GPRI Statement on Global Phosphorus Scarcity

26th September, 2010

This statement has been prepared in response to the 'World Phosphate Reserves & Resources' report released by the International Fertilizer Development Center (IFDC) on Wednesday 22nd September 2010.

The members of the Global Phosphorus Research Initiative welcome the news that the world may indeed have more available phosphate rock than previous estimates suggest. There is no dispute today among scientists, industry and policy-makers that without phosphorus we cannot produce food and that "*phosphate rock is a finite resource – at some point in time the earth's supply may be exhausted*"[1]. IFDC's Principal Scientist, Steven Van Kauwenbergh was commissioned to prepare a geological study of phosphate rock, using secondary data sources to better understand the magnitude and lifetime of phosphate rock reserves and resources. Van Kauwenbergh has done a thorough job with what little data are available. However, for reasons outlined below, we believe the IFDC report should be interpreted with great caution, and further, when this geological study is considered in the wider context of sustainability and global food security there is still a pressing need to take action to change our current phosphorus use trajectory.

1. Reliability of the IFDC Report

The IFDC report suggests we have 60 000 Mt of phosphate rock reserves, compared to previous US Geological Survey (USGS) estimates of 16 000 Mt. While the report acknowledges that 'dire consequences' would be linked to a peak in the production of phosphorus, the report claims that peak phosphorus is not likely to occur this century, that we have '300-400 years' remaining and therefore there is little need for concern.

In relation to these claims, we would make the following points:

- If the 60 000 Mt reserves figure was accurate, the peak phosphorus timeline would be pushed forward by several decades. That is, there would still be a peak in the production of phosphorus this century. In their 2009 paper, GPRI members Professor White, Dr Cordell and Associate Professor Drangert's estimated a peak phosphorus timeline around 2030-2040[2] based on the best

[1] quote from the IFDC Media Release.

[2] Cordell, D, Drangert, J-O & White, S (2009) *The Story of Phosphorus: Global food security and food for thought.* **Global Environmental Change**, Vol 19, Issue 2, May 2009, p.292-305.

available USGS data. The study cautioned that while the timeline may vary, the fundamental problem of phosphorus scarcity would not change. The peak phosphorus methodology and results have not been addressed in the IFDC report, although Van Kauwenbergh has concluded '*there is no indication there is going to be a "peak phosphorus" event in the next 20-25 years*'.

- Whilst an update on the USGS estimates is welcome, these IFDC phosphate rock reserve figures are still estimates based on secondary sources and shrouded in much uncertainty. Van Kauwenbergh stresses '*this is a preliminary estimate'*, and further that the real data are still unknown because they are held by the mining companies themselves, e.g. OCP in Morocco and numerous companies in China. Due to commercial confidentiality, these companies may never release their data. The Report suggests that 85% (51 000 Mt out of 60 000 Mt) of the newly calculated reserves are in Morocco, but bases this substantial increase on a 1998 paper and a coarse assumption regarding ore concentration. Van Kauwenbergh acknowledges that "*it is not known if all of this phosphate rock is truly producible at today's costs and prices. There is no data to assess mining costs*". Van Kauwenbergh, despite stressing that the level of reserves are dynamic and dependent on the price of phosphate rock, has not explicitly stated the assumed price on which his reserve estimates are based. We conclude that the reserve estimates in the IFDC report are highly conjectural and as yet inconclusive.

- Van Kauwenbergh concludes his report by stating that at current production rates, we have "*sufficient phosphate rock concentrate to produce fertilizers for the next 300-400 years*". There is no calculation in the report from which this conclusion is derived. To estimate such a timeline, Van Kauwenbergh appears to have used a constant production rate (approximately 160 Mt/a of phosphate rock). However, there is substantial research and evidence to suggest that demand for phosphate will grow in the medium and long-term, and hence production rates will need to increase accordingly. Phosphorus demand is strongly linked to population, hence feeding 9 billion people by 2050 will mean approximately 50% increase in phosphorus fertilizer demand (if no increased efficiency is achieved). Further, an increase in the per capita demand for phosphate fertilizer is forecasted, due to the increasing trend towards meat- and dairy-based diets. Many of the soils in developing countries (particularly in sub-Saharan Africa) are phosphorus-deficient and require substantial applications of phosphate fertilizers to build soil fertility. Finally, new competing demands for phosphorus for non-food purposes, such as biofuel crops, will further increase demand. The assumption of a constant extraction rate of 160 Mt per year is highly questionable and unrealistic for a long-term forecast.

