatment, including economic / funding sustainability in the current context of pressure on public funding**: improving nutrient removal and sewage "disposal" are major cost challenges, nutrient and organic carbon recycling offer significant opportunities
- **Organic contaminants in sewage**: The use of sewage biosolids in agriculture enables recycling of sewage nutrients and of organic matter to soils. This is important for economics of waste water treatment, nutrient dependency, and in restoring soil organic matter (drought resilience, climate change impacts …)[i]. Concerted R&D is needed both for environment and health risk assessment of organic contaminants, reduction or removal of these, traceability, consumer acceptance and agronomic value. See EIP-AGRI Focus Group detailed below.
- **Data, economic and policy tools and business models to address the bio-nutrient circular economy**: The bio-nutrient and organic carbon circular economy are different consumer and industrial goods, involving a wide range of sectors (waste

and water, farming, food and consumers, renewable energy, fertilisers, chemical industry) and new systems understanding, data tools for decision making, and methods are needed.

- **Nutrient food product footprints**: for consumers to change behaviour and to support public and corporate decision making, nutrient footprinting throughout food product production chains need to be developed, including impacts of losses, and taking into account nutrient recycling
- **Synergies between biomass-based renewable energy, biomaterials production and nutrient management**, including nutrient use optimisation and nutrient recycling: This should include use of wastes as feed material for biomass production, nutrient recovery and recycling from digestates. Opportunities include: optimising use of raw materials (mineral fertiliser inputs), jobs and growth, climate change and water quality impacts
- **Importance of phosphorus, in specific forms in industry**: A minor consumer of phosphorus resources in quantity, P4 = white phosphorus and derivatives and high-purity phosphoric acid are essential for a range of high added value industrial sectors, strategic for Europe[ii]. Europe is today import dependent for P4 and the inclusion of "phosphate rock" in the EU list of critical raw materials does not address this. In complement to the SUSPHOS network[iii], R&D is needed to clarify the environmental challenges and the growth opportunities, including addressing issues in P4 use[iv] (e.g. chlorine or solvents in processing, environmental fate of organophosphorus products)
- **Improving and implementing nutrient efficiency technologies**: A cross-sector approach should be developed, with experience transfer from e.g. water industry or chemicals to other sectors such as manure treatment. This should support possible future development[v] of a "Resource Efficiency" BAT BREF
- **Nutrient management in livestock production, including consumer diet and geographical distribution of livestock production**: Livestock production is shown[vi] to cause nearly ¾ of European N and P emissions. Both consumer diet choices and improving nutrient use, reducing emissions and recycling manure (including valorising manure organics and nutrients) are key to both addressing human health challenges (obesity, cardio vascular disease and related costs to society), to achieving Agriculture BEMP[vii] and livestock BAT[viii], agriculture greenhouse emissions, soil conservation, water quality protection but also to improving farmers' incomes and safeguarding jobs in the meat production and processing industries.
- **Redesign of sewage treatment from remove to recover**, and of other organic waste streams. Instead of using energy input to "remove" organics and nutrients (to $CO_2$, atmospheric nitrogen and sludge), plants design objective will be conversion of carbon into either energy or soil improvers and recovery of nutrients
- **Big data**: offers major, currently unexplored, opportunities for improving nutrient management. Nutrient losses are highly variable with local conditions (terrain variations within fields, weather, type of fertiliser and crop, date of application) and compilation of precise data could considerably improve understanding and farmer information.
- Geopolitics: Innovation in efficient water and nutrient management (linked to food security) in North African Mediterranean region, and the possibilities to valorize those in the context of **geopolitical tensions (e.g. migration).**

To support and enrich these proposals, we refer to the following:

**DG RTD workshop conclusions 2015**: A number of R&D projects addressing nutrient recycling have already been funded / are underway / in selection phase, by the EU (FP7, Horizon2020, InterReg, LIFE+). Many of these came together at the Berlin 2015 workshop co-organised with DG RTD [ix] Key conclusions include:

- Technologies exist, but challenges to roll-out to market include need for coherent legislation and policy support
- Importance of demonstration plants (call in 2016 WP)
- Issue of organic contaminants in sewage sludges
- Value of clustering and networking to enhance experience transfer and facilitate market uptake

**BSAG (Baltic Sea Action Group) publications**: "The Role of Nutrient Cycling in Circular Economy", May 2015, Brussels and "Nutrient Cycling at the Core of Circular Economy[x]

**EU Commission consultation on the circular economy 2015:** The results of the public consultation on the circular economy 2015 confirmed the interest of stakeholders for the bio-nutrient circular economy:

- 30% of all respondents identified bio-nutrients as "secondary materials the EU should target first" (Q5.3)
- 54% cited bio-nutrients or phosphorus somewhere in their response (all questions)

**RISE Foundation report on nutrient recovery and recycling and agricultural intensification 2016[xi]:** The RISE Foundation (Rural Investment Support for Europe) has published a 92 page report on issues, opportunities and actions for nutrient recovery and reuse (NRR) in European agriculture. The report makes 16 recommendations to enable nutrient recycling to contribute to better nutrient stewardship and, by diversification of nutrient sources, to nutrient supply security. Recommendations cover the need to improve nutrient data, review of legislation and regulatory coherence, policy support and EU Circular Economy package, consumer acceptance and livestock production and consumption.

