Data quality and implications for P governance
- from speculation to knowledge -

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What we learned ...

- Never blindly trust statistics you have not calculated yourself (Common saying!)
- Continental and national averages are rather useless for effective implementation of recycling strategies! -> Regional/local level is a MUST due to structural diversity!
- Normalized data / ratios can be misleading, absolute data/figures have to be preferred
- Official Statistics not necessarily reflect reality, often just estimates or assumptions -> directl contact to owners of material flows the only way for the real picture …
- Data reliability and consistence for sludge is low (sludge only by compiling different sources) (Eurostat, national offices, direct contacts, but inhomogenous definitions, units)
- Waste monitoring focused on pollutants, not on valuable ingredients (like nutrients)
- And when „monitored“, different factors for nutrients applied (esp. for manure!!!)
- Concentrations/loads mainly limited to total content, not species
- Data quite isolated to legislative domains … not along value chains (waste, agriculture …)
- Imports and actual consumption (esp. human food consumption) hardly distinguished

To be identified - Structural differences!

Compared to national average, agriculture does not play an important role in Berlin!
Not a relevant market for fertilizers!

Berlin 89.176 ha

- Wasser (5.967 ha) 7%
- öffentliche Grünfläche (12.661 ha) 14%
- Wald (16.328 ha) 18%
- Landwirtschaft (3.740 ha) 4%
- Siedlungs- und Verkehrsfläche (50.320 ha) 57%

Germany 357.169 km²

- Wasser (8.634 km²) 2%
- öffentliche Grünfläche (8.806 km²) 3%
- Wald (107.970 km²) 30%
- Landwirtschaft (186.465 km²) 52%
- Siedlungs- und Verkehrsfläche (45.293 km²) 13%

Source: DESTATIS 2013
Limited data availability for internal mass balances

P load varies

1. ash after incineration
2a. undrained sludge after anaerobic digestion
2b. sludge liquor after dewatering
3. direct agricultural utilisation of dewatered sludge

P load and availability varies (removal, digestion ...)

www.p-rex.eu
Sewage sludge routes in Europe 2010 – and P?

European total quantity: ~ 11 million tons sludge (dry matter)

- Only absolute quantities reveal relevance
- Importance of harmonized definition of categories (i.e. what is OTHER???)
Difference of sludge valorization and P recycling

Total sludge quantity in Germany (2013): 1846 kt DS/y

Approximately 20% of P in sludge, approximately 12,000 t P/y recycled today!

According to Destatis 2013, Lehrmann 2011

www.p-rex.eu
P potential in Berlin’s wastewater stream

Total P load (influent) treated by BWB: 2.841 Mg P

- From Berlin: 2.452 Mg P (86%)
- From Brandenburg: 389 Mg P (14%)

6 WWTPs: 2.841 Mg P

Fractions:
- Human excreta: 2.116 Mg P (3,2%)
- Detergents: 369 Mg P (1,4%)
- Indirect discharge: 356 Mg P (1,4%)

- Loss to surface water: 90 Mg P (3,2%)
- Struvite: 40 Mg P (1,4%)
- Sewage sludge: 2.711 Mg P (95,4%)

Kabbe, Bäger and Mancke 2014

www.p-rex.eu
P removal and sludge treatment depending on WWTP size (discharge limits, digestion)

According to UBA 2014, DWA 2014

- Therefore different P conc. in sludge

181 WWTP > 100,000 p.e. accumulate
≈ 28,000 t P/y in sludge
≈ 45% of the total potential
phasis in this study

No. of sewage treatment plants included into a recovery concept (nominal utilization)

10,000 WWTP
According to UBA 2014, DWA 2014
P content in German „mono“-incineration ashes

Source: according to Krüger & Adam 2014,
What is mono-incineration and what ash is suitable for $P_{\text{rec}}$?

<table>
<thead>
<tr>
<th>Ash Type</th>
<th>P Content (%)</th>
<th>Fe Content (%)</th>
<th>Al Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard-grade phosphate rock</td>
<td>4.5</td>
<td>1.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Low-grade phosphate rock</td>
<td>3.5</td>
<td>0.8</td>
<td>0.3</td>
</tr>
<tr>
<td>Ash out of municipal sludge</td>
<td>3.0</td>
<td>1.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Ash out of municipal and industrial sludge</td>
<td>2.5</td>
<td>0.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Ash out of industrial sludge</td>
<td>2.0</td>
<td>0.5</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Ash according to Krüger & Adam 2014, Phosphate rock according to EcoPhos 2015, ICL 2015
Regional infrastructure

Mono-incineration (municipal sludge)
Mono-incineration (municipal/industrial sludge)
Mono-incineration (industrial sludge)
WWTP > 100000 p.e.
Co-inc. in coal power plants
Co-inc. in cement works
Co-inc. in municipal waste incineration plants
Phosphorus fertilizer industry
Phosphorus load of WWTP > 100000 p.e.;
Capacity of mono-incineration

- 50 t P/y; ≈ 1.100 t DS/y
- 100 t P/y; ≈ 2.300 t DS/y
- 200 t P/y; ≈ 4.500 t DS/y
- 500 t P/y; ≈ 11.000 t DS/y
- 1.000 t P/y; ≈ 23.000 t DS/y
- 2.000 t P/y; ≈ 45.000 t DS/y
- 5.000 t P/y; ≈ 114.000 t DS/y

Mono-incineration according to Krüger & Adam 2014,
Co-incinerations according to Jasper & Kappa 2012,
Fertilizer Industry according to IVA 2014
What official stats are based on real monitoring?

Who is cross-checking reported data? Is there any Quality Assurance???

How can we create traceability of published data? **No trace, no trust !!!**

Who will have to pay for reliable monitoring? (like the German ash monitoring)

Who is responsible to define and harmonize categories/parameters?

Who can engage higher monitoring and/or reporting frequency as needed? Sludge reports from MS to EUROSTAT only every 3 years!?! But data are there anyway for annual reporting!!!

*Todays we just guess!*

What you see is just your best guess what is out front. (*Ames*)

*Tomorrow, we have to be sure!*
Thank you ...

Wisdom just written on paper will once be ash; Only the wisdom applied will shape our future!

Guess who 😊

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