Swiss – German phosphorus recycling conference

This meeting, Basel, 18th October 2017, was organised by FHNW School of Life Sciences, the Phos4You InterReg Nordwest Europa project, BaselArea.swiss and the German Phosphorus Platform (DPP). 160 stakeholders were informed on the status of phosphorus recycling policy in Switzerland and Germany. The launch of the **Swiss Phosphorus Network** (*www.pxch.ch*) was announced.

The positions of Swiss sludge disposal operators were linked to a selection of possible phosphorus recycling technologies available and future developments discussed.

The day was moderated by **Daniel Frank, German Phosphorus Platform** (DPP).

Matthias Nabholz, Canton of Basel-Stadt, underlined that Germany and Switzerland are the first countries in the world to make phosphorus recovery obligatory, opening opportunities to become innovation leaders.

Phosphorus recovery regulatory obligations in Switzerland and Germany

Kaarina Schenk, Swiss Federal Environment Agency (BAFU), explained the **new Swiss category of "Mineral Recycled Fertilisers"** (see ESPP eNews n°*15*) which will accompany implementation of the federal phosphorus recovery obligation, introduced in the Waste Ordinance (see SCOPE Newsletter n°*118*). This fixes limits for heavy metals such that any accumulation in soils does not compromise safety for at least 500 years, whilst remaining technically feasible. NAC (neutral ammonium citrate) and 2% citric acid are considered better indicators of fertiliser value of phosphate than water solubility. The objective is that this new fertiliser category should be implemented from 1st January 2019.

At the same time, **Switzerland is working to implement the Waste Ordinance phosphorus recovery obligation**. This obliges recovery of phosphorus from sewage sludge or sludge incineration ash, and from slaughterhouse wastes. At present, the technical requirements of the phosphorus recovery obligation are not defined (e.g. what % of phosphorus must be recovered, where, under what conditions) and a technical working group will be launched in early 2018 bringing together the Kantons, industry and experts to make proposals. Nonetheless, BAFU underlined that current mono-incineration capacity (incineration of sewage sludge separately not mixed with municipal solid waste or industrial waste) is insufficient to take all Switzerland's sewage sludge.

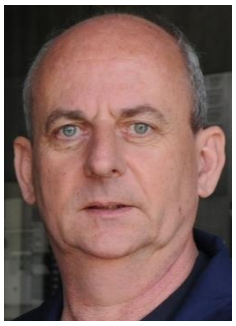
In **discussion**, participants at the meeting noted that until these criteria are fixed, **it is premature to invest in phosphorus recovery in Switzerland**, because technical choices made now may prove to be incompatible or too demanding compared to the final obligations. However, study of phosphorus flows and of logistics, and preparation of a move to separate mono-incineration should already be engaged.

Christian Kabbe, Isle Utilities, presented the status of the German phosphorus recovery legislation, which has been adopted at the same time as a revision of regulations concerning sewage sludge application to land. Although the regulations have now been adopted, **implications of certain aspects remain to be clarified**. To simplify, the new P-recovery legislation will require (within 12 or 15 years, for sewage works > 100 or 50 000 p.e.) recovery of phosphorus if P>2% DM in sludge. The same requirements apply to smaller WWTP if they cannot spread sludge on farmland. (around 24% of German sewage sludge currently goes to agriculture), but this is not clear in the final text. The **sewage sludge use on farmland is acutely limited by the new fertilising regulation** (German Nitrates directive) which limits the nutrient loads applied to land.

Anders Nättorp, FHNW, summarised phosphorus flows in Switzerland, He noted that phosphorus in sewage sludges is around 5 800 tP/y and in animal products around 1 500 tP/y in Switzerland, and that this is currently lost as sewage sludge goes to cement works. This **phosphorus recovery potential is slightly higher than Switzerland's annual consumption in mineral fertilisers**. He summarised

different possible routes for phosphorus recovery for which technologies are today available: precipitation from liquid streams; extraction or thermal treatment of sewage sludge; leaching, thermal treatment or acidulation of ash. Based on P-REX data (see SCOPE Newsletter n°*115*) he estimates that phosphorus recovery could cost 0 – 50 €/t of sludge in addition to current Swiss sludge disposal (incineration) costs of 90 – 140 €/t (tonne of dewatered sludge).

