



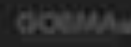
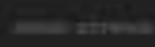
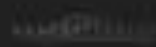
OVIVO

Analysis of Startup and Long Term Performance of a High Throughput Deammonification System

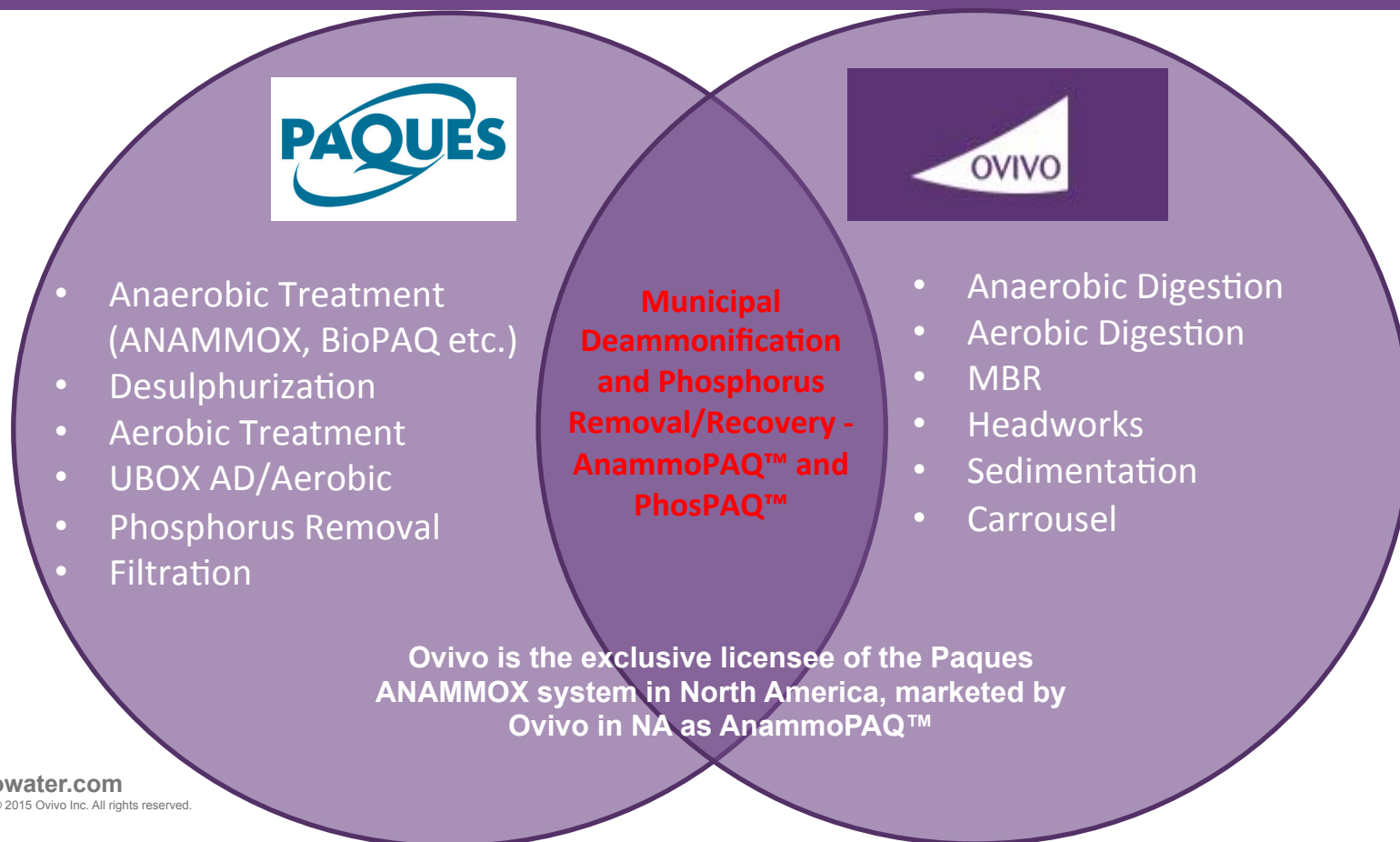
by

Mudit Gangal

Product Manager - AnammoPAQ™



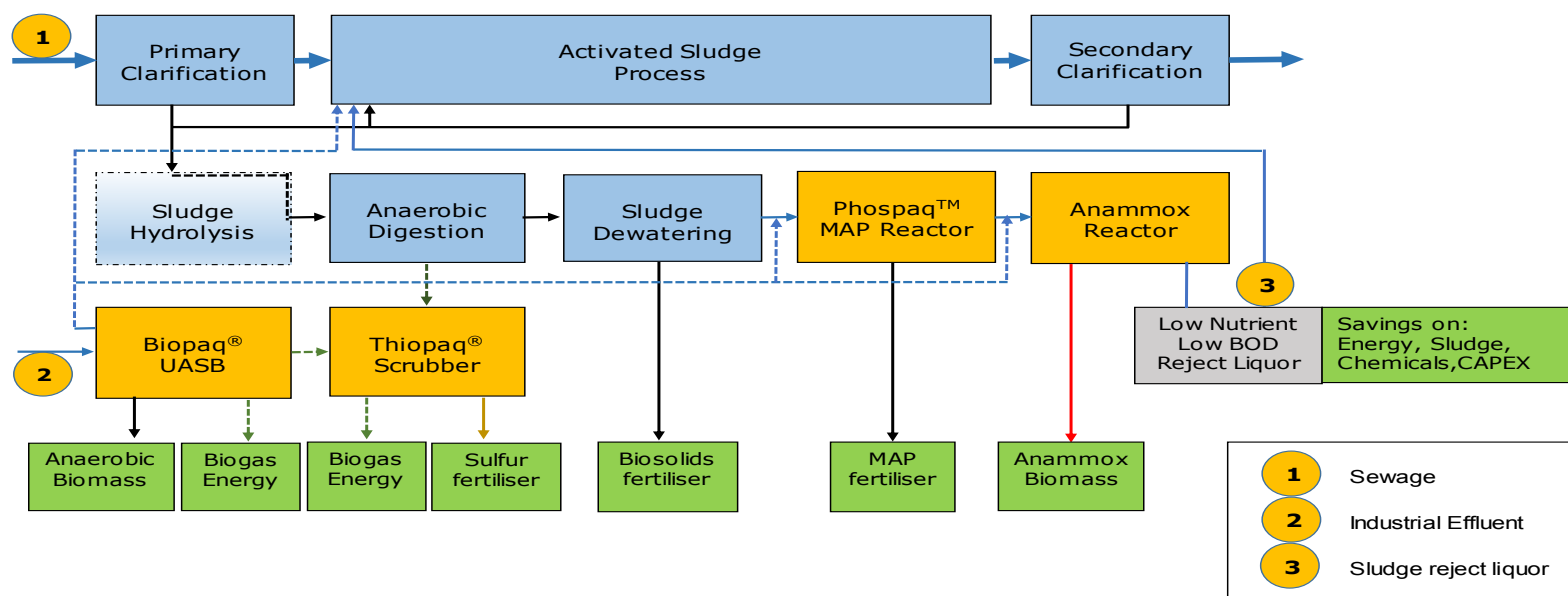
ONE COMPANY
ONE FOCUS





Topics

- **Opportunity**
- Solution
- Data and Case Studies
- Conclusions and Q&A



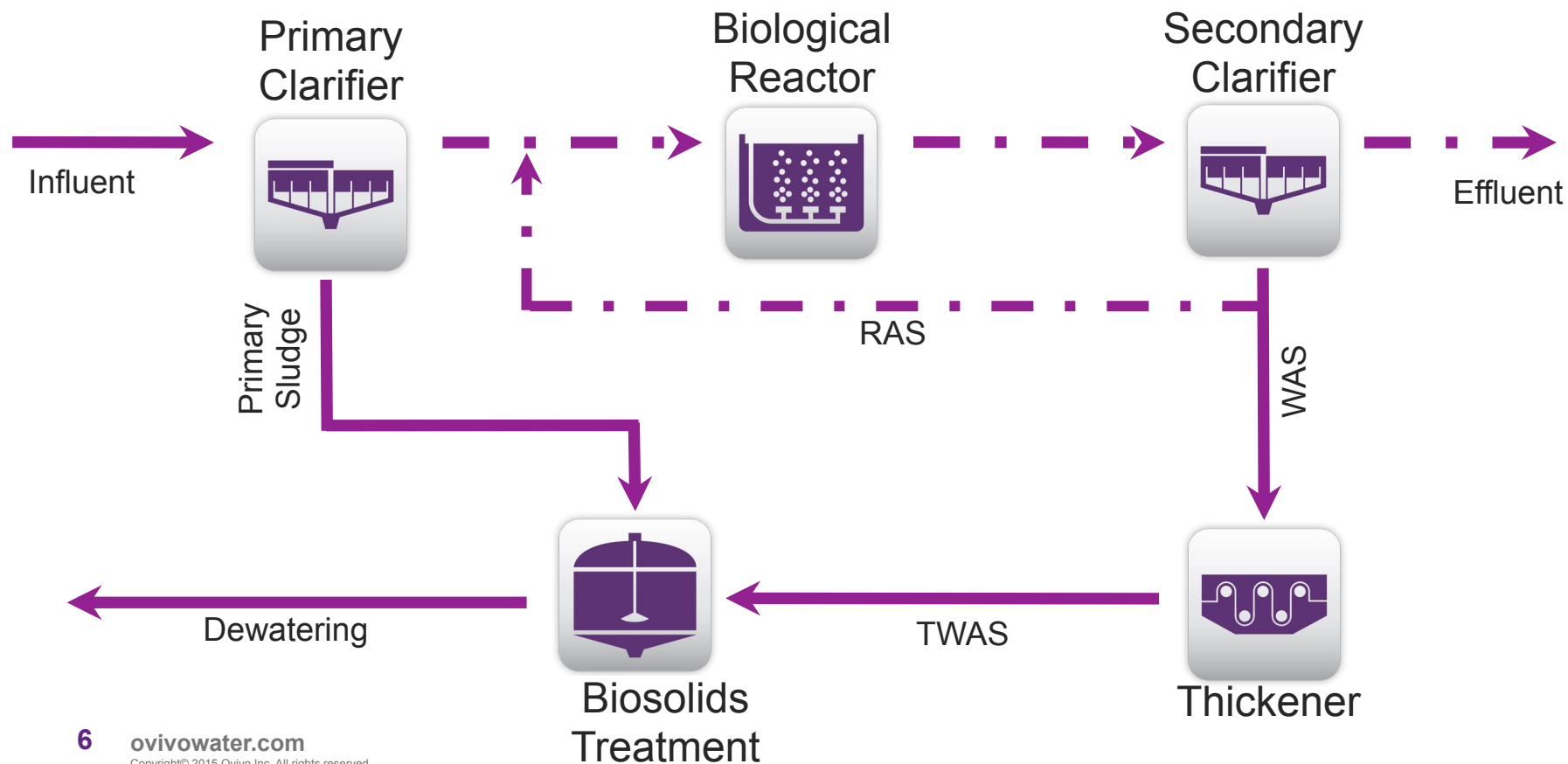
Biosolids Management

- > 15,000 POTWs in US
- 30+ BGD WW treated
- One ton dry sludge/MGD
- Sludge treatment > 30% O&M
- THP gaining momentum
- Side stream treatment crucial



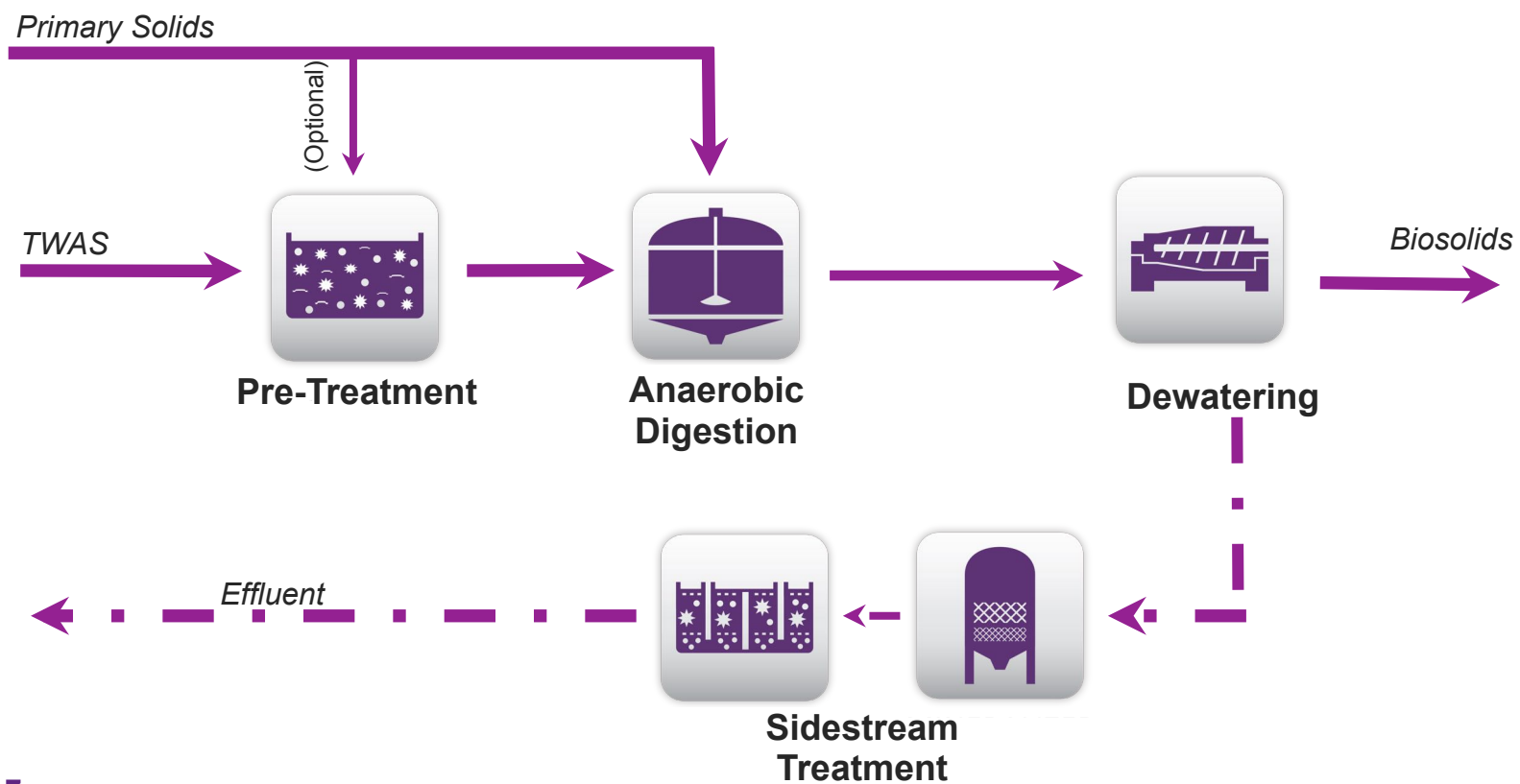


Typical Activated Sludge Process



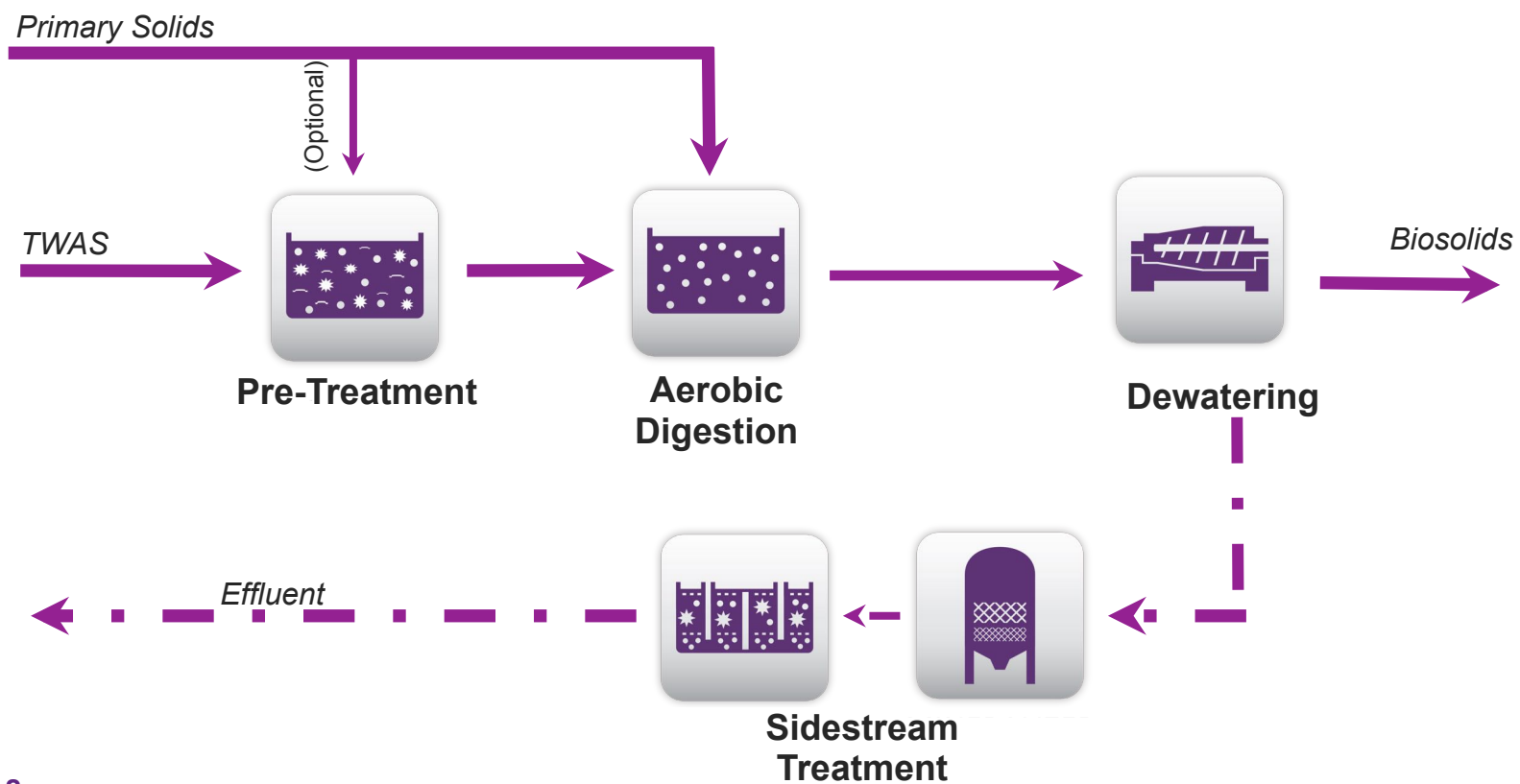


Biosolids Optimization Options



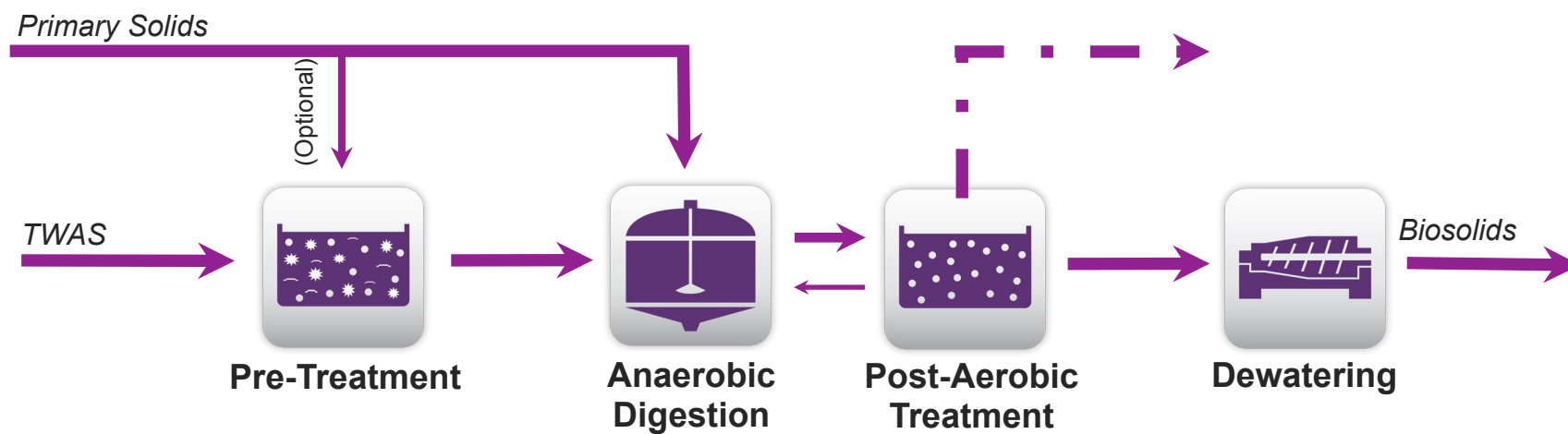


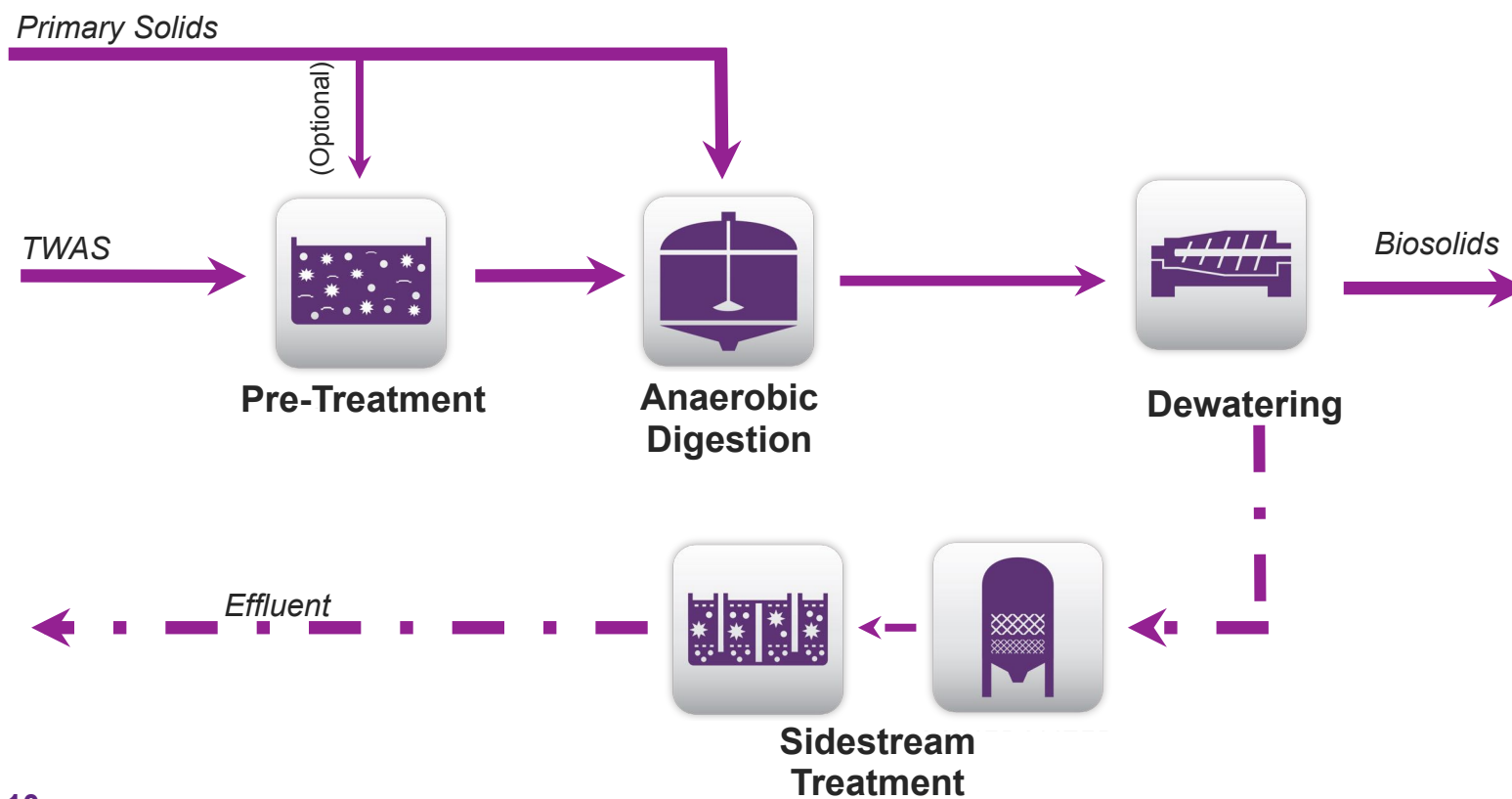
Biosolids Optimization Options





Biosolids Optimization Options





Client Concerns

- Typical Anaerobic digester sidestream
 - 1,000+ ppm Ammonia-N
- THP could significantly increase the ammonia levels
- Sidestream can add 10-30% load on main stream
 - ~1% to 3% flow of Q
- Nite/Denite requires energy + C





Industrial effluents

- Food industry
- Fermentation industry
- Rendering

Municipal WWTP

- Conventional biosolids dewatering liquors
- THP biosolids dewatering liquors
- Sludge drying condensates
- (Mainstream Treatment)

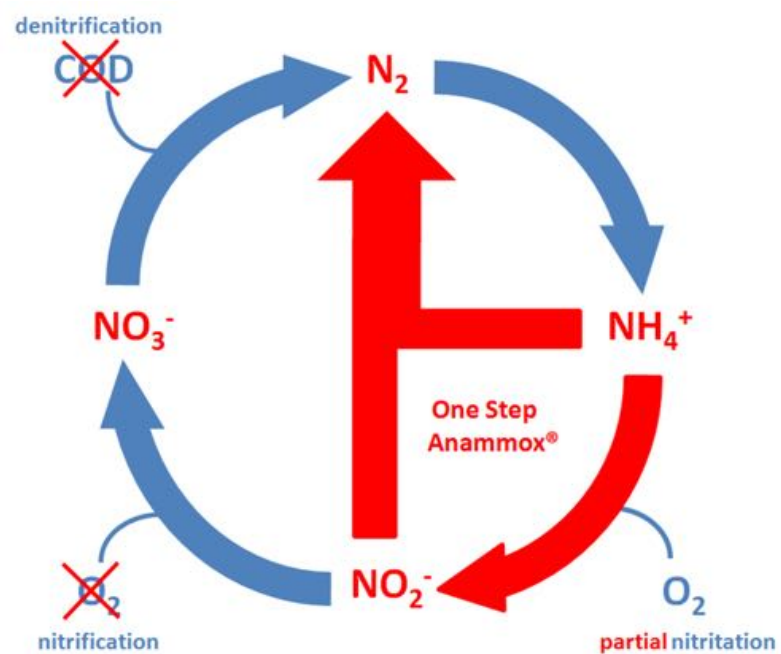
Others

- Leachate
- Organic Solids Digestors reject liquors



Topics

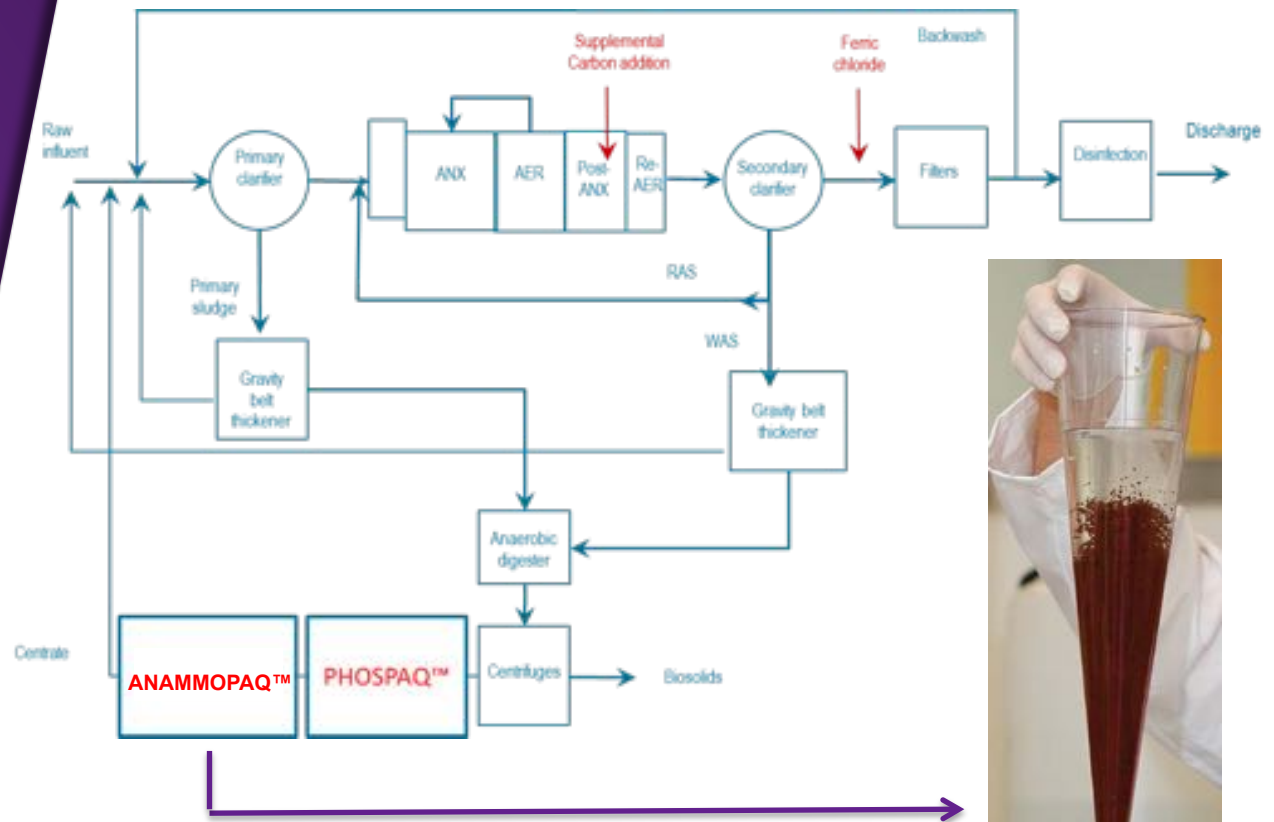
- Opