

SCIENTIFIC COMMITTEE ON HEALTH AND ENVIRONMENTAL RISKS (SCHER)

Request for an opinion on new conclusions regarding future trends of cadmium accumulation in EU arable soils

Background

On 28 April 2014, the EU inorganic fertiliser industry notified the Commission of a report updating assessment of the effects of using inorganic phosphate fertilisers on cadmium accumulation in EU arable soils.

Current EU legislation concerning fertilisers (in particular Regulation (EC) No 2003/2003) does not contain limits on the content of cadmium, although some risks relating to the presence of cadmium in the food chain have been well identified.

The European Commission is currently engaged in a profound revision of Regulation (EC) No 2003/2003 that would include limit value for cadmium for the whole EU. As cadmium concentration in crops increases with increasing soil cadmium concentrations, all other factors being constant, predicting long-term change in soil cadmium content is considered important to determine trends in cadmium exposure of the general population through the food chain.

In 2002, the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE¹) used a mass-balance approach² to calculate the concentration of cadmium in inorganic phosphate fertilisers that would not lead to a net accumulation of cadmium in arable soils in EU-15+Norway over 100 years. The report concluded that at a concentration of 20 mg cadmium/kg P₂O₅ in inorganic phosphate fertilisers, accumulation of cadmium is not expected in most EU soils.

The objective of the study conducted for Fertilisers Europe was:

1. To update that mass-balance assessment with recent data on input and output parameters applicable to EU-27+Norway taking into account that since the assessment of 2002, atmospheric emissions of cadmium have decreased, the use of inorganic phosphate fertilisers has decreased and that they are now better tools to estimate cadmium leaching from soil.
2. On the basis of the new estimates, to calculate scenarios of long-term change in soil cadmium

Terms of reference

In view of the relevance of this report to the review of Regulation (EC) No 2003/2003 on fertilisers, the SCHER is requested for an opinion on the following aspects:

¹ Now known as SCHER

² A balance between cadmium inputs (atmospheric deposition, P fertiliser use, lime, sludge, manure application) and cadmium outputs (crop uptake, leaching).

1) **Assess the overall quality of the report and identify any significant deficiencies.** Has the methodology for assessing soil accumulation used by the CSTEE in 2002 been followed? If not, is the model used by the author pertinent? Is the quality of the report comparable to the evaluation prepared by the CSTEE in September 2002? In particular, please evaluate the soundness of some basic assumptions, including:

a. The **average background concentration of cadmium in soils**: wouldn't a weighted mean on the basis of the surface area of arable land in the countries considered in Table 3 on p. 12 be a better proxy for a European mean?

Is the FOREGS data representative as reference values for agricultural soils? According to the sampling strategy for the FOREGS project³; '*residual soil from areas with agricultural activities was avoided, since the top soil is usually affected by human activities*'.

b. The **average content of cadmium in fertilisers** on the basis of Nziguheba and Smolders (2008): is this single source a sufficient basis for this fundamental parameter in the calculation? Are the 196 samples considered in that paper broadly representative of the phosphate rock fertiliser sources used in the EU? If so, is an arithmetic mean representative of the distribution presented in Fig. 10?

c. **Atmospheric deposition**: please evaluate the appropriateness of 0.35 g Cd/ha/y as the best estimate of the mean cadmium deposition, as well as the standard deviation and the realistic worst case (p. 20 –Annex 3), taking into account also the 2011 EEA report on Hazardous Substances in Europe's Fresh and Marine Waters⁴, and the content of the report on the study on diffuse water emissions in E-PRTR by Deltares⁵ (although cadmium from diffuse agricultural sources specifically was not considered). Is the assumption on pages 16-17 of the Fertilisers Europe report appropriate, i.e. that dry deposition can be ignored?