Waste and water companies' positions



Alain Zaessinger, ProRheno (sewage works and sludge management structure) manage some 30 000 t/year of sewage sludge in North West Switzerland, together with **ARA Rhein**. They presented a study of investment options for replacing the ageing sludge incineration ovens in the two locations. The process is defined (**mono-incineration**) and will enable later phosphorus recovery, as required by the new Swiss legislation.

Christoph Egli, AVA Altenrhein (authority with c. 20 sewage works), underlined that we stand at the very beginning and for most Swiss WWTP it's not clear which technology should be applied. Based on the lack of a robust technology readiness **there should not be an overhasty exclusion of promising technologies at this point**.

He points out the essential information which is needed concerning what the phosphorus recovery obligations will be under the new Swiss legislation: Where will this be required/whose duty is it? How much (%) of phosphorus must be recovered? What are the criteria for the recovered product: quality? phosphorus content? This means that it is impossible to decide what process to adopt, or to estimate costs.

The Swiss Water Association (VSA) will organise a workshop in January 2018 to identify the WWTP's requirements. He furthermore presented sludge treatment in Altenrhein, costs of infrastructure and operation, underlining the role of the sludge treatment organisation KIGO in Eastern Switzerland. Furthermore he presented the Pyrophos (pyrolysis) project.

Claudio Bianculli, presented **ZAB (Association for waste recycling Bazenheid),** which provides sewage sludge treatment for a number of municipalities in East Switzerland (100 000 t sludge/year). Investment in modern incinerators enables cost-effective recovery of energy. **Phosphorus recovery will be tomorrow's challenge**.

Phosphorus recovery processes

Stefan Schlumberger, ZAR, presented the **Phos4Life** process (see ESPP eNews n°*12*) being developed to recover phosphorus from 30 000 t/y of sewage sludge incineration ash from **Kanton Zurich** and other localities in Switzerland. This is currently being pilot tested in Spain. The ash will be dissolved in sulphuric acid, generating phosphoric acid and gypsum. This is similar to the wet acid process used by the phosphate industry to produce most of the world's phosphoric acid. The gypsum, containing aluminium, silicon, calcium and sulphate, and c. 0.5% phosphorus (P), is expected to be compatible for use by the cement industry. The phosphoric acid will then be treated using solvent extraction and hydrochloric acid to remove iron, as iron chloride which can be recycled as coagulant P-removal salt to sewage works. The resulting phosphoric acid will then be purified using solvent extraction (process already used in the technical and food phosphate industries) to remove heavy metals and produce an industrial grade phosphoric acid.

The full scale Phos4Life P-recovery process is **expected to cost 50-70 CHF/tonne of dewatered sludge**, compared to current total costs of sludge treatment (digestion, dewatering, incineration) of c. 300 €/tonne (including costs for digestion, dewatering, transport and mono-incineration). These costs were about 400CHF (2014) before recent investments in the new centralized and more energy efficient incineration installation in the city of Zurich.

Patrick Herr, Remondis Aqua, presented the company's TetraPhos® process (see SCOPE Newsletter n°*123*), which **takes as input mono-incineration ash from fluidized bed combustion of municipal sewage sludge**. The TetraPhos® process treats the ash with phosphoric acid, then, after separation of acid insoluble residue, purifies the resulting leachate with sulphuric acid, ion-exchange and selective nano-filtration **to generate an industrial quality phosphoric acid**. The process also enables recovery of iron and aluminium salts as coagulants, for recycling in sewage works phosphorus removal, gypsum intended for production of building material and a residual ash waste that either is used in the cement industry or if the latter is not possible is landfilled. More than 80% of the ash phosphorus is recovered in the phosphoric acid. Where designed as part of an integrated plant consisting of an incineration facility and a P-Recycling installation, waste heat can be used to concentrate the phosphoric acid product. The rollout of the technology will be implemented as public-private partnership between municipal partners and Remondis. **From 2019, a large scale TetraPhos® plant at the Hamburg Wasser WWTP is planned to treat 20 000 tonnes of ash annually, to recover more than 1 600 tonnes of P**.

