DONUTSS workshop summary:
Data on Nutrients to Support Stewardship

This report aims to summarise key discussions and outcomes from workshop organised by ESPP, BioRefine Cluster Europe, Ghent University, Wageningen University and Vienna University of Technology, with support from the European Commission, in Ghent 3rd and 4th September 2015. Day 1 involved scientists and data managing organisations, day 2 brought in stakeholders and potential data users. This report is not a complete record and, to facilitate reading and group themes, the order here does not reflect the two days' meeting organisation.

The speakers' slides and the conclusions of the four break-out discussion groups on Day1 are also available on available on *http://phosphorusplatform.eu/donutss*

Opening

The workshop was opened by Chris Thornton, European Sustainable Phosphorus Platform, Erik Meers, BioRefine and Eric Liégeois, European Commission DG GROW.

Chris Thornton, ESPP, thanked **DG GROW** and **BioRefine** for contributing to the workshop costs, and particularly thanked Eva Clymanns and Erik Meers for the organisation, and **Kimo van Dijk** (Wageningen University) and **Ottavia Zoboli** (Vienna University of Technology) for ensuring the workshop content and preparation with speakers.

Erik Meers presented the **BioRefine InterReg North-West Europe** project. The objectives are to develop a circular economy for bio-nutrients from organic wastes and for by-products from bio-energy production, including dissemination of R&D through the value chain into market implementation. The **BioRefine Europe Cluster**, which has developed out of this project, today brings together over 20 EU-funded projects, to take forward this action across Europe, to facilitate experience transfer, synergy and dissemination.

European Commission input

DG Environment

Francesco Presicce, DG Environment, outlined nutrient data requirements to support EU policy implementation, in particular in the water sector. He focused on the Nitrates Directive (Nitrate Vulnerable Zone Action Plans – which often integrate phosphorus (P), Codes of Good Agricultural Practice) but mentioned also other water policies relevant to nutrients, such as the Urban Waste Water Treatment Directive, Water Framework Directive, Marine Strategy Framework Directive and other relevant EU policies on air quality (nitrogen), industrial emissions (e.g. intensive pig and poultry BAT currently under finalisation, see SCOPE Newsletter n° 116), animal by products, Common Agriculture Policy (includes "nutrient balance" indicator), etc. He reminds that around half of Europe's rivers are not achieving Water Framework Directive quality objectives in 2015, with diffused pollution significantly affecting 90% of river basin districts and the agricultural sector identified as the primary source of pollution. As regards eutrophication, phosphorus is identified as an issue in most cases. Key issues of these policies include quantifying environmental losses of nutrients (water quality) and ensuring nutrient balances for agriculture (farm inputs minus outputs). In both cases, this relies on calculations based on coefficients for e.g. animal excretion, crop requirements and uptake, agricultural run-off ... Implementation is based on the most recent and reliable scientific evidence, as has been confirmed in several cases by the European Court of Justice.

Data and scientific knowledge on nutrient flows, coefficients, impacts, is therefore essential, with data needs being defined by Directive requirements, and has a direct impact on users and the environment through implementation.

Data needs were also identified in the EU Consultative Communication on Sustainable Use of Phosphorus (see SCOPE Newsletter n° 95) concerning efficiency of P use, global phosphorus reserves and their accessibility. Data on phosphorus resource losses to water and to landfill are also very important in the context of circular economy.

European Commission DG GROW

Eric Liégeois, DG GROW, explained that nutrient recycling can be a significant element in the EU's Circular Economy policy, suggesting that a possible ambition could be that 20 – 25% of fertilisers placed on the market by around 2025 could be produced from bio-resources (secondary raw materials), leading to structural changes in the industry/market, new investments and new jobs. This should also contribute to implementation of EU environmental and water policies. He indicated that data is needed to confirm the market and resource potential for bio-nutrient products and to define actions, in particular at the regional level.

