Workshop on good practices and experience in sludge management and treatment

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A practical example of municipal wastewater sludge handling from Denmark
Introduction

A practical example of sludge handling

In the following:
• Background
• Sludge Management Plan
• Sludge in agriculture
• Polluted sludge

Photo: Stabilized sludge 20% DS
Utility SDS A/S
• 50 000 p.e. to WWTPs
• 700 km²

Operating in an area with co-operation between municipally owned Water Utility Companies
(wastewater treatment, sludge treatment, IASs, procurement and billing)
• 640 000 p.e. to WWTPs
• 2.700 km²
Background

Wastewater treatment
WWTP centralization process

Sludge treatment
Bigger plants:
Anaerobic sludge digestion / energy recovery / mechanical dewatering

Smaller plants:
Mechanical dewatering and chemical stabilization

Final sludge disposal route
• 93% reused in agriculture
• 7% landfilled
  (temporarily - hopefully)

93% reused in agriculture
7% landfilled (temporarily - hopefully)
Background

Denmark 2016
National sludge disposal statistics

National Resource plan for waste management

Expecting that 80 percent of the phosphorus from sewage sludge is reused by 2018

More stringent limit values than required in the EC Directive

Limit values mg/kg dry matter

<table>
<thead>
<tr>
<th>Heavy metals</th>
<th>Denmark</th>
<th>EU</th>
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<tbody>
<tr>
<td>Cadmium</td>
<td>0.8</td>
<td>40</td>
</tr>
<tr>
<td>Copper</td>
<td>1 000</td>
<td>1 750</td>
</tr>
<tr>
<td>Nickel</td>
<td>30</td>
<td>400</td>
</tr>
<tr>
<td>Lead</td>
<td>120</td>
<td>1 200</td>
</tr>
<tr>
<td>Zinc</td>
<td>4 000</td>
<td>4 000</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.8</td>
<td>45</td>
</tr>
<tr>
<td>Chromium</td>
<td>100</td>
<td>-</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Foreign substances</th>
<th>Denmark</th>
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<tbody>
<tr>
<td>LAS</td>
<td>1 300</td>
</tr>
<tr>
<td>PAH</td>
<td>3</td>
</tr>
<tr>
<td>NPE</td>
<td>10</td>
</tr>
<tr>
<td>DEHP</td>
<td>50</td>
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</table>
Revisiting the Plan at SDS A/S:

Treatment and storage facilities needing renovation
=> Evaluation existing Plan

Possible improvements without increasing costs?
Revisiting the Plan at SDS A/S:

Existing plan - goals
- Reuse of sludge
- Least cost solution

Existing plan - method
- Treatment
  - Mechanical dewatering
  - Chemical stabilization
- Storage
  - Capacity for 9 month production
- Final disposal
  - Agriculture
Sludge Management Plan

Screening for opportunities

Recovery of resources
  • Energy
  • Minerals

Reuse of sludge
  • Agriculture
  • Industry

New technology
  • Development
  • Testing

Some only cost effective through cooperation with neighbor Utilities

Opportunities screened out at the moment

Incineration
  • At the moment not ensuring recovery of Phosphorous
  • More expensive than reuse in agriculture

Landfill
  • Not considered viable as long term solution
  • More expensive than reuse in agriculture
Revisiting the Plan at SDS A/S:

New plan - goals
- Recovery of energy
- Recovery of minerals
- Exploitation of new technology and future research

New plan - method
- Partial treatment at own WWTPs
- Further treatment at neighbor Utility 120 000 p.e. WWTP

Costs
- In the same range as existing solution
Sludge Management Plan

With the new plan SDS A/S has achieved:

- Recovery of energy
- Reuse of sludge in agriculture (organic material, P and N)
- Near future - recovery of 50% P (fertilizer product called PhosphorCare®)
- Indirect – access to new research / technology
- Indirect - access to specialist knowledge
**RISKS**

**Non compliance for agricultural purpose**

Risk considered low -

- The sludge quality in the past period has been compliant
- There are no major industrial polluters in the area

**Farmers not willing to receive sludge**

Risk considered low -

- Traditionally the most widely used method of sludge disposal in DK
- Only about 3% of the agricultural area is fertilized with sludge
- Extensive quality control
- Farmer receives compensation in the order of 50-200 euro/ha
- Farmer can save about 130 euro/ha per 3 year
Sludge in agriculture

Recent farmer survey

- **Barriers:**
  - Odor
  - Uncertainty about nutrient content
  - More difficult to plan the use of organic fertilizer than traded fertilizer

- **Benefits:**
  - Receiving organic material for improving soil structure
  - Reduction of fertilizer costs
  - Organic fertilizer is easily accessible

**Bio-fertilizer Agents**

- More agents on the market
- Deals with paperwork
- Collects, delivers and distributes sludge on the field
Sludge in agriculture

Example: Monitoring - direct usage

- **Water Utility**
  - Yearly reporting
  - Declaration 8 days before delivery
  - Responsible for:
    - Declaration regarding compliance with requirements and other values
    - Online yearly reporting on amounts that has been supplied
    - Written agreement with farmer (contract, declaration and map)

- **Ministry of Environment**
  - Register fertilizer suppliers
  - Compliance check
  - Yearly reporting
  - Yearly report on amounts of sludge used in agriculture

- **Municipality A**
  - (origin)
  - Overseeing:
    - Compliance of sludge quality
    - Storage
  - Written agreement

- **Municipality B**
  - (fields)
  - Overseeing:
    - Contracts and deadlines
    - Distributed not exceeding thresholds
    - Storage

- **Farmer**
  - Responsible for reporting on:
    - Checks that the area for disposal is sufficient in regards to the amounts ordered
    - Yearly field plans for organic fertilizer including maps
    - Yearly fertilizer accounts
    - Plough latest 6 hours after distribution

Analysis to Water Utility
Municipality and Ministry of Environment
Laboratory
Sludge in agriculture

Example: Reduced administrative burden by the introduction of Sludge Agents
Polluted sludge

Example – Heavy metals from industry

Neighbor Utility
- 20% wastewater imported
- Cadmium way above limit

Success in locating source
- Desk study industry permits
- Flow proportional sampling
- Major polluters identified

Closing source
- Pre-treatment equipment at source currently being implemented
Polluted sludge

Plan A
Agriculture

Plan B
Reuse in industry (price agriculture +80%)

Plan C
Incineration/landfill (under investigation)

Plan D
Landfill (price agriculture +200%)

Temporarily alternative sludge disposal routes

Additional disposal cost
- Data collected can prove source of pollution
- Additional costs are charged to the polluter
A practical example

- Sludge Management Plan allowing for:
  - Recovery of energy
  - Full reuse of organic material and minerals
  - Exploitation of new technology and future research

- Made feasible through:
  - Cooperation between Utilities
  - Sludge Agents as facilitator between Utility and Farmer
  - Good quality sludge

- Polluted sludge
  - Search for source
  - Intermediate period
  - Pre-treatment at source
Thank you
More Information

For info or further questions on this seminar and the activities of the JASPERS Networking Platform, please contact the JASPERS Networking and Competence Centre at the following email:

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JASPERS Website: jaspers.eib.org