Otto Schwarzmann, SUN Nürnberg (sewage works operator), presented experience of operating the **Mephrec** process pilot installation (0.6 t sewage sludge per hour capacity, batch operation). This process operates at >1400°C and generates a "slag" currently containing 2-2.5% phosphorus (P) and with low heavy metal levels. **Operational difficulties encountered include**: the quality of the syngas, generated by the recovery furnace, will not reach economically the standards of fuel-gas to use in electricity generation motors, because of high fly ash particle and coal tar content. Also, the fertiliser value of the slag remains to be proven (see SCOPE Newsletter n°*115*: P-REX results suggest low plant availability). This experience shows that developments and financial assumptions based on lab scale experiments have to be validated at a larger scale. At the moment SUN is negotiating with the project consortia about future collaboration.

Matthias Mann, Küttner GmbH, presented the **Kubota furnace process**. This is also a metallurgical approach technology with a furnace system operating on dried sewage sludge (80% dry matter) with a process temperature at >1300°C. Over 30 furnaces are operated by Kubota in Japan (see SCOPE Newsletter n°*125*), but not today for phosphorus recovery. Most of these are for sludge (mono or shared with household waste) disposal, producing a sage which can be used e.g. as a construction material. Studies are underway into possible phosphorus recovery in furnaces treating only sewage sludge as input. Around 90% of the input phosphorus is transferred to the thermal slag product (this slag represents around 92% of total input mass), whilst most of the contaminants come out in the flue gas from which they can be separated by standard flue gas treatment systems (8% mass). Results presented of **pot trials (soil pH up to 7.2)** show the slag giving similar plant harvests to triple super phosphate for rice, but c. 10% lower for wheat and grass.

Marie-Edith Ploteau, Lippeverband Germany, summarised four phosphorus recovery processes which will be demonstrated in the Phos4You Interreg NWE project (2016-2020, *www.nweurope.eu/phos4you*):

- **Sludge bio-acidification** (IRSTEA France) to solubilize phosphorus **combined with struvite precipitation** (**Struvia** process from Veolia) at Lille WWTP (France). The combination of both reactors is expected to significantly increase the P recovery yield from sewage sludge liquor.
- **Chemical acid extraction of phosphorus from partially dried sewage sludge** (Liège University) followed by a reactive-extraction step and fractionated precipitation to remove contaminants and finally a precipitation of calcium-magnesium phosphate that can directly be used as fertiliser ingredient. A mobile demonstration plant that will be used in by-pass at different WWTP throughout Europe will enable to adjust and validate the process in a corresponding simulation tool.
- **Thermochemical two-stage treatment of sewage sludge (EuPhoRe-process)** including a reductive step at 650-750 °C and an oxidative one at 900-1000°C in a rotary kiln, as well as a flue gas cleaning. The process produces phosphate-rich ashes very low in contaminants in which phosphorus is expected to be plant available. A 100 kg dry matter input/hour pilot is to be built at

Emschergenossenschaft´s installation in Dinslaken, Germany to validate the process and refine parameters. Parallel to Phos4You, the full-scale rotary sludge incinerator in Oftringen, Switzerland (30 000 tDM/y, manufactured in 1992), will be modified for large-scale implementation of the EuPhoRe process. This should enable the use of the ashes in the fertilizer production chain (instead of current disposal).

- **Acid extraction of phosphorus from sewage sludge incineration ash**, followed by contaminant removal, will be tested at (pre)-industrial scale by the Lippeverband with different ashes from two incinerators of the Emscher-Lippe region, located in Bottrop and Lünen (DE).

Other Phos4You activities include **studying sludge incineration ash quality** from HVC Dortrecht (NL) and SNB Moerdijk (NL). The phosphorus recovery from these ashes is planned at the **Ecophos** full-scale factory in Dunkerque, France (see SCOPE Newsletter n°*120*)

Fertiliser value and safety of the different recovered phosphorus products will be assessed. It was underlined that **unrealistically high nutrient inputs (kgP/ha equivalent) as in some previous experiments should be avoided**, and that **soil pH is an important criterion** (test in both slightly acidic and neutral soils).