DG GROW will accompany the development of the Circular Economy for bio-nutrients by working to remove trade barriers (creating a level playing field for organic and recycled fertiliser products) through the revision of the EU Fertiliser Regulation, and by improving coherence of the legal framework (including Animal By Products Regulation) and interpretation. DG GROW also intends to select, and accompany with other Commission services, six "model demonstrator regions" to showcase actions and innovations for the bio-nutrients circular economy.

DG GROW indicated that nutrient data and monitoring is needed to guide investment in bio-nutrient circular economy, to guide policy decision making and to monitor progress in resource recycling. Stakeholder dialogue with industry, farmers' organisations, is essential to define data needs regarding both nutrients and possible contaminants.

EU Fertiliser Regulation revision

Vincent Delvaux, DG GROW, presented status of the EU Fertiliser Regulation revision process. The revised regulation proposal is intended to be published end 2015/early 2016, alongside or following the planned EU Commission Circular Economy Communication. This regulation proposal will then be submitted to Council and Member States towards adoption.

The revised Fertiliser Regulation aims to ensure a level playing field between bio-nutrient fertiliser products and mineral fertilisers, because at present Member State mutual recognition of nationally authorised recycled or organic fertiliser products is not functioning. The revision aims to address issues with the current Fertiliser Regulation: lack of safety limits for certain contaminants, non-coherence with Animal By Products Regulation, current update process is too slow to adapt to new fertiliser products.

The proposed revision will be flexible, conform to New Legislative Framework principles, introducing "recovery rules" and essential requirements (safety, quality, labelling and user information). The "recovery rules" will specify, for specific categories of recovered fertiliser products: the eligible input materials, the treatment process criteria, the safety and quality requirements including specific contaminant limits where appropriate and the quality assurance procedure. Blending is recognised as important to optimise bio-nutrient products, including synergy combinations with mineral fertilisers: in the case of blending, all components of the blend must be CE labelled (revised Fertiliser Regulation conform) to obtain a CE labelled final blend product.

DG GROW intends that specific criteria for at least four categories of recovered nutrient products (for use as fertilisers and/or as fertiliser production process ingredients) should already be prepared for implementation (proposal is adoption by the EU Commission as annexes) as soon as the revised Fertiliser Regulation is adopted and promulgated:

- composts/digestates: EU Commission JRC proposed criteria already published
  https://ec.europa.eu/jrc/sites/default/files/eow_biodegradable_waste_final_report.pdf
- struvite: ESPP draft proposal submitted to JRC and published *www.phosphorusplatform.eu*
- biomass ashes (combustion of energy biomass, manures, sewage sludges, meat and bone meal): ESPP draft proposal submitted to JRC and published *www.phosphorusplatform.eu*
- biochars: ESPP has now started preparation of input to JRC (September 2015): please contact ESPP if you wish to contribute to or comment on this ESPP proposed draft *info@phosphorusplatform.eu*

For the latter three categories, DG GROW has mandated JRC (EU Commission scientific service) to work on defining criteria documents, after stakeholder and Member State consultation.

The revised regulation may enable Member States to (continue as at present) authorise products as "national" fertilisers, in order to facilitate regional products, innovation, SME market access (such nationally authorised products could only be exported to other Member States subject to mutual recognition).

A key objective of the Fertiliser Regulation revision is to enable user (farmer, food chain) trust in EC labelled bio-nutrient fertiliser products (e.g. safety, quality).

Nutrient flows and data needs

Phosphorus SFAs and lessons learned

Kimo van Dijk, Wageningen University, presented his work assessing European phosphorus flows and stocks at the Member State level (Science of the Total Environment 2015). Europe imports around 2 000 kt P (Gg P), of which c. 60% in mineral fertiliser and 20% in animal feeds. Around half of this imported phosphorus is lost/sequestered into the environment, the other half is accumulated (including 900 ktP accumulated in soils, 204 lost to surface waters and 59 to landfills). Losses along the food chain include c. 30% in food processing (e.g. meat and bone meal) and c. 50% in households (sewage sludge, organic solid waste, food waste, pet excreta, etc.).