**EIP-AGRI Focus Group on agronomic use of recycled nutrients**: ""How to improve the agronomic use of recycled nutrients (N and P) from livestock manure and other organic sources?". Launched in 2016[xii]

**Q2: outputs and impacts:**

The economic impacts of improving nutrient management and developing the nutrient circular economy are potentially considerable:

- Nitrogen losses cost Europe 70- 300 billion €/year[xiii]
- Phosphorus losses cost the USA c. 3 billion US$/year[xiv] (no EU estimate available)
- Circular economy: nutrient recycling and a regenerative food system are identified as a key circular economy potential area by the Ellen MacArthur Foundation[xv], but no economic assessments are developed for this sector (see indications above regarding the challenge of need of data and economic models)
- The Impact Assessment for the EU Fertiliser Regulation revision proposal SWD(2016)64 refers to "increase growth and job creation" by facilitating nutrient recycling, but does not provide figures.
- An outline of possible employment generation by phosphorus recycling and stewardship was made by ESPP in 2013[xvi]

Overall, there seems consensus that nutrient stewardship and recycling offers important potential for reducing environmental costs, generating circular economy growth (including farmers' incomes), innovation, and employment (particularly in rural areas). However, as indicated above under challenges, there is to date a lack of data or economic models, because models developed for industrial systems are not applicable to the nutrient economy.

Market deployment within 5-7 years:

The following innovations are ready for wide market within this horizon, if (big) data to support decision making, regulatory and economic policy structures are put into place:

- **Nutrient (N, P) recovery** from (existing) sewage works, manure, for which a range of technologies are available, and which will be facilitated by the revised EU Fertiliser Regulation (expected 2017 or 2018) but new policy and economic models are needed. Redesign of treatment from removal to recovery is underway, but requires further R&D and will be slow because of the decades long infrastructure renewal cycle
- **Nutrient recycling from biogas digestates and bio-energy, bio-materials production:** essential for environmental and economic sustainability[xvii] of these sectors
- **Use of big data** to improve nutrient use efficiency, reduce nutrient losses, identify economically viable streams for recycling, ensure traceability of organic recycled nutrient products
- **Recycling of phosphorus to high-value industrial forms** (P4, high purity phosphoric acid).
- **Recovery of phosphorus from sewage sludge incineration ash**: this is to become obligatory in Switzerland[xviii] and certain EU member states are considering similar action

## Q3: Gaps in science, policy, etc and potential game changers

Gaps: see challenges above

Game changers:

- **Place of meat consumption** in European and global diet, with conflicting pressures to reduce EU meat consumption (cost to consumers, health and environment issues) and increasing meat consumption worldwide (resulting in accelerating global tension on agricultural nutrient supply)
- **World food prices tensions**: the combination of climate change impacts, water tension, limits to exploitable agricultural land, increasing world population and increasing global meat demand (Asia, developing countries) will result in tension on world food commodity prices and risks of increases and considerable fluctuations. Fertiliser (nutrient) prices are linked to food prices.
- **Soil organic carbon**: deterioration of organic carbon levels in many European soils is becoming increasingly critical, with impacts on water retention (drought crop resilience, flooding) and on climate change. This will push to increase appropriate recycling and reuse of organic waste streams, subject to appropriate management of contaminants (sewage, manures …)
- **Consumer attitudes to organic wastes and traceability**: the current trend in consumer attitudes (e.g. to 'hygienic bidet' toilets[xix], Global G.A.P.[xx] exclusion of use of sewage sludge) tend to make recycling more difficult technically (dilution) or by societal rejection of organic waste recycling in agriculture. This needs to be reversed to address soil, nutrient and carbon sustainability.
- **World production of white phosphorus P4**: the two main suppliers of the EU are currently Kazakhstan and Vietnam. The former poses transport logistics security issues. Vietnam production is dependent on cheap electricity from China, which at some time can be expected to stop.

## Q4: Horizontal issues

The challenges indicated above in Q1 and Q3 concerning **diet** (meat consumption) and **consumer acceptance** (including farmers, supermarkets, public) of organic waste recycled product use in agriculture (from scientific risk assessment to public acceptance) require interaction between social sciences, economics , medical and environmental sciences, technology, markets.

Gender aspects are important as sectors such as agriculture (farming, famer advice), chemicals, waste treatment are progressively feminising in many countries. How can development of the bio-circular economy support this trend?

International cooperation is important to facilitate export of EU nutrient recycling technologies and know-how, by adapting these to different social, economic, logistic and environmental situations of other world regions.

