European Commission Consultation on the sustainable use of phosphorus

How can we use phosphorus more efficiently and create opportunities for recycling?

Release date: 8 July 2013
Deadline for response: 1 December 2013

P-REX is a European research project funding by the FP7 program and tackling the issue of phosphorus recovery from municipal wastewater. The P-REX consortium took the opportunity of a market stakeholder workshop organized on September 17th in Poděbrady, Czech Republic, to develop a joint reply to the consultation. From more than 60 participants coming from 12 European countries, 20 individuals provided their elements of reply to each of the eleven questions asked in the consultation document. The present joint reply is a synthesis of the replies and discussions at the workshop, and is endorsed by the workshop's participants listed at the end of the document.

Name	**See list at end of document**		
Institution	**P-REX consortium and associated partners, see list at end of the document**		
Sector	**Authority**	**Industry 15**	**Science 5**
Sub-Sector	**Water 4**	**Agriculture 2**	**Recycling 10**
Total number of questionnaires	**20**	**Participants Countries**	**AT, BE, CH, CZ, DE, DK, FI, FR, HU, NL, SE, UK**

Q01	***Do you consider that the security of supply issues for the EU in relation to the distribution of phosphate rock are a matter of concern? If so, what should be done to engage with producing countries in order to tackle these issues?***
	There are concerns, especially in terms of long time supply security and impact of market price evolution. Even long term contracts are no warranty for long term supply. Different measures to reduce import dependency and to increase supply security have been proposed. • EU should try to mitigate local political instabilities to reduce supply risks • Supply should be secured by spreading the risk (the more suppliers, the lower the risk) and increasing cooperation with the export countries • Fostering good governance and support to enhance ecological, economic and social standards in supply countries • Maintain remaining domestic fertilizer production • Development and provision of purifying technologies (i.e. decadmiation and more efficient removal of Uranium), and technical options (P-mining, processing and fertiliser production depends on other resources like water, sulphur, natural gas etc …)
Q02	***Is the supply and demand picture presented in the EC Consultative Communication accurate? What could the EU do to encourage the mitigation of supply risks through i.e. the promotion of sustainable mining or the use of new mining technologies?***
	As matter of fact, EU strongly depends on P imports no matter if the picture is accurate or not! There is strong need for more specific information on reserves and resources. Since accuracy strongly depends on data sources, EU should establish its own research and monitoring. To encourage the mitigation of supply risks, the promotion of sustainable mining and use of better mining technologies might help a little, but the impact of measures at EU territory will be more effective. There is also the question of sustainable mining?

	Could mining of raw material ever be considered sustainable? Besides the encouragement of EU mining companies to explore and operate mines, improved P management and recycling to close the P cycle as much as possible are considered crucial for reducing and mitigating supply risks. • Seamless international trade to encourage the mitigation of supply risks • Technology transfer with accent on processing, acid purification, decadmiation and water treatment (where EU is most competent)
Q03	***Do you consider that the information on the worldwide supply and demand of phosphate rock and fertilizer is sufficiently available, transparent and reliable? If not, what would be the best way to obtain more transparent and reliable information at EU and global level?***
	The information on worldwide supply and demand of phosphate rock and fertilizer is considered from “non-sufficient” to “as transparent as can be expected”. Big part of the information is private owned and disclosure of all details cannot be enforced nor expected, most importantly the technologically enhanced natural radioactivity in phosphate rock, Uranium and heavy metals as fertilizer associated elements. Of course, multi-stakeholder platforms or networks can increase cooperation and improve data collection. Also the establishment of an European P research and monitoring centre (EUGS) was proposed. On global level, a mandate from the United Nations for a global survey might be helpful. Concerning demand, the information about P in chemicals besides agriculture are considered even less reliable. But altogether, more detailed information on worldwide supply and demand will not change the fact of increasing and critical dependency of Europe on global market and price.
Q04	***How should we handle the risk of soil contamination linked to phosphorus use in the EU?***
	There are two main approaches. Risk reduction by reduced P application on soil (through annual limit per soil type and land use) and/or effective and transparent quality assurance for material applied on soil, including measures towards low Cadmium and low Uranium content phosphate mineral fertilizers. The combination of both will be the most efficient. The key contaminants of primary P sources have already been identified, therefore, the introduction of binding limits for the heavy metals Uranium and Thorium, as well as stronger limits for Cadmium are considered reasonable. Corresponding obligatory limits are also required for all imported food and foodstuff. To reduce preventable contamination by overuse of fertilizer, frequent soil monitoring and mapping are necessary. Smart fertilizing with regards to crop and soil needs is one option. Recycled P is often characterized by better quality than the primary P material. Therefore, strengthen P recycling will contribute to reduce contamination as well. Incentives for the reduction of soil contamination have also been discussed, i.e. for application of fertilizers with lower contamination than the average. Of course, all have to meet the binding limits anyway. But incentives may trigger the development of innovation to produce less and less contaminated products.
Q05	***Which technologies have the greatest overall potential to improve the sustainable use of phosphorus? What are the costs and benefits?***
	There are many ideas and technologies to improve the sustainability along the P value chain. Since mining is not directly in the hands of Europe, the focus has been laid upon processing, use and recycling. To date, costs are in many cases a matter of estimates or results of modelling, strongly dependent on the quality of inventory data. Therefore, the reliability of the results is not always given. There is still a strong need for reality based data derived from practice. Different research and demonstration programs are dedicated to generate these data. A