Overall, food production shows a "phosphorus efficiency" (outputs/inputs) of c. 50%, with c. 70% for crops and 20-30% for animal production. The food P cost are an input of 4.0 kg P for each kg P in food supplied, and even 10.3 kg P for each kg P in food intake by humans. The biggest phosphorus flows are in the agri-food system, but some other flows showed to be significant, e.g. pet foods represent c. 1/7th of the human food P flow.

Michael Jedelhauser, Ludwig-Maximilian University Munich, addressed data insufficiency questions, based on the comparison of 7 published national phosphorus SFAs (Substance Flow Analysis) dated 2009 - 2014: Austria, Germany, Sweden, Netherlands, France, UK, Switzerland.

He noted considerable variation in data sources and uncertainty in much of the data, both for quantities and concentrations, differences in treatments of data uncertainty, the lack of standards for data collection or treatment, resulting in non-comparability between different studies and different published data. The example of Switzerland is interesting, where a phosphorus flow data monitoring tool has been established with the objective of identifying flows for which updating of data is necessary. Standardisation of data input to the SFA tool STAN would be useful.

Ottavia Zoboli, Vienna University of Technology, noted the importance of developing time series of data and presented experience from Austria where phosphorus MFA (mass flow analysis) has been carried out and compared for the years 1990-2013. See also Eveillard, UNIFA France, below. The Austria time series showed that there are considerable variations in a number of phosphorus flows, sometimes changes by a factor of 2x in 1-2 years: e.g. ban on use of MBMA (meat and bone meal ash) in animal feed, flows of P in the Danube river impacted by flood events. The time series enable to provide feedback to data producers on systematic data errors and to understand how the system changes, e.g. new flows had to be added to the pre-existing static system analysis to include developments of the bioenergy industry.

Joeri Coppens, Ghent University, presented the experience of collecting phosphorus data for Flanders. Detailed operational data was able to be collected because the work was commissioned by the Flanders Government and led by a steering committee involving stakeholders from different sectors (agriculture, food industry, manure treatment, water industry, energy …).

Flanders is a very nutrient intensive region (population and animal production density) and key conclusions are that crop production is c. 90% phosphorus efficient, but 90% of crop production is used as fodder (animal feed) and livestock production is only c. 30% P-efficient. Losses in the food industry and consumer phase mean that <15% of system input phosphorus reaches the plate. Also, nearly 30% of wastewater in Flanders is discharged untreated. Overall, food waste and excess manure show significant potential for phosphorus recycling, rather than municipal wastewater.

Cynthia Carliell-Marquet, Birmingham University, presented a phosphorus flow analysis of the UK, carried out with the objective of identifying challenges and opportunities for the wastewater treatment industry (see SCOPE Newsletters n° 116 and 113). Conclusions confirm that the UK has a high phosphorus imbalance (imports higher than exports), with considerable accumulation in soils. Over half of farm phosphorus inputs are to grassland. UK agriculture shows an overall >80% phosphorus efficiency (outputs/inputs), but this does not show regional disparities, with livestock production (grassland) in the west of the country and arable production in the east.

The work aimed to not only produce data but also propose decision tools, and five indicators were proposed: net P imports, agricultural P efficiency, consumption of mineral P fertiliser, wastewater phosphorus recycling (currently c. 60% as most sewage biosolids are used on farmland) and net P use per capita.

Nutrient data for management

Gerard Velthof, Alterra Wageningen UR, summarised information available on nitrogen (N) and data needed for management. Farmers need reliable data on nitrogen inputs (levels of N and crop availability in manures and biosolids), on nitrogen outputs (nitrogen content of crop harvests) and on N mineralisation and cycling on the farm. Data available to farmers is improving (soil analysis, analysis of manures, meteorology …) and precision fertilisation (geolocalisation, injection …) is developing, so that the challenge is to transform data into useable agronomic recommendations.

Nitrogen data important to policy decision makers addresses air quality, climate change, soil nitrates, and is based on a combination of measurements and calculations using coefficients. A key challenge is harmonisation of emissions coefficients, which currently vary widely between Member States, whilst ensuring that these are site and system specific to improve accuracy.

