Recovery of phosphate

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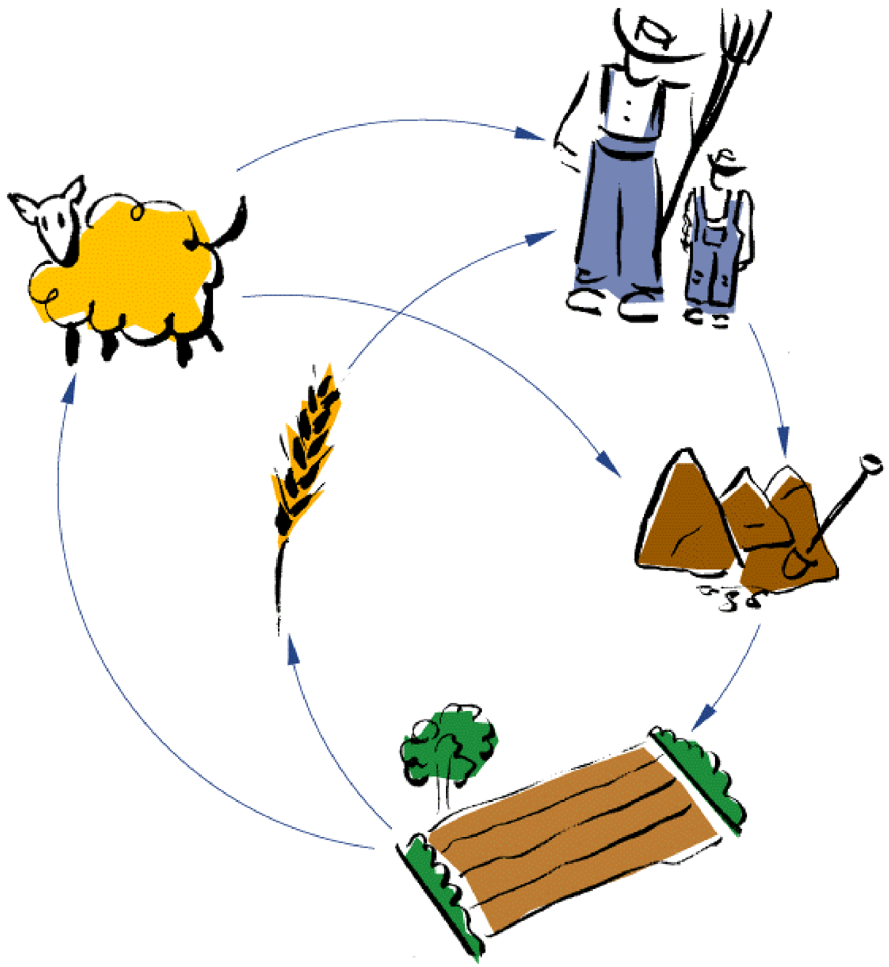
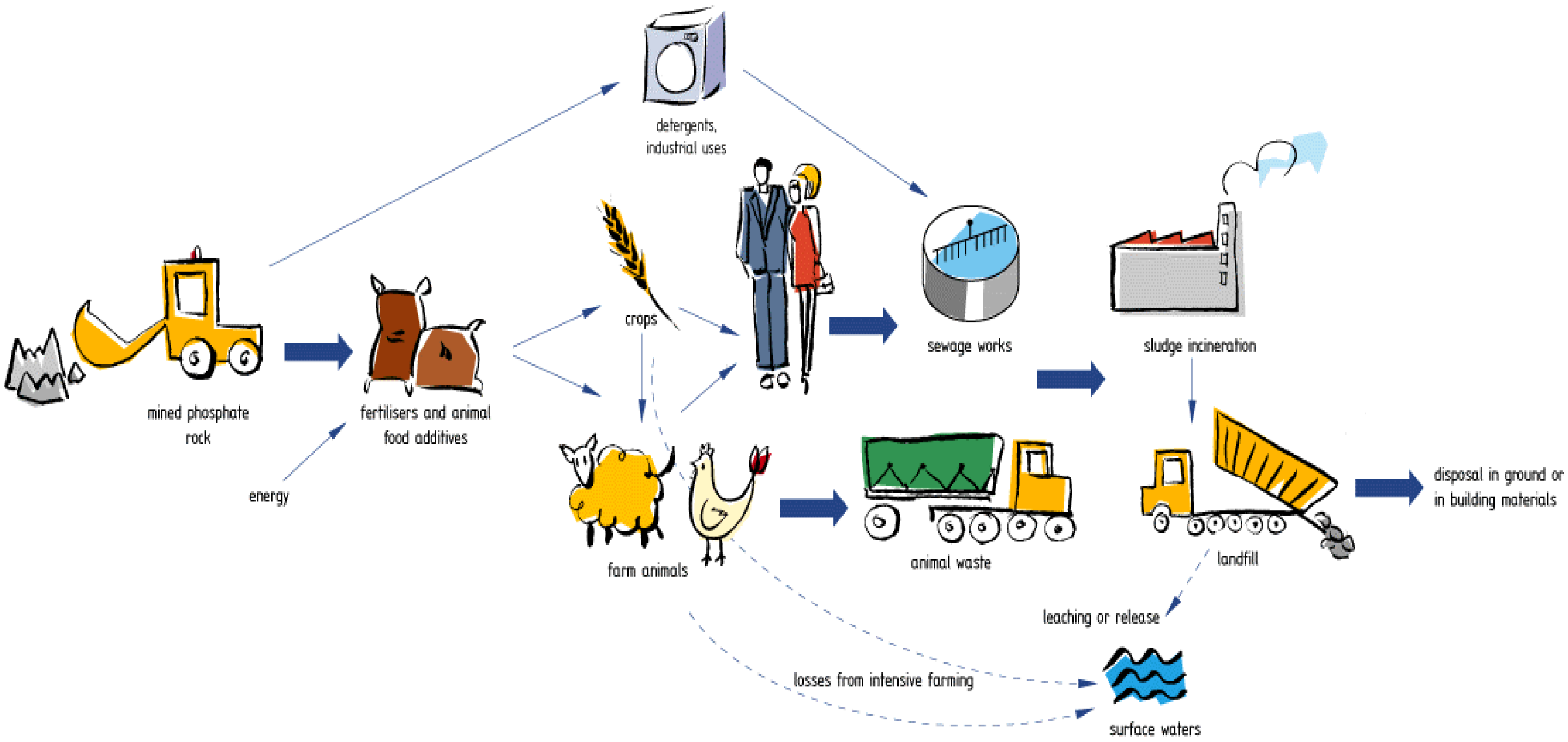
Dutch Foundation of Applied Water Research