Else Bünemann, FiBL (Research institute for organic agriculture) explained that around 2/3 of phosphorus input to agriculture in Switzerland currently comes from recycling of manure and agricultural byproducts. She presented experimental data on fertiliser value and solubility of recovered phosphate materials, using different extractants, mainly data from pot trials, including sewage sludge incineration ash (low plant availability), meat and bone meal ash (high in acidic soils), struvite (high). For some materials, plant availability and solubility depend on production process or characteristics: for example, one pyrolysis product showed low plant availability, but an alkaline pyrolysis product showed high plant availability. Availability of calcium phosphates depends on the **crystal form**. She concluded by underlining that **water solubility is not a good indicator of plant availability**, that plant availability depends strongly on **soil pH**, and can be modified by **granulation/particle size**.

Maurice Jutz, FHNW, announced the launch of the **Swiss Phosphorus Network** (*www.pxch.ch*). The network will facilitate exchange of information between Swiss actors considering also the different language regions and act as contact point to ESPP and other actors on the European level. Five demonstration projects in Switzerland are currently under way: **Bern, Zofingen, Bazenheid, Zürich and Altenrhein**.

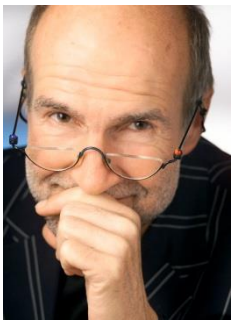
Panel discussion and conclusions

Agency, Christoph Egli representing WWTP association Altenrhein and VSA (Swiss WWTP association), Cladio Bianculli, ZAB, mono-incineration operator and was moderated by **Thomas Wintgens, School of Life Science, FHNW**.

It was emphasised by the operators that today it is not clear what is required in terms of phosphorus recovery, nor how much it will cost. **Because this is not fixed by regulation, it is not possible to pass the costs on to water consumers**. The Swiss Federal Environment Agency replied that a study will be engaged in 2018 on conditions and cost, but that a new law would be necessary to allow to pass on costs. The Swiss Federal Office for Agriculture underlined that the price of recovered phosphate fertilisers must be the market price or farmers will not use them, and that recovered fertilisers must respect quality standards to ensure soil protection.

It was concluded that **stakeholders can expect to be invited by Swiss regulators to work on the detail of implementation in early 2018**. These should provide clarity whilst also enabling flexibility. The panel concluded by underlining the **general support for the Swiss phosphorus recovery obligation**, seen as offering important opportunities for improving sustainability and **developing innovation**, and the conviction that technologies under development will enable to achieve the objectives.

Ludwig Hermann, Outotec and **President of the European Sustainable Phosphorus Platform (ESPP)** closed the day and summarised conclusions:



- The new German and Swiss phosphorus recovery obligations are already moving things forward, and will enable these countries to be **innovation leaders**
- Work is needed to define implementation conditions and **how costs can be passed on** to consumers

- A range of **different technologies** are under development, with different approaches and leading to different finished products
- **Agronomic performance** of quality recycled phosphorus products is comparable to mineral fertilisers, despite their not being water soluble
- **Quality criteria are important** to ensure safety for soil, crops and farmers, and confidence of users and consumers

European nutrient recycling R&D meeting

This second day meeting, Basel, 19th October 2017, was organised by FHNW School of Life Science, the Phos4You InterReg project, the European Sustainable Phosphorus Platform (ESPP), the German Phosphorus Platform (DPP) and BaselArea.swiss. Over 25 EU (Horizon 2020, LIFE, Interreg) and national funded R&D projects, along with participants from industry and policy makers, discussed research orientations, opportunities for project coordination and synergies and needs for future research and demonstration activities.