Christian Kabbe, Kompetenzzentrum Wasser Berlin, summarised **P-REX** *http://p-rex.eu* work collating data to identify phosphorus recycling opportunities from municipal waste water treatment plants (wwtp) in Germany. At present nearly 30% of German sewage sludge is spread to land, after treatment, returning around 20% of total P in German sewage to land (spreading is often from wwtps without P-removal obligation). The 181 largest wwtps in Germany (> 54 million p.e.) generate around 30 kt/y of P in sewage sludge and targeting these would be the most efficient route to recover phosphorus. However, much of this sewage sludge is mixed with other wastes (industrial sludge, municipal solid refuse) in incineration, resulting in a low phosphorus ash not suitable for P-recovery. Also, iron or aluminium salts used for phosphorus precipitation can be an obstacle to use of the ash for fertiliser production. The P-POT study provides data on phosphorus recycling potential in the Berlin Region (*http://www.kompetenz-wasser.de/Phosphorpotenziale-im-Land-Berlin.578.0.html* in German)

To support P-recovery policy definition, a data mapping is needed of the larger wwtps, chemical P-removal in these, mono-incineration plants, and possible ash user industries (phosphate fertiliser or phosphoric acid industries). At present data is not coherent between different German Ministries and between regions, and data is lacking on phosphorus flows in sewage works, phosphorus concentrations and forms in different flows.

Anne Miek Kremer, Dutch Central Bureau of Statistics and previously **Eurostat**, explained that Eurostat collates data from Member States and other organisations, in particular to monitor EU Directives. Significant nutrient data should be collected in the 28 CAP agri-environmental indicators (AEI, COM(2006)508), as defined by the DireDate Project 2010-2011 (Summary conclusions *http://ec.europa.eu/eurostat/documents/3888793/5849721/KS-RA-11-005-EN.PDF/569091cf-bd81-4369-ac9f-347b6bab33a5*). Some data on nutrients is collected at very detailed local level in FSS (Farm Structure Surveys), but only in some years. Methodologies for composite nutrient budgets are defined by the OECD/Eurostat Handbook (2013 update), coordinated with UNICE - CLTRAP (Goteborg Protocol), IPCC and EMEP. However, there are no IPCC guidelines for phosphorus, so no agreed methodology.

There are considerable difficulties regarding data availability and consistency because most Member State data transmission is voluntary (not obliged under Directive reporting), with different methods and often not reporting every year. In particular, reliable and coherent coefficients are not available for grassland (35% of European UAA utilised agricultural area) and for nutrient concentrations in crops, manure excretion factors … Extending data collection or collation will be very difficult because of strong pressure on both EU institutions and Member States to reduce costs and personnel.

Geertrui Louwagie, EEA (European Environment Agency), presented the Agency as a data user, producing documents such as the "State of the Environment" every five years, currently within the EU 7th Environment Action Programme policy framework. The Agency is currently exploring the use of nutrient data in various contexts: how to estimate nutrient inputs/loads (e.g. via combined use of statistics and modelling) to assess ecosystem condition and resulting impacts, ideally covering pressure from different sectors; how to relate CORINE land cover/use data to nutrient data; how to calculate nutrient balances across economic sectors. Thus, nutrient data is important for ecosystem assessment, ecosystem capital accounting and food system assessment, with a need for time series, spatially explicit data to identify regional situations, and sufficiently large geospatial coverage.

Examples of data collection

Philippe Eveillard, UNIFA (French national industry association of mineral and organic fertilisers and soil improvers), presented the national Observatory of Mineral and Organic Fertilisation, put into place by these industries in France (see SCOPE Newsletter n° 109), which collects and publishes annual data on N, P, K, S and Mg use in mineral and organic fertilisers, manure and recycled bio-nutrients, region by region for France.