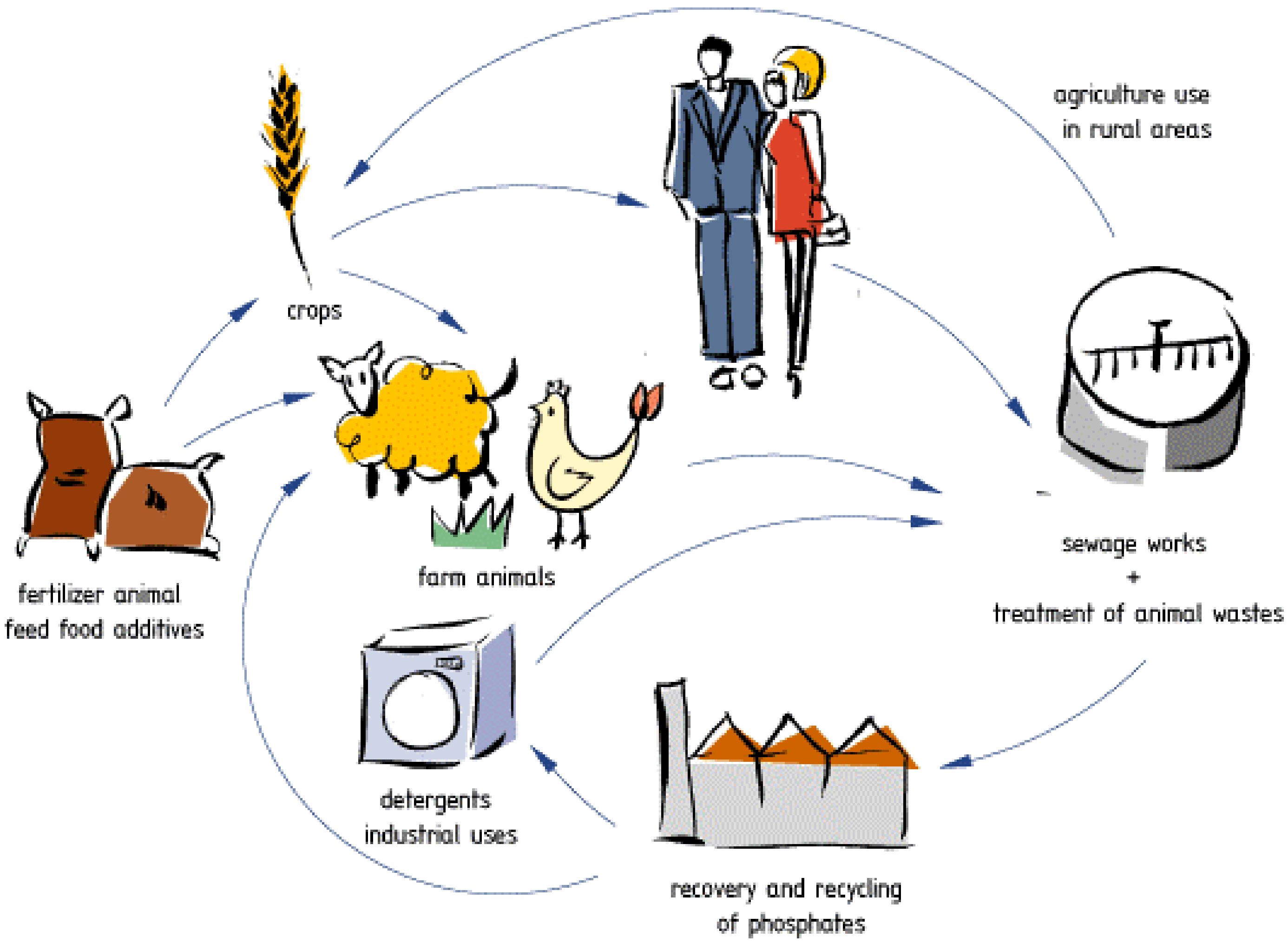
Traditional P-cycle



Modern throughput P-system



Future P-cycle



P-recovery

Stimulating factors:

- EC Urban Waste Water Treatment Directive
- Limits to sludge spreading
- High sludge treatment costs (The Netherlands, Japan)
- P-recovery policy of industry (CEEP)
- P-recovery policy of government (Sweden, UK)
- Struvite deposit problems
- A demand for sustainable phophorous resources

Drivers for the water industry

Potential for cost savings:

chemical addition and sludge handling costs

Potential for cost recovery:

sale of recovered phosphate product

Potential to enhance phosphorus removal:

achieve lower effluent phosphorus concentrations

P-recovery techniques

Biological P-removal is a facilitating process

- **Calcium phosphate formation (Crystallactor®)**
- **Struvite precipitation (Phosnix®)**
- **Precipitation as aluminium or iron phosphate**

... But also ion exchange resins, magnetic seperation, adsorption ...