This is the second such European meeting, following the first EU nutrient recycling projects and policy workshop, Berlin, 2015 (see SCOPE Newsletter n°*111*), organised by ESPP, the European Commission and P-REX. The conclusions are published by the European Commission at *http://bookshop.europa.eu/en/circular-approaches-tophosphorus-pbKI0115204/*

Burkhard Teichgräber, Lippeverband, Lead Partner of the **Phos4You project**, explained that the associated public waterboards Emschergenossenschaft and Lippeverband treat sewage from nearly 4 million people. Recycling of phosphorus is considered an important sustainability objective. But due to industrial discharges into the wastewater, the sewage sludge in the Emschergenossenschaft has been incinerated since 1970's. In rural regions of Lippeverband, sludge has been used in agriculture wherever feasible, in accordance with regulations. However, **concerns about contaminants such as pharmaceuticals or micro-plastics** further push to move to sludge incineration and to look for alternatives to recover nutrients. Around 90% of the sewage sludge incinerated currently goes to mono-incineration. The waterboards are currently looking at an add-on process to recover phosphorus from an existing sludge incineration line, and a new line to process sludge directly to a fertiliser product

Eric Jakob, Swiss State Secretariat for Economic Affairs, explained that Switzerland aims to ensure **economic framework conditions** which enable business development and innovation, including stability and predictability, stakeholder consultation, and a balance between environmental and economic objectives. In this context, the Swiss phosphorus recycling obligation offers opportunities for Switzerland to be an innovation leader.

Chris Thornton, ESPP, summarised EU policies driving nutrient stewardship, from the EU Waste Water Treatment Directive and Nitrates Directive in 1991, through to the circular economy approach today. Important policies are the inclusion of phosphate rock and P_4 on the EU Critical Raw Materials list, the revision of the EU Fertilisers Regulation (and STRUBIAS = criteria for struvite, biochars, ash derived products), R&D funding, standards … He presented a number of examples, showing that companies, farmers' cooperatives and municipalities are **already today successfully recycling thousands of tonnes of nutrients and organic carbon** from manure, animal by products and sewage.

EU R&D funding for actions on nutrients

Stefania Rocca, EASME (Executive Agency for Small and Medium-Sized Enterprises), presented funded projects relevant to nutrient recycling under Horizon 2020 and LIFE over the last two years, and opportunities in 2018-2019.

Relevant Horizon 2020 projects funded in 2016, under the **"Industry 2020 in the Circular Economy"** calls for CIRC-01 and CIRC-02, include large innovation projects such as Systemic, Run4Life, Water2Return (present in Basel). Decision is underway for large demonstration projects under 2017 call.

In 2018 and 2019, new calls under **Horizon 2020 Societal Challenge 5** (Climate action, environment, resource efficiency and raw materials) will address **"Connecting economic and environmental gains – the Circular Economy"**, and including topics on how

to remove contaminants from secondary materials (SC5-01) and on water-smart economy and society (SC5-04).

Projects are also possible under Horizon 2020 bottom-up calls such as the SME Instrument and FTI (Fast Track to Innovation), as well as the LIFE programme. LIFE covers two sub-programmes: environment (including nature) and climate action, and supports the focus on circular economy.

Gaëtan Dubois, European Commission, DG Agriculture, presented the Horizon 2020 Societal Challenge Agriculture and Food (SC2) and the actions of **EIP-AGRI (European Innovation Partnership).** EIP-AGRI aims to make links between R&D under H2020 and the European rural development policy (ERDP).

Under Horizon 2020, several major projects funded in 2016 or pending decision 2017 concern farm recycling and agriculture impacts on water. Calls in 2018-2019 will address **valorisation of urban biowastes, organic agriculture fertilisers from biogas digestate and closing nutrient cycles**.

Another possibility under Horizon 2020 is "**Thematic Networks**" to compile "knowledge ready for practice". Such a network could address synergies between the different current and upcoming R&D activities relevant to nutrients and make links to industry and stakeholders for policy and uptake. However, such networks are only funded for specific duration, so the objective could be to establish a process or structure which could then be self-maintained.

The EIP-AGRI brought together a **"Focus Group" of experts on recycled nutrients** in 2016 (summary of conclusions in SCOPE Newsletter n°*124, report online*). These groups aim to identify research needs and themes for "Operational Groups" (see below).

The Recycled Nutrients Focus Group identified the need for research in the following areas:

- **Organic contaminants**
- **LCA** methodologies/risk assessment
- Assessment of **Nutrient Use Efficiency**
- **Acceptance** of the use of recycled fertilisers by farmers, food industry, public consumers
- Development of **tailor-made recycled nutrient products**
- Use of **remote sensing** for precision farming
- Development of **farm tools** for nutrient content determination and soil carbon balance assessment

These conclusions will input into future EU R&D funding definitions.