## Q5: Emerging priorities for SC5

**Circular economy** for nutrients to respond to:

- **resource stewardship** (nutrient efficiency and recycling)
- a world with increasing pressures on food supply and fluctuations in **global food prices**
- **traceability** of organic waste recycling / contaminants, to enable both risk management (including of "tomorrow's" contaminants, today not identified) and to answer consumer concerns and facilitate acceptance
- pressures on **farmers' incomes and rural employment**
- limitations to **public utility budgets**: how to make waste water treatment long-term economically sustainable

[i] "Seven ways to save our soils", The Soil Association UK, 2016, 19 pages and "Living Soils: A Call to Action", 28 pages http://www.soilassociation.org/soils

[ii] See SCOPE Newsletter n° 120 at www.phosphorusplatform.eu

[iii] FP7 Marie Curie network www.susphos.eu

[iv] See e.g. "Italmatch takes part in LIFE, the European Community program dedicated to sustainable development" http://www.italmatch.it/wp-content/uploads/2015/10/ITC_IS_LIFE_uk-021.pdf

[v] « Work Programme for the exchange of information under article 13(3)(B) of the IED for 2016 (and the outlook for the following years) », EU Commission 29 January 2016 published at https://www.naturvardsverket.se/upload/stod-i-miljoarbetet/vagledning/industriutslappsdirektivet/Work-programme-eu-comm-2016.pdf

[vi] "Impacts of European livestock production: nitrogen, sulphur, phosphorus and greenhouse gas emissions, land-use, water eutrophication and biodiversity", Leip at al., Environmental Research Letters,
10(2015) 115004 http://dx.doi.org/10.1088/1748-9326/10/11/115004

[vii] "Best environmental management practice for the agriculture sector - crop and animal production" – Final Draft – August 2015 https://ec.europa.eu/jrc/en/research-topic/best-environmentalmanagement-practice and direct link http://susproc.jrc.ec.europa.eu/activities/emas/documents/AgricultureBEMP.pdf

[viii] "Best Available Techniques (BAT) Reference Document for the Intensive Rearing of Poultry or Pigs", Industrial Emissions Directive 2010/75/EU (Integrated Pollution Prevention and Control), European Commission JRC, "Final draft" August 2015 http://eippcb.jrc.ec.europa.eu/reference/irpp.html

[ix] "Circular approaches to phosphorus: from research to deployment", 48 pages, European Commission Directorate-General for Research and Innovation 2015, ISBN 978-92-79-46827-8 http://bookshop.europa.eu/en/circular-approaches-tophosphorus-pbKI0115204/

[x] Both at http://www.bsag.fi/fi/News/Documents/BSAG%20Brussels%20May%202015%20NUTRIENT%20CYCLING%20IN%20CIRCULAR%20ECONOMY.pdf

[xi] RISE Foundation "Nutrient recovery and reuse (NRR) in European agriculture. A review of the issues, opportunities and actions", 92 page, 2016, A. Buckwell, E. Nadeu, with contributions from L. Six (Fertilizers Europe), K. Van Keer (Yara) and A. Williams http://www.risefoundation.eu/projects/nrr and full report http://www.risefoundation.eu/publications

[xii] https://ec.europa.eu/eip/agriculture/en/news/new-call-eip-agri-focus-group-experts-now-open-0 and SCOPE Newsletter n°114 on www.phosphorusplatform.eu

[xiii] "Costs and Benefits of Nitrogen for Europe and Implications for Mitigation", Van Grimsven et al., Environ. Sci. Technol., 2013, 47 (8), pp 3571–3579 http://pubs.acs.org/doi/abs/10.1021/es303804g and "The European Nitrogen Assessment: Sources, Effects and Policy Perspectives", Sutton et al., 2011, Cambridge University Press, Cambridge.

[xiv] "Eutrophication of US freshwaters: analysis of potential economic damages", Dodds et al., Environmental Science & Technology, 43(1), pages 12-19, 2009 http://pubs.acs.org/journal/esthag

[xv] "Growth Within: a circular economy vision for a competitive Europe", 100 pages, 25th June 2015, Ellen MacArthur Foundation, McKinsey Center for Business and Environment, SUN (Stiftungsfonds für Umweltökonomie und Nachhaltigkeit) http://www.ellenmacarthurfoundation.org/news/latest-researchreveals-more-growth-jobs-and-competitiveness-with-a-circulareconomy

[xvi] "Estimating potential economic benefits and job creation of P-recycling and P-stewardship", 29/5/2013 http://www.phosphorusplatform.eu/component/jifile/download/YWU0NjlmMTA0N2E1N2I1OTc3ZjQwN2MzNDE5YWQ3MWE=/espp-jobs-and-employment-outline-29-5-13-pdf

[xvii] EU public consultation currently open to 10th May 2016 « Preparation of a sustainable bioenergy policy for the period after 2020 »

[xviii] Swiss waste ordonnance, entered into force 1/12/2016 with a ten year delay for implementation https://www.news.admin.ch/message/index.html?lang=de&msgid=59785

[xix] http://www.treehugger.com/bathroom-design/bidets-eliminate-toilet-paper-increase-your-hygiene.html

[xx] www.globalgap.org