And there are also different techniques for incinerated sewage sludge

Calcium phosphate

Calcium phosphate (Crystallactor®)

- A few full scale reactors are in operation
- High quality product
- Can be used by fertiliser industry and phosphate industry

Crystallactor® at Geestmerambacht, The Netherlands

Struvite

Struvite (Phosnix®)

- Good experience on full scale in Japan and Italy
- High quality product
- Can be used as fertiliser or in certain phosphate industry process routes

Ube Industries Sakai plant, Japan

Economic feasibility

Feasiblity depends strongly on circumstances per country, determining factors are:

- **P-concentration in influent**
- **sludge handling costs**
- **costs of the P-recovery technique**
- **market value of P-recovery products**

Publicity on P-recovery

Several activities to reach all actors:

- **SCOPE newsletter**
- **two special issues of Environmental Technology**
- **1st Int. Conf. in Warwick in 1998 (100 visitors)**
- **2nd Int. Conf. in Noordwijkerhout in 2001 (270 visitors)**

Inventory study in The Netherlands

Clients: STOWA, Thermphos and CEEP

Consultant: Haskoning B.V.

Objective:

Which phosphate rich streams are available from wwtp's that can be used for production of elementary phosphorus ?

Thermphos B.V.

Base material: Phosphate ore (600.000 tons/year)

Phosphate usage: 190.000 tons P_2O_5 / year

Production: Elementary phosphorus

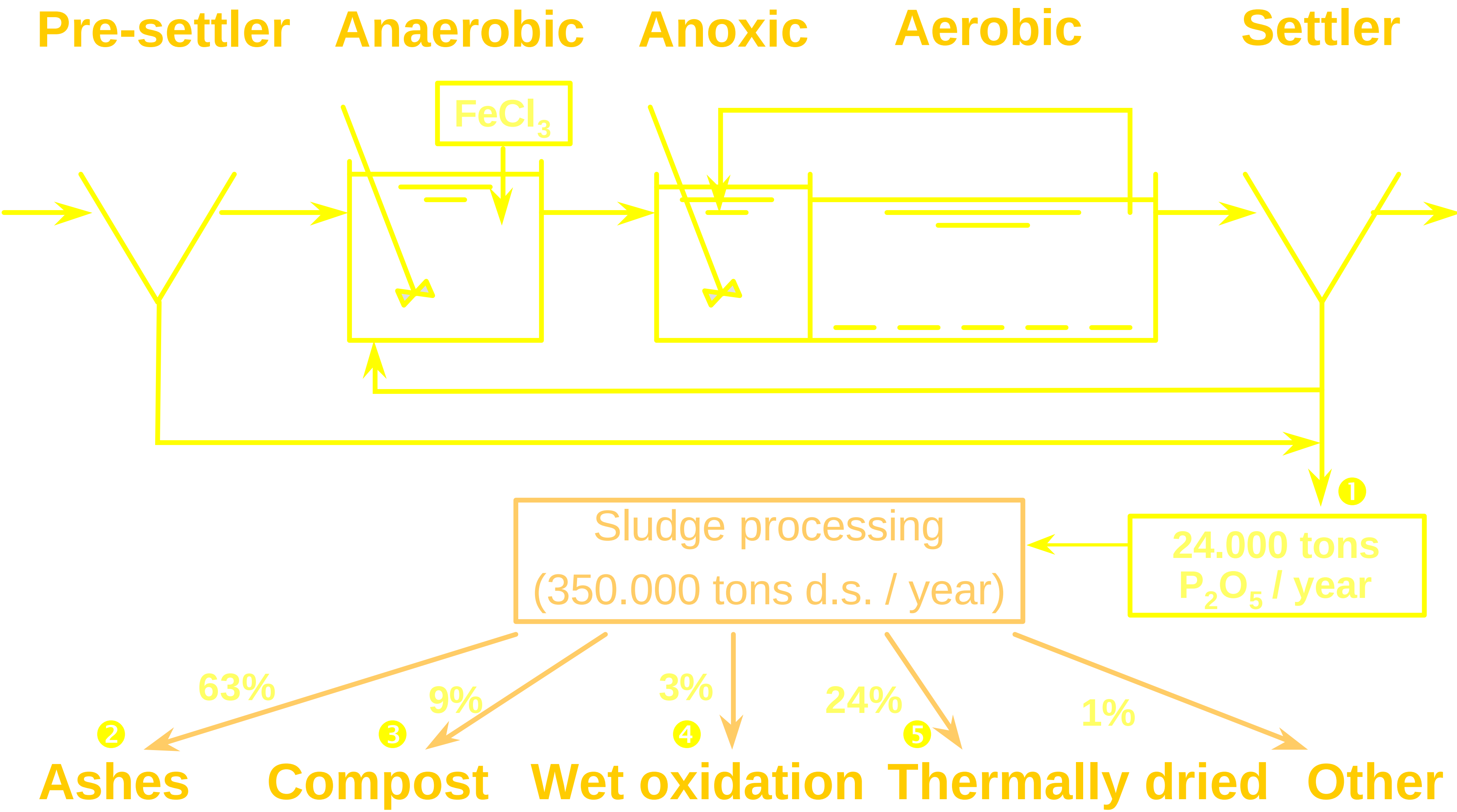
Aim: Replacement of 20% base material by phosphate rich streams within 5 years

Option: Usage of phosphate-rich sludge from wwtp's

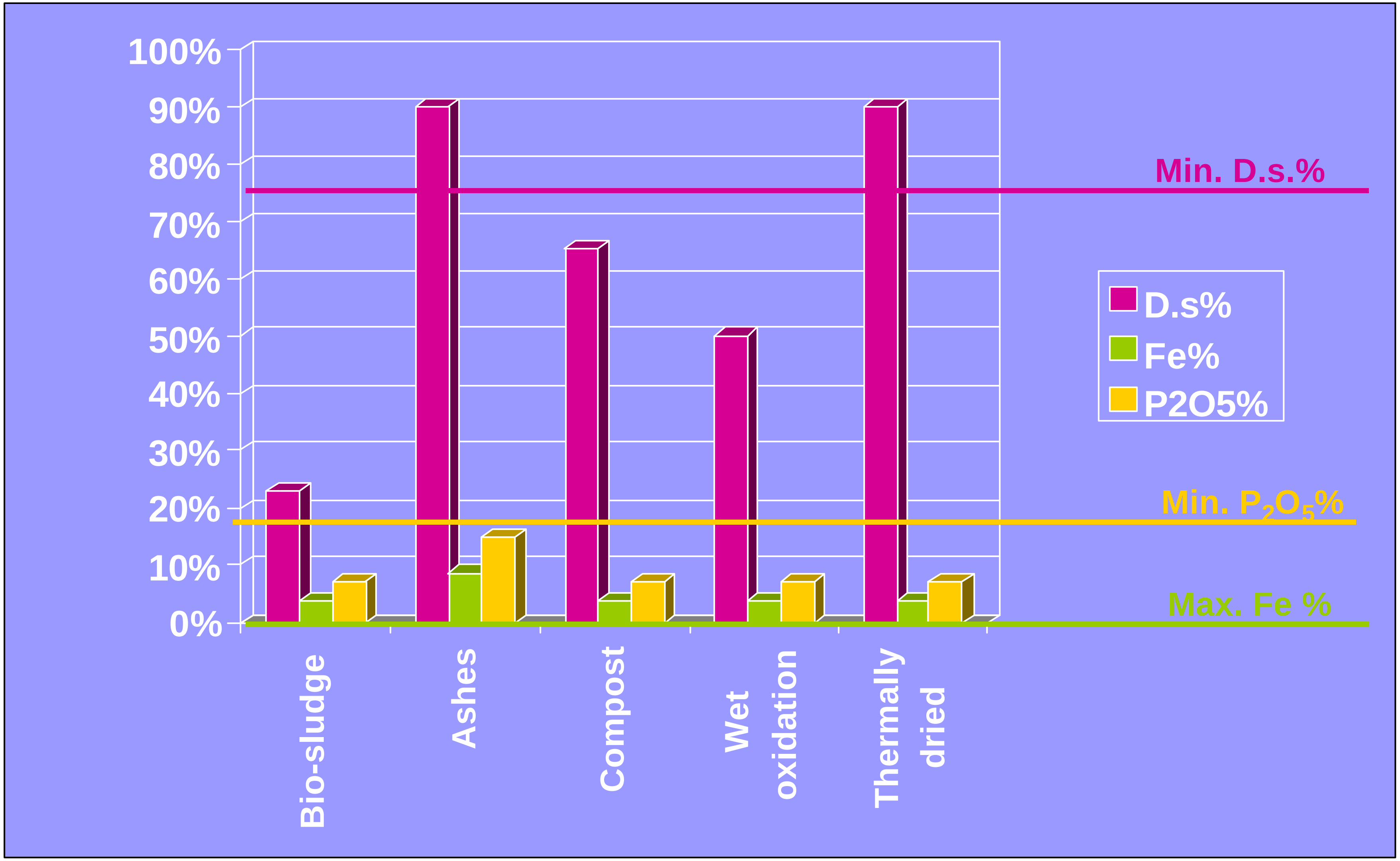
Requirements for P-rich streams

- **Dry solids:** > 75%
- **P_2O_5:** > 18% of dry solids
- **Iron (Fe):** Maximum of 0,5% if P_2O_5=20%
  £ 2000 tons / year extra
- **Zinc (Zn):** £ 20 tons / year extra
- **Cu / Cr / Ni / Co / V:** £ 2 tons / year extra

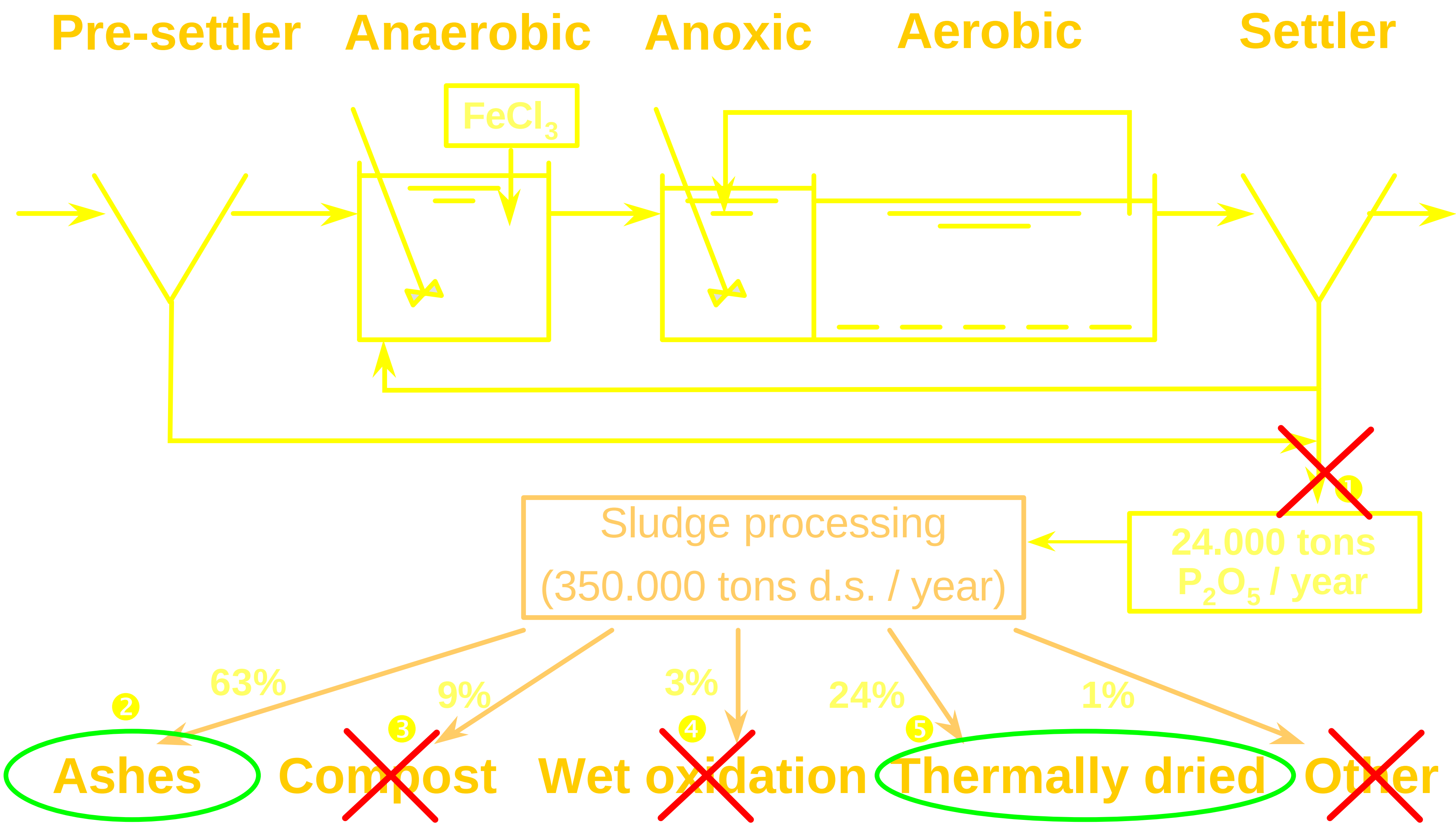
Phosphate flow through wwtp's



Requirements versus availability



Phosphate flow through wwtp's



Solutions

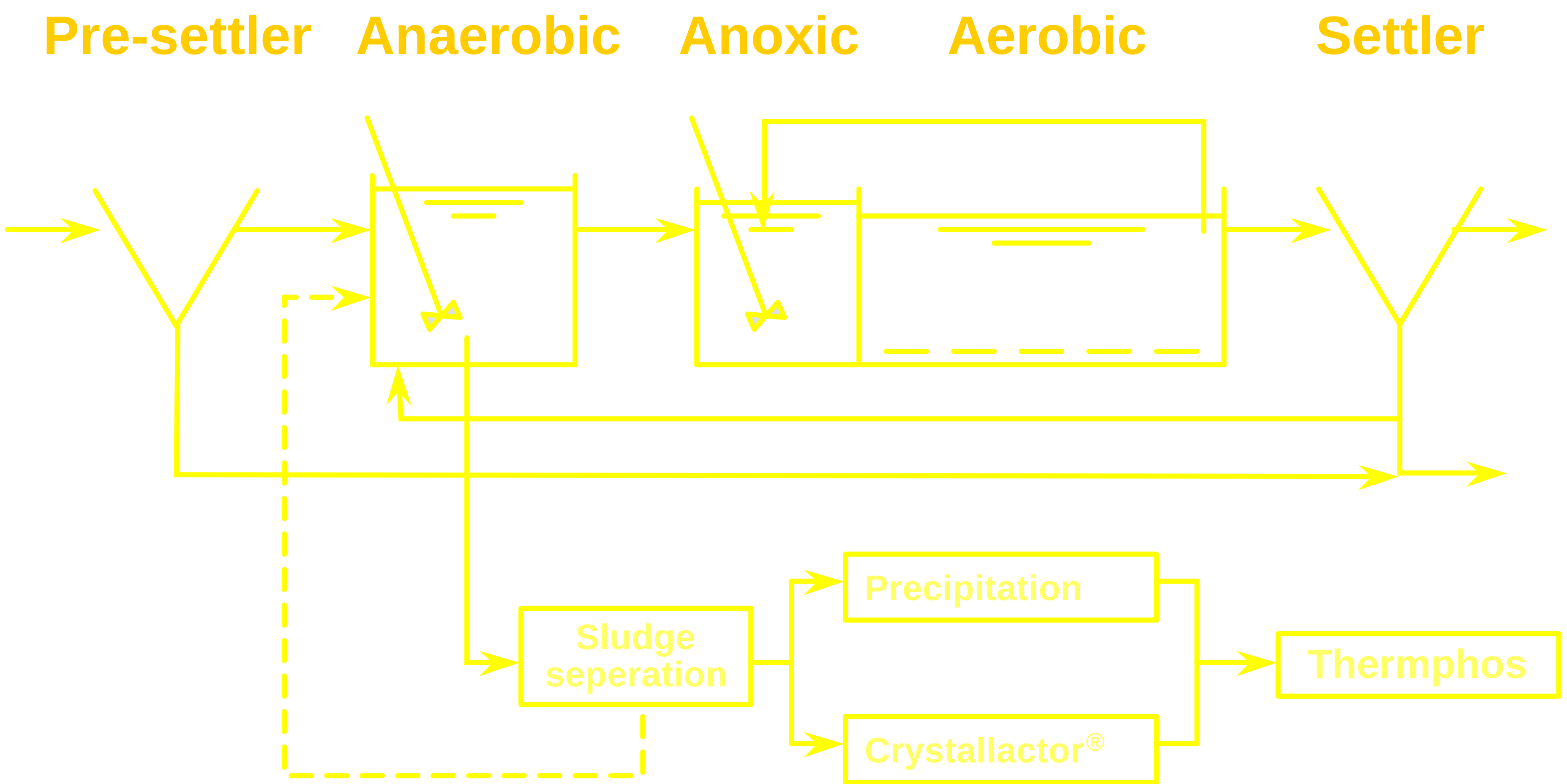
Metal concentration too high:

- dosing of aluminium chemicals at wwtp's
- implementation of side-stream processes
  - e.g. with the Crystallactor®

P_2O_5 concentration too low:

- implementation of side-stream processes
  - e.g. with the Crystallactor®

Side-stream implementation



Qualification of side-stream sludge

Precipitation

D.s.%	=	2%
P_2O_5%	=	29%
Cu/Zn/Fe	=	<<<

} Further research

Crystallactor®

D.s.%	=	75%
P_2O_5%	=	24%
Cu/Zn/Fe	=	<<<

} Feasible !

Perspective for The Netherlands

Current : **72 wwtp's with Bio-P removal**

Within 2010 : **29 to be built with Bio-P removal**

↓

↓

Max. 5% of Thermphos base material

Conclusions of the inventory

- **Yearly amount of P_2O_5 from wwtp's : 24.000 tons**
- **Main *bottlenecks* for usage by Thermphos B.V.:**
  - **- Too low dry solids concentration**
  - **- Too low P_2O_5 concentration**
  - **- Too high metal concentration (Fe / Cu / Zn)**

- **Direct usage of wwtp-sludge : Not feasible**

Solution : implementation of Crystallactor®

Covers all bottlenecks

About 5% of Thermphos base material can be made available within 2010

Result from the 2nd Int. Conf.

For the situation in the Netherlands

- Besides Thermphos, also the fertilizer industry became interested
- Therefore the Crystallactor® is not the only option, also struvite and iron precipitation can be applied
- A working group will be formed with all actors in the industrial column of P-recovery, also animal waste, waste processing and different industries
- The P-recovery working group will start a lobby towards the regulators

P-recovery web site

For more information:

visit the P-recovery website on

http://www.nhm.ac.uk/mineralogy/phos

Thank you for your attention