EIP-AGRI Operational Groups

Operational Groups (OGs) are local, multi-stakeholder actions, set up to address specific challenges or opportunities, using **Rural Development Funding (RDF)**. Thus, they come from bottom-up local initiatives, funded depending on thematic possibilities in each Region's RDF Programme, with the objective of enabling wider dissemination of results and learning. To date 98/118 Regions include Operational Groups in their Programme, and over 3000 Groups are expected to be launched 2014-2020. Some OGs closely related to nutrients recycling have already started in different regions.

Synergies between R&D projects

The meeting enabled 24 R&D projects relevant to nutrient recovery to rapidly present (1 slide each *www.phosphorusplatform.eu/R&D*), and also a number of PhD students working on phosphorus recovery, enabling all participants to identify each project and make contacts. The **ESPP catalogue of R&D projects**, identifying around 100 R&D projects relating to nutrient management, was circulated at the meeting (*www.phosphorusplatform.eu/R&D*) facilitated this networking. The following projects presented their projects: **AgroCycle, ALGAECAN, ASHES, Biorefine Cluster Europe, BONUS PROMISE, DECISIVE, DOP, ENRICH, IMPROVE-P, INCOVER, Newfert, Nurec4org, Phorwärts, Phos4You, QUB Phosphorus from wastewater, RAVITA, RichWater, Run4Life, SABANA, SMART-Plant, SYSTEMIC, The Resource Container, Water2Return and 3R2020+.**

Several of the projects and technologies are **ESPP members** (**Phos4You, Phos4Life/Zurich Kanton/ ExtraPhos/Budenheim, Ecophos, Systemic, SMART-Plant, ENRICH/Cetaqua, Run4Life** *www.phosphorusplatform.eu/members*) enabling dissemination of their results through ESPP's network and publications, and contacts with ESPP's industry and policy maker membership.

This showed that there are a number of different phosphorus recovery and nutrient recycling **demonstration sites and installations in projects**

now underway (and further ones will be launched soon, see above), with important potential for exchange of experience and comparison of results. Industry partners of projects present in Basel show the interest for this work. The projects cover different geographical areas, sectors, type of research, topics and waste/residue flows to be recycled.

Parallel sessions

Five parallel sessions discussed enabled the projects and participants to exchange, with the following conclusions:

Recycled nutrient product qualities and standards. Rapporteur: **Oscar Schoumans, Wageningen Environmental Research**

- Plant nutrient availability assays: provide important information, but should not be regulated. Industry and farmers will identify which products work
- Variability in organic-based recycled materials: farmers are accustomed to managing variability: however measurement standards and real-time measurement systems should be developed
- Organic contaminants are an important issue for recycled product acceptance: regulatory action is needed

Nutrient recovery in the sewage works of the future. Rapporteur **Nicolas Morales Pereira, FCC Aqualia**

- Potential for integration of nutrient recovery into innovative new water treatment systems
- Wide range of technologies and approaches
- New business models are necessary
- Farmer and consumer acceptance of recycled products is a key challenge

Life Cycle -Analysis (LCA) and -Costing (LCC). Rapporteur **Marianne Thomsen, Aarhus University**

- Discussion of LCA 'Functional Unit' and System Boundaries
- Issues with data: often missing, not public, out of date (based on outdated processes), difficulty to move from specific installation data to generic
- Need for work between projects to ensure coherent methodologies

Technology transfer from sewage to/from manures and other streams. Rapporteur: **Emilie Snauwaert, Flemish Coordination Centre for Manure Processing**

- Challenge: downscaling to reliable, small-scale, simple-to-operate recovery technologies for rural areas
- Importance of product standards for recycled fertilisers (expected with EU Fertiliser Regulation)
- Need for funding of:
  - farmer investments
  - demonstration sites, at different scales and different contexts, covering both recovery techniques and the quality of end-products
  - cross border collaboration
  - consumer education about the need to recycle nutrients
- Policy and regulation are key drivers for change

Nutrient recovery: how to move from R&D to implementation. Rapporteur: **Maelenn Poitrenaud, SEDE Environnement (Veolia).**

- Prepare implementation: technical assessment, market analysis, risk assessment, business plan, objectives and planning, milestones
- Need to manage IP (intellectual property)
- Develop strategic partnerships: final users (e.g. farming organisations), investors

Newtrient manure treatment technology evaluation & catalogue

Steven Rowe, Newtrient (representing nearly all of US dairy producers *www.newtrient.com/Catalog/Technology-Catalog*) presented via Skype this organisation's online inventory and evaluation tool for manure processing technologies and process suppliers (see SCOPE Newsletter n°*125*).