Calculations of nutrient concentrations in crops are based on COMIFER coefficients, last updated in 2008 based on analysis of crops. For example, analysis led to reduce the P-concentration figure for wheat, possibly because crop P concentration had been higher in the 1950's with over-fertilisation and lower yields.

Regional nutrient balances are calculated (inputs compared to outputs in crops) with time series 1989-today (2013). This enables to show time trends in nutrient application and regional disparities in nutrient resources and balances. For phosphorus, the trend over the last 20 years is for decreasing use, resulting in neutral or low (<2.2 kg P/ha balance) in many regions (compared to a balance of +19 kg P/ha in Brittany), that is probably a net reduction of soil phosphorus (given inevitable losses to run-off and in non-accounted small flows, e.g. straw).

The results show both regional differences and changes over time, which are important for industry and agriculture policy decision support. It is important to update some coefficients used in calculations, e.g. reductions in P use in animal feed (e.g. precision feeding, use of phytase). More information is needed on flows, dry matter and nutrient concentrations for bio-wastes to better identify recycling potential.

Wim Vanden Auweele, European Compost Network, noted that the EU Commission in COM(2010)235 estimated 118-135 million tonnes/year of biowaste, with a potential production of 60-70 million tonnes/year of compost and digestate. He underlined that organic products such as composts and digestates are variable in composition, with the variability depending principally on the input materials and on processing (e.g. sieving). He explained that ECN's Quality Assurance Scheme ensures data collection on total N, mineral N, P, K, Mg, Ca, organic matter and that it is the intention of ECN to further harmonise the data. Currently, this is harmonised at the European level for a number of countries (Austria, Belgium, Germany, Netherlands). ECN also gathers information about markets for the end products, as not all compost and digestate is used as organic fertiliser/soil improver on agricultural land, but also for other purposes e.g. growing media, public green, landscaping, …

Tomas Turecki, European Commission DG Research and Innovation, commented that there are likely to be opportunities in Horizon 2020 for funding projects relevant for bio-nutrient data collection and assessment, in different sectors and at different scales. However, these tools will not address the need for coordination to move forward now, and may not be appropriate for working towards permanent observatories and data systems.

Stakeholder inputs: what data is needed for decision support?

Frank de Ruijter: TSC (The Sustainability Consortium) develops sustainability information for implementation in business decision making, benchmarking of suppliers and reporting (progress monitoring over time). Nutrients are included in TSC's "Key Performance Indicators", based on SISC (Stewardship Index for Speciality Crops *www.stewardshipindex.org*) indicators:

-   nitrogen use intensity (kgN input per tonne harvest)
-   phosphorus: difference between fertilisation recommendations based on soil status (test) and application

These indicators pose challenges because data is not available on fertilisation recommendations or soil P status. Also there are issues with how to transfer data from farmers to retailers.

Future potential further indicators could include:

-   eutrophication: run-off risk (e.g. Field to Market water quality index)
-   resource depletion: use of recovered/recycled phosphorus as % of total P consumption

Bertrand Vallet, EUREAU, underlined the water industry's commitment to resource recovery from wastewater: energy, chemicals, bio-nutrients. Efforts are already successfully engaged to improve sewage sludge quality and reduce contaminants and ensure monitoring (e.g. Sweden REVAQ quality certification). Nutrient content of sewage biosolids are measured, as well as contaminant levels, wherever they are used in agriculture, in order to enable farmers to adjust the amount to apply on land. These measurements are done by the operators of the sewage plants. Users demand good information to ensure trust.

The water industry's key need is for data about the potential market for recovered nutrients: where, in what form, with what quality requirements? Challenge is to ensure the link-up between potential users and markets, policy makers, recovery technologies and water industry operators to secure the potentially large investment needed for nutrient recovery under different forms.

Sofia Grau Gonzalez, Depuración de Aguas del Mediterráneo water company Spain, outlined the PhorWater project, which includes modelling of wwtp P dynamics under different scenarios of management. She noted that most sewage works do not have operational data on phosphorus inflow, nor on uncontrolled precipitation within the works. Data is also needed on environmental impact of nutrients, on phosphorus recovery potential in sewage works and on cost assessment of P-recovery technologies. A combination of such data and appropriate regulation is needed to push water companies to invest.