	key question still remains the monetarization of environmental benefits or pollution. • Smart fertilizers and smart fertilizer application are beneficial (precision farming) • Reuse of biosolids, after appropriate treatment, from municipal wastewater treatment, digestates, manures, as main internal streams of phosphorus, hosts the greatest potential and also the greatest benefits to recycle phosphorus locally or between neighboring regions • Minimizing unwanted substances entering sewers and WWTP´s (control and cleaning at source) can lead to higher quality of biosolids (transparency, acceptance etc.) • Implementation of already viable technologies like P recovery from wastewater stream as struvite from the aqueous phase and processes extracting P from the solid sludge phase (sludge and sludge ash), especially, if these technologies provide operational benefits to the plant operation. • Recycling of food grade animal bone • Many promising technologies struggle with the financial market rules, where investors are very sensible for high returns (12%) and assess risks higher than possible benefits. • Most challenging is the separation of nutrients from contaminants, which counts for both: primary P sources and recovery/recycling
Q06	***What should the EU promote in terms of further research and innovation into the sustainable use of phosphorus?***
	First of all, multi-stakeholder cooperation is a crucial element to transfer research results and knowledge into innovation. But, many promising technologies are still waiting to become an innovation (in terms of market success) due to lack of money for the investment, economic and legal barriers. Also, the following paradigm shift has to be taken into account: adequate, gradually more challenging regulation does not hamper economic development. It triggers R&D and technological progress and secures long-term technological leadership (also jobs). The following topics have been discussed: • Reduction of P-demand: Smarter application of P (fertilizers), chemical industry etc. find ecologic substitutes, where possible, prohibit abuse of P (i.e. in cement production, landfill of high P content materials such as biosolids incineration ashes) • Increase of P-recovery: Large-scale demonstration of innovative technologies and concepts for phosphorus recovery • Find and apply synergies between different mass flows for more effective recovery, since feasibility is often a matter of scale • Define recovery clusters for regions to make the most out of the scale factor • Support for demonstrating new technologies (first full-scale plant) • P flow analysis, LCA, many models are based on estimates or outdated data -need for frequent P monitoring in all relevant material flows! • Standardized and harmonized assessment and analyses and clear and transparent presentation of results to allow comparison • Continuing improvement of biosolids processing, monitoring and land application management, including via composting and digestion • Investigation of environmental and health impact of sludge and manure treatment • Impact of bio-availability (crop uptake, soil, leaching …), How do plants adapt to certain soil (nutrient supply, pH) and climate conditions • Where biomass and sludge cannot be recycled directly, monoincineration should be preferred instead of co-incineration (that is, NOT mix in incinerators P-rich sewage sludges with low P wastes, such as domestic refuse) to make sure, that the P content will not be diluted and remains as high as possible for recovery • Joint ventures to promote EU technology for non EU raw material