2. Implications of the IFDC report for policy-makers, farmers and others

Policy-makers, farmers, industry, scientists and the general community should be clear on what the IFDC report changes, and what it does not change.

What the IFDC report changes:

- If accurate, this geological survey suggests we have more phosphate in the ground. At best this 'buys time' until substantial changes to our use of phosphorus need to be made. However it only pushes forward the peak phosphorus timeline several decades. It does not remove the threat of peak phosphorus.

- The report strongly recommends the development of a 2nd stage, and, the development of a *Virtual Fertilizer Research Center* which will investigate the data further together with other stakeholders. This proposal is welcomed by the members of the Global Phosphorus Research Initiative.

What the IFDC report <u>does not</u> change:

- This report only comments on geological phosphate rock reserves and resources. That is, what is estimated to be in the ground, and estimated to be mineable or potentially mineable at current technologies and prices. From a sustainability and food security perspective, the amount of phosphorus available and accessible to farmers for use on fields is the key question. In reality, despite the megatonnes estimated to exist in the ground, phosphate may not be accessible due to physical, technical, energetic and economic constraints, or geopolitical and legal constraints, or financial constraints for farmers. *The IFDC report does not (and was not intended to) provide a detailed assessment of such accessibility of phosphate to farmers or the global capacity to provide access*.

- The Report does not reduce the seriousness of the geopolitical dimensions of phosphate rock. According to the Report, Morocco alone controls 85% of all phosphate rock reserves and together with China, controls 91% of reserves. The geopolitical implications of this on the global market are significant and could contribute directly to global fertilizer market insecurity. Importing countries ranging from sub-Saharan Africa, South Asia to the European Union cannot afford to continue relying so heavily on such a geopolitically concentrated resource, which is critical to food production, without long-term security agreements. Governance of the resource will come into question by governments and UN bodies if the conclusions of the IFDC report are to be generally accepted. An open vetting of the Report is thus a necessity because of its potential impact on global fertiliser and food security.

- Whilst the total megatonnes have increased according to the study (because reserves are a dynamic figure based on cost and technology), the amount of high quality reserves are decreasing. The remaining phosphate rock is of a lower quality, that is, it contains less % P_2O_5 and more contaminants. These reserves will be harder to access and require more energy and resource inputs to extract and process. The price of energy is also likely to increase in the future, adding to the cost. The report acknowledges this "*As the cost of phosphate rock increases (based on demand and/or as lower-cost phosphate rock deposits are mined out), producers will have to move more material, process lower grade ores, open new mines, employ increasingly expensive technology and use additional raw materials and processing media (such as water) to produce ore concentrates*."

- More megatonnes does not change the fact that we are fundamentally shifting to an era where cheap fertilizers will be a thing of the past. Indeed the Report acknowledges that costs and hence price will increase as the high quality and accessible phosphate rock is depleted.

- Despite the new figure, the phosphate rock market may be subject to further volatile prices, as was seen in 2008 when phosphate rock price rose 800%. This can be further exacerbated with the projection of increased market concentration in one country, Morocco.

- The report does not change the serious situation of inequitable distribution of phosphate – while all the world's farmers need access to phosphorus, only those with purchasing power can currently afford fertilizers. Many of the unprecedented 1.02 billion hungry people in the world today are poor farmers working with phosphorus-deficient soils.

- Finally, the report does not change the fact that current human use of phosphorus for food production has lead to a global epidemic of freshwater eutrophication and creation of marine 'dead zones', which threatens many of the world's potable water supplies and endangers aquatic biodiversity. In fact the Report's conclusions will only contribute to continued unsustainable means of using fertiliser in the fastest growing developing countries at a time when the need for sustainable development is being emphasised by most governments and UN bodies.

There is general consensus between Van Kauwenbergh and GPRI members that:

- phosphate rock is finite and therefore we need to ensure efficient use of phosphorus and resource recovery from wastes; and

- there is a strong need for better data collection, monitoring and analysis of phosphate rock reserves, production and trade through a multi-stakeholder platform.