Benoît Planques, ECOFI (European Organic-Based Fertilizer Industry Consortium) and **Italpollina**, considered that data is needed on the potential size of bio-nutrient product markets, possible input materials flows and on implications of different EU policies. At present, organic fertilisers face different definitions across Europe, which makes combining country databases difficult or even impossible. The Fertiliser Regulation revision is expected to address this issue. Data is needed on quality and not only on quantity of flows, including nutrient and organic carbon concentrations. This data is needed both to promote the new products to users and to inform policy makers.

Laetitia Six, Fertilizers Europe, indicated that the association already provides statistics on mineral fertilisers to Eurostat because its member companies wish to have accurate data on their products' markets. Concerning bio-nutrients, data is needed on what resources are potentially available for processing into fertiliser products: types of input materials, quantities, impurities, seasonality and flow fluctuations (important as fertiliser factories function continuously). Data must be regionalised, in order to identify hotspots with nutrient recovery potential and proximity to fertiliser factories or logistics.

Jori Ringman, Confederation of European Paper Industries (CEPI), explained that the paper industry has 900 production sites across Europe, producing 8 million tonnes of sludges (dry matter). Today, there is data on contaminants but not on nutrient concentrations, but this could be monitored. Also users might not be interested in the same contaminants as those currently monitored. The industry is interested to assess possible opportunities for recycling of bio-nutrients in its by-products and wastes, possibly based on a nutrient flow assessment (flow models already made for wood and fibres), in particular looking at possibilities to "close the loop" by returning paper industry bio-nutrients to forest soils.

Break-out discussion groups

The conclusions of the four break-out discussion groups on Day1 are published on
http://phosphorusplatform.eu/donutss

- **Group 1: Inputs and trade, production and process**

- **Group 2: Agricultural nutrient uses and losses**

- **Group 3: Waste and Wastewater**

- **Group 4: Nutrient Balances and Indicators**

DONUTSS workshop overall conclusions

1) **Why is nutrient data needed?**
   a) Bio-nutrient circular economy (policy definition, market evaluation …)
   b) Identify nutrient hotspots for industry actions / markets / investments: mapping of nutrients recycling potential
   c) EU Critical Raw Materials assessment (Materials Systems Analysis MSA)
   d) Monitor and enforce implementation of EU policies
   e) Product (food) footprints, sustainability indicators, LCAs

2) **Data management objectives**
   a) Transform available data into useable information: collate, summarise, map
   b) Identify and address key data gaps
   c) Develop data time series (to identify trends, impacts of policies or external events)
   d) Improve accuracy of coefficients
   e) Provide feedback to data producers to improve data

3) **Challenges and obstacles**
   a) Absence of harmonisation between Member States
   b) Much data is estimative, modelled, uncertain (e.g. coefficients for emissions, losses)
   c) Data available is often out of date
   d) Data is often aggregated: original data not accessible
   e) Publication of data often in national language only
   f) The internal EU market without borders reduces the quality of intra-EU trade data
   g) Absence of harmonisation of definitions, technical terms, product names …
   h) Data needs and coefficients are locally specific and sector specific
   i) Nutrient management challenges are regional or local
   j) No identified "data leader" for nutrients
   k) Recognised methodologies exist for N, not for P or for other nutrients
   l) Different proposals for nutrient or indicators, often rejected as simplistic
   m) Farm data is sensitive (farmers do not want it used for enforcement) and confidential
   n) Bio-nutrients are often sold directly as waste / by-products from producers to farmers (no market data)
   o) Member States reluctance to harmonise & transmit
   p) Limited or contracting monitoring and data management budgets (EU, Member States)
   q) Different industries have different objectives
   r) Need to take into account mixing/blending of bio-nutrient streams and products
   s) Future technologies may modify data needs

4) **What is already there which can help?**
   a) Eurostat data collection for agri-environment indicators
   b) P-REX E-Market tool *www.phosphorusplatform.eu*: could be extended to visualise mapping of nutrient recycling potential (e.g. mono-incinerators, fertiliser processing factories …), both supply and demand
   c) EEA regional nutrient balances and projects for reports on ecosystems, natural capital, food system
   d) EU regulation implementation (requirement to monitor)
   e) Existing data on biomass (e.g. JRC observatory established by Bio-Based Industry Consortium *http://biconsortium.eu*), on composts/digestates (EBA, ECN), biochars, sewage sludges (EUREAU, REVAQ …), on chemicals (contaminants JRC IPCHEM)
   f) National bio-nutrient (mainly P) flow studies, but often for only one year and P flows and balances quantification for the EU-27 Member States (Van Dijk et at. 2015)
   g) Collected data by EU sector, process and product associations
   h) Typology of input materials in JRC compost/digestate End-of-Waste proposal
   i) Typology of bio-nutrient products and EU criteria under development in Fertiliser Regulation revision
   j) Agriculture and food industry: BEMP, BAT, sustainability indicators, industry performance indicators …
   k) Increasing local/user data (farmers, food) = "big data"

5) Areas where further knowledge is needed
   a) Coefficients used to model nutrient content for manures, animal excretion, losses, run-off
   b) Nutrient flows in grasslands, including offtake grass yield
   c) Nutrient concentrations (inc. N, P, K, Mg, Ca, …) and forms of nutrients in different flows and materials in agri-food sector, sewage works, waste sector …
   d) Data on contaminants and other elements (e.g. Fe, Al) in bio-nutrient flows
   e) Methods to take into account data uncertainties
   f) Time series for bio-nutrient flows over time, to enable identification of trends and changes

6) EU Directives and policies relevant to nutrient data management
   a) Water policy: UWWT, WFD, Nitrates, Marine Framework, Groundwater …
   b) Food Safety Directive
   c) Fertilisers Regulation, Organic Farming Regulation, Animal By Products Regulation …
   d) Communication on bio-waste management COM(2010)235
   e) Industrial Emissions Directive (IED)
   f) EMAS (BEMPs)
   g) Agriculture: Common agricultural policy, Agri-Environmental Indicators

7) Proposed actions to take forward
   a) **Inventory** of existing data, typologies, data holders and users
   b) **Define data needs** for different users: relevant flows, type of data (volume, form of nutrient, concentration, nutrients, contaminants), degree of certainty/accuracy needed, spatial and temporal requirements
   c) **Identify the market potential** for recycled nutrients taking into account the amount of eligible raw materials for fertiliser production but also the efficiency of the existing treatment processes
   d) Collate **existing project data**, e.g. DIREDATE
   e) Explore **possible research** needs and possible R&D funding (Horizon 2020, COST …)
   f) Identify **other data sources** to transpose for nutrients, e.g. bio-energy
   g) Develop stakeholder & EU inter-service **dialogue** on nutrient data: needs / available / management and **inter-sector networking** to identify which material flows can be really used (business opportunities: where, under what conditions)
   h) In particular: develop dialogue with **farmers organisations, food industry, waste sectors**
   i) Identify **existing monitoring** where nutrient analysis may be added for low additional cost
   j) Define **which EU Directives/policies need or generate nutrient data**, inc. other sectors (air, energy …)
   k) Propose **EU mandates** for collection of key data
   l) Require harmonised publication of **data in EU-funded R&D projects**
   m) Identify **standards needs** (CEN, ISO …) to support better nutrient data management
   n) Propose and define **nutrient indicators**, e.g. define "recovered" P and how to measure it (necessary to define targets for industry or policy makers)
   o) '**Big data**" (e.g. IT platform farmers / data transfer): involve companies involved in "big data" processing
   p) **Awareness raising**: promote need for data, data collection, monitoring: support for decisions for policy, markets and business, technology development …
   q) Develop **visual mapping** (for communication to decision makers) of what is where / visualisation / hotspots