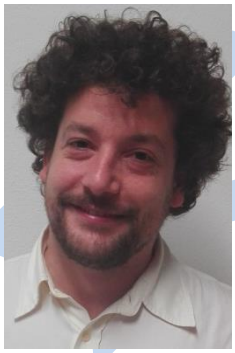
Over 220 technologies have been evaluated, of which over 180 are now in the online catalogue. Evaluations are based on economics, transparency and commercial viability including whether the technology is today operational on-farm, presence of supplier and after-sales, assessment of on-farm operating cases. Around 2/3 of the technologies currently in the catalogue address nutrient recycling.

Steve Rowe underlined that **Newtrient is interested to speak with European manure processing technology suppliers** and on-farm case studies.

Steve Rowe, Newtrient, will be present at ManuResources, Eindhoven 27-28 November. You should register www.manuresource2017.org/ and then use the ManuResource Conference website Programme -> Matchmaking function to request to meet him there.

Conclusions for future actions

A final panel discussed needs for future actions and possible coordination between projects, with **David Scaglione, Gruppo CAP water utility Milan region, Marja-Liisa Tapio-Biström, Finland Ministry of Agriculture and Forestry, Sílvia López Palau, Suez / Cetaqua**, moderated by Chris Thornton, ESPP.



Panellists noted that technology is not today the obstacle to nutrient recovery and recycling but rather:

- **Legal framework**
- Need to engage stakeholders to ensure that recovered products are adapted to **farmers' requirements**
- **Promote acceptance of use of recycled nutrients** by stakeholders such as the food industry, consumers

However, as well as pilot scale demonstration of new technologies, full-scale demonstration of nutrient recovery is important, **integrated into resource and carbon efficient water and waste management**. Cost and technology assessment of these operating systems is important to provide information to industry and policy makers.

Sewage biosolids management is a major operating cost for sewage works: **real data on cost impacts of nutrient recycling** is essential (based on full-scale operations, not pilots or estimates).

Research needs

Proposals for future research needs were put forward:

- Maintaining acceptance and ensuring safety and soil quality in **sewage biosolids use** on crops

- Integrating nutrient recycling and **organic farming**
- **Digital tools** for nutrient management
- Rethinking the **food system** to integrate nutrient stewardship and return of organic carbon to soil
- Assess **emerging contaminants in biosolids and manure**, and how to reduce these upstream or in treatment systems
- Promote an **independent panel** and data base, for evaluation of nutrient recycling technologies, systems and costs
- Development of high-quality recycled nutrient products and their **use in precision farming**
- **Demonstration plants** in different regions, different types of waste / water, different treatment systems
- Developing the sewage works / waste system of tomorrow, designed as a **resource factory** rather than pollution abatement

These objectives require collaboration **between agricultural and environmental** stakeholders and policy makers.

Proposals for joint actions

In order to move forward, proposals included:

- Establish a **Mediterranean network on nutrient recycling**, maybe within ESPP, addressing the specific regional challenges such as water reuse, Mediterranean agricultural systems and crops
- Structure further cooperation between the different nutrient-related R&D projects present, such as **joint dissemination**, **back-to-back events at important industry trade fairs** (water and waste, food industry, bioeconomy …)
- **Organise a further R&D projects meeting**, to follow on from this one, in 2018, to involve the newly funded EU projects (see above), projects not here, etc.

The aim would be to have a **continuous exchange between nutrient R&D projects**: avoid the stop-and-go which has resulted in the past from meetings too far apart (Berlin March 2015, Basel October 2017) and from coordination organised by projects (three year duration).

Conference outcomes, slides and programme
www.nweurope.eu/phos4you