d. **The quantity of P fertiliser used in EU-27 + Norway** (22 kg P₂O₅ ha⁻¹): please elaborate on the soundness of the calculation in Table 7 page 22 of the report, in particular on the (implicit) weighing factors used to calculate the value in the column "Total arable land". What would be the impact on future trends in soil cadmium accumulation of other scenario of P consumption of 40 kg P₂O₅ ha⁻¹, 60 kg P₂O₅ ha⁻¹, 80 kg P₂O₅ ha⁻¹ and 100 kg P₂O₅ ha⁻¹.

e. **Scenarios used, statistical treatments and conclusions drawn from this.** Future accumulation rates have been modelled using 2160 different scenarios. These scenarios are the results of making all possible combinations of a set of levels for all included parameters (e.g. 0, 0.35 and 0.7g Cd ha⁻¹ yr⁻¹ for deposition and 2, 2.5, 3, and 4 % for organic matter content, etc). This means that all values for each parameter is represented by the same amount of values among the 2160 scenarios i.e. for 33% of the scenarios the deposition is set to

³ <http://weppi.gtk.fi/publ/foregsatlas/article.php?id=10>

⁴ <http://www.eea.europa.eu/publications/hazardous-substances-in-europes-fresh>

⁵ <https://circabc.europa.eu/w/browse/43b37b86-5706-4e2d-80cd-88007dd31319>

0, 0.35 and 0.7g Cd ha⁻¹ yr⁻¹ respectively etc. (It appears unrealistic that 33 % of the soils have close to zero in deposition.) This set of scenarios has then been used to calculate statistics for the accumulation of cadmium in European soils, figures that are also reported in the conclusions and abstracts. Is it scientifically sound to make this kind of statistics based on a set of hypothetical scenarios and to present conclusions for European soils based on these statistics?

- 2) **Opinion on the appropriateness of the scenarios studied** in particular as regards the algorithm representing soil/water distribution coefficient (K_D). Could the new model lead to an overestimation of soil cadmium leaching at EU and national level? What are the implications of the new model for estimates of the effects of leaching on surface and groundwater concentrations of cadmium? How has new pH estimates affected the outcome of the model and the conclusions?

pH has a large influence on the outcome of the accumulation modelling. In the new reports an average pH for European soils has been set to 5.8 (based on new data from the GEMAS database). In former studies e.g. the EU RAR (ECB 2007)⁶ the European average soil pH was set to 6.5. The reason for this difference of almost one pH unit is not explained.

How has this change in average pH been addressed in the K_D /leaching estimates, which are strongly dependent of pH? If the reported soil pH is dependent on analysis method it must be crucial that the same analysis method for pH is used for the soils to be modelled, as in the underlying data used for developing algorithms for K_D . It is not clear which methods have been used to measure pH in the 4 underlying studies for the K_D /leaching algorithm used in the new reports. It is mentioned in Six and Smolders (2014)⁷ that, when pH_{H2O} was available a conversion was made to reflect pH_{CaCl2}, but nothing explains how this conversion was done.

Can SCHER analyse whether the change in average pH is a consequence of the use of different analytical methods or has soil pH really changed in Europe? How has this change affected the conclusions on accumulation compared to former studies?

Is the choice of the cropping systems (cereal mono-cropping, potato mono-cropping and cereal-potato rotations) representative of EU agricultural practice?

- 3) **Opinion on the reliability and validity of the conclusions** (pages 39 to 51 – Annex 3) concerning the accumulation of cadmium in EU arable soils and its likely leaching to waters. In the light of the answers to the questions above, what would be the possible implications for human exposure of accepting the conclusions of the Fertilisers Europe report.

⁶ ECB, European Chemicals Bureau, 2007. European Union Risk Assessment Report- Cadmium oxide and Cadmium metal Part I – Environment. 3rd Priority List, Vol.72. European Chemicals Bureau, European Commission. (EUR 22919 EN).

⁷ Six, L. and Smolders, E, 2014. Future trends in soil cadmium concentration under current cadmium fluxes to European agricultural soils. *Science of the Total Environment* 485–486 (2014) 319–328.