The members of the GPRI have recently undertaken a number of scientific studies on the nature and implications of global phosphorus scarcity for long-term food security. These include an assessment commissioned by the EU, and contributions to a chapter on phosphorus and food security in the next UNEP Year Book, which identifies emerging areas of concern[3]. We believe that current global phosphorus usage practices are threatening the world's future ability to produce food, and phosphorus leakage is degrading much of the world's water resources, both for potable water use and aquatic biodiversity. There is a pressing need to develop a coordinated response to global phosphorus scarcity that includes:

a) the development and implementation of sustainable technologies and strategies for the recovery of phosphorus from the food system for reuse in agriculture. That is, the safe and efficient extraction of phosphorus through precipitation, incineration, compost or other means from all waste flows from agriculture, food production, households and industry (e.g. crop residues, animal and human excreta, food waste, wastewater).

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[3] Cordell, D, Drangert, J-O & White, S (2009) *The Story of Phosphorus: Global food security and food for thought.* Global Environmental Change, Vol 19, Issue 2, May 2009, p.292-305.

Cordell, D., Neset, T. S. S., Drangert, J.-O. & White, S. (2009), *Preferred future phosphorus scenarios: A framework for meeting long-term phosphorus needs for global food demand*, International Conference on Nutrient Recovery from Wastewater Streams Vancouver, 2009. Eds D. Mavinic, K. Ashley and F. Koch. ISBN:9781843392323. IWA Publishing, London.

Cordell, D. (2010), *The Story of Phosphorus: Sustainability implications of global phosphorus scarcity for food security*, Doctoral thesis. Collaborative PhD between the Institute for Sustainable Futures, University of Technology, Sydney (UTS) & Department of Thematic Studies - Water and Environmental, Linköping University, Sweden. No.509. Linköping University Press, ISBN9789173934404, Linköping.

Mavinic, D., Ashley, K. & Koch, F. (Eds.) (2009) *Proceedings from the International Conference on Nutrient Recovery from Wastewater Streams* Vancouver, 2009, www.nutrientrecovery2009.com, London, IWA Publishing, ISBN: 9781843392323.

Rosemarin, A., Bruijne, G. d. & Caldwell, I. (2009), *Peak phosphorus: The next inconvenient truth,* The Broker, August 2009, 15, p.6-9.

Schröder, J., Cordell, D., Smit, A. & Rosemarin, A. (2010) *Sustainable Use of Phosphorus*, Final Draft, prepared by Wageningen University (The Netherlands) and Stockholm Environment Institute (Sweden), prepared for the EU Directorate General (Environment), EU Tender ENV.B.1/ETU/2009/0025.

Smit, A. L., Bindraban, P. S., Schröder, J. J., Conijn, J. G. & Meer, H. G. v. d. (2009), *Phosphorus in agriculture: global resources, trends and developments,* Plant Research International, Wageningen University, Report to the Steering Committee Technology Assessment of the Ministry of Agriculture, Nature and Food Quality, The Netherlands, and in collaboration with the Nutrient Flow Task Group (NFTG), supported by DPRN (Development Policy Review Network) Wageningen.

b) measures to substantially reduce the demand for phosphorus and reduce losses to water and non-arable land (including increasing efficiency of phosphorus use in agriculture, reducing spillages and wastage during food production and consumption and encouraging a change of diets towards less phosphorus-intensive foods); and

c) effective and inclusive governance and associated institutional arrangements to ensure long-term phosphorus security in all regions of the world (including a combination of regulatory and economic instruments).

Signed,

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About the
Global Phosphorus Research Initiative

The Global Phosphorus Research Initiative (GPRI) is a collaboration between independent research institutes in Europe, Australia and North America. The main objective of the GPRI is to facilitate quality interdisciplinary research on global phosphorus scarcity and sustainable responses for future food security. The GPRI also facilitates networking, dialogue and awareness raising among policy makers, industry, scientists and the community on the implications of global phosphorus scarcity and possible solutions.

The GPRI was co-founded in early 2008 by researchers at the Institute for Sustainable Futures at the University of Technology, Sydney (UTS), and the Department of Thematic Studies - Water and Environmental Studies at Linköping University, Sweden. Today, GPRI members also include the Stockholm Environment Institute (SEI) in Sweden, the University of British Columbia (UBC) in Canada and Wageningen University in The Netherlands.

GPRI members have researched and written extensively on the sustainability dimensions of phosphorus scarcity, including peak phosphorus and sustainable solutions (such as phosphorus use efficiency and recovery and reuse), for example the *Sustainable Use of Phosphorus* Report prepared for the European Commission DG Environment. Relevant publications, ongoing news and events can be found at our website: www.phosphorusfutures.net. Due to growing international interest in this emerging field, the GPRI is also developing a global network of concerned scientists, practitioners, policy-makers, industry, NGOs and citizens.