Q07	***Do you consider that the available information on the efficiency of phosphorus use and the use of recycled P in agriculture is adequate? If not, what further statistical information might be necessary?***
	The availability of information on the efficiency of P use and use of recycled P in agriculture is not considered adequate but is improving. There are already many information and data available, but data resolution (regional and local level) is not sufficient. Also the comparability of data is still an issue. Different and non-specific definitions of mass flow categories, parameters and indicators (for example: "other") make it hardly possible to compare the data of different member states. Harmonization and standardization is considered necessary. In the case of sewage sludge and manure, transparency on the land application is inadequate because not only the P content or concentration of P in different material has to be monitored, also the type and form, in which P is bound within the matrix is essential to evaluate the actual "use" of P. (i.e. in the case of sewage sludge). Frequent monitoring of the P profile of soil is considered essential. Complementary economical information (cost) is necessary.
Q08	***How could the European Innovation Partnership on "agricultural productivity and sustainability" help to take forward the sustainable use of phosphorus?***
	Initiation of cross-sectoral cooperation of supply (P processing and recycling) and demand side (end-users, farmers etc.). Support of business cases. Highlight economical scenario developments for sustainable industrial use of P. (See links to networks at end of document) Integration of phosphorus stewardship into EU agricultural policies, including reducing soil losses and eutrophication, efficient use of phosphorus in farming and by crops, safe use of mineral and recycled phosphate products Promoting studies on how sludge valorization in agriculture can be made safer, to verify benefits in practice (financial and plant nutritional). Promotion of uniform regulations across member states and of effective manure management. Close collaboration with the European Nutrient Platforms (ESPP, NNP, VNP, DPP …). Facilitation of using secondary P-products in organic farming.
Q09	***What could be done to ensure better management and increased processing of manure in areas of over-supply and to encourage greater use of processed manure outside of these areas?***
	• Best to create an agricultural system, where crop and livestock are grown in reasonable relation (mixed farming). If and where not possible, manure needs to be processed. Best would be to extract the nutrients in defined quality from the solid phase or at least to concentrate them to increase transportability. (i.e. after biogas production, the digestates can be processed) • Education and advisory on regional base • Ensure that phosphorus and nutrient stewardship are included in manure management policies, including in manure energy recovery • Strict application of regulation limiting disposal to land beyond crop needs and/or beyond concentration threshold in soil. Costs for processing/disposal have to be paid by intense livestock producers. • To facilitate transfer from "surplus regions" to "deficit regions"; set regulation to promote a % of recycled P in fertilizers (for example 10% like share of biofuel in European fuel mix) • Production of high-grade fertilizer from manure (i.e. using the energy from manure-processing biogas units) -> definition and monitoring of quality criteria • develop network/market for trading manure surpluses (communication)

	(Switzerland already has a website for handling manure: https://www.agate.ch/portal/web/agate/hofdungerflusse)
Q10	***What could be done to improve the recovery of phosphorus from food waste and other biodegradable waste?***
	Apply waste hierarchy to the phosphorus rich resource: 1- Reduce, 2- Resource recovery, 3- Energy recovery. One major element is prevention of food wastage, especially during processing on the way from farm to fork. Raising public awareness for the P issue might help to avoid waste of food, but also the rethinking of unnatural quality criteria for food, best before dates, package size have to be considered. Short films like the one produced by the Dutch Nutrient Platform for the ESPC 2013 (see www.phosphorusplatform.eu) or by the project P-REX (https://vimeo.com/78539404) might be more efficient instruments to raise awareness compared to paper publication. One prerequisite for recovery is the collection of the relevant material. Separate biodegradable waste collection (not mixed with other waste) must be mandatory, the P recovery and green energy (biogas) production go in line (synergy) (Question of political ranking … today, energy is considered more important) Additionally and since enabling technologies are available and economy is the limiting factor, the EU can, like in the case of energy, impose a program to reduce P import dependency. A binding and common recovery rate can be 30% P from all P relevant waste streams by 2020 and 50% by 2030 (including current practices such as safe and transparent direct agricultural valorization of biosolids) to set the poles and achievable goals. This will also include exploitation of the P from food grade animal bones, which are – although it is generated in large rendering industrial scale, currently not used, as well as the prohibition to landfill or incinerate biodegradable waste. Ensure surveillance of cadmium, uranium and other contaminants in imported human and animal foods and ingredients to ensure that limits applied to phosphates used in agriculture in the EU are matched by limits on imports
Q11	***Should some form of recovery of P from waste water treatment be made mandatory or encouraged? What could be done to make sewage sludge and biodegradable waste more available and acceptable to arable farming?***
	First priority is to fully implement waste water collection and treatment (EU Waste Water Treatment Directive, EU Water Framework Directive). Many member states are behind deadlines. Only when waste water is correctly collected and treated, and phosphorus is no longer lost to surface waters deteriorating water quality, can P-recovery be implemented. One form of recovery cannot be made mandatory or preferred in regulations and incentives, since every waste water treatment plant has different conditions: - P concentration in influent - P elimination method (chemical precipitation or biological accumulation) - Digestion of sludge - Access to monoincineration? - Different sizes and capacities (quantity of wastewater treated, sludge produced, P load in total) These are just some parameters that influence the feasibility or just suitability of the various P recovery technologies. Therefore, a recovery mandate will only be applicable for each WWTP, if it is related to the real possibilities for recovery. A better solution will be incentives or even funding (not only for the first demo plant per country!) for plant operators who upgrade their plants with P recovery technology or who produce sludge that can be applied for direct land

	application (safe and plant available). An incentive for the fertilizer industry, covering both imports and domestic production, to reach a % quota of P-recovery in the European P containing fertilizer mix (for example 5%) could be also efficient as it would force them to identify the “low hanging fruits” (most profitable sites) and to invest / enter long-term agreements with operators and producers of secondary P-products. Since, economic viability should be given and strongly depends on scale, a mandatory for WWTP > 100,000 p.e. might be considered. Introduce P-recovery and stewardship into existing BATs for eg. fertiliser production, phosphoric acid, waste(water) treatment and frequent updating not only by governmental authorities, but strongly involving practitioners (operators) is recommended. Further on, the following points shall be considered: • All P recovery technologies applied must be ecologically sustainable! • LCA and stakeholder consultation should be engaged concerning use of iron and aluminum in sewage works for P-removal, taking into account resourcing of these elements, environmental impacts when sewage sludges are re-used and crop availability of phosphorus and implications for P-recovery processes: is this really sustainable? • Since the Phosphor issue is a matter for the whole society, not only the plant operators and connected households shall bear the costs. Actually the cost is low (few Euros/(Person*year), if everybody contributes. • Foster upstream work of WWTP (sewer police, source control) to minimize contamination of sludge • It is a question of quality. If good and defined quality can be guaranteed, then end user confidence and trust can be established. The monitoring of quality need to be adapted to the real threads (not only heavy metals, but also organics and pathogens) -> certificates and labels --- after transparent monitoring! EU wide standardized procedures and regulation Ban of diluting, transferring and dissipating P into material, where its nutritional function is not relevant
Q12	***Are there any other important topic related issues, that should have been addressed in the consultation?***

	• Interlink all P issue activities to EU FERTILIZER REGULATION revision (DG ENT, Mr. Eric Liegeois)
	• Criteria of vital importance to make P-recycling fertilizer available for sale and acceptable to arable farming are:
	  • Sewage sludge ash is considered waste … a hurdle for border crossing transport and follow-up processing!
	  • Develop a European quality label for products recovered from biowastes, with criteria for energy and nutrient recovery and for health and contaminant safety
	  • Facilitate use/marketing of products recovered from bio-wastes, either as soil amendments, for processing in fertilizers or for other uses, by ensuring that legislative obstacles are reduced and simplified (eg REACH, end-of-waste, fertilizer regulations), in particular for SMEs without strong regulatory/chemicals know-how
	  • How to anticipate the necessity for nutrient recycling in the bio-economy (production of bio-fuels and bio-materials)?
	  • Assessment of potential (non-displaceable) job creation in energy and nutrient recovery from waste streams

The following participants (individuals and/or organizations) agreed to submit this document as joint response to the European Commission’s Consultation on sustainable use of phosphorus.

Name of individual or representative	Organisation's logo
Dr. Jiři Holas Agricultural Research Council, Ltd. www.arcnet.cz	
Dr. Christian Adam *Dr. Jan Stemann* www.bam.de	
Dr. Rob de Ruiter www.ecophos.com	
Prof. Dr. Mario Mocker www.umsicht.fraunhofer.de	
Dr. Christian Kabbe *Boris Lesjean* *Dr. Christian Remy* www.kompetenz-wasser.de; www.p-rex.eu	
Carl Dewaele www.nuresys.com	
Ludwig Hermann www.outotec.com	
Anja Wagenbach P.C.S. Pollution Control Service GmbH www.pcs-consult.de	
Arnoud Passenier Member of the P-REX Advisory Board	
Edward Someus www.refertil.info	
Oliver Gantner www.ressourcenforschung.de	

Dr. Kersti Linderholm
www.silvberg.se

Christopher Thornton
Member of the P-REX Advisory Board

Richard Haarhuis
www.waterstromen.nl

Willem Schipper
Member of the P-REX Advisory Board
www.wsconsulting.nl

Topic related networks:

www.phosphorusplatform.eu

www.vlakwa.be/nutrientenplatform

www.nutrientplatform.org

www.deutsche-phosphor-plattform.de

www.refertil.info

www.p-rex.eu

www.globaltraps.ch

www.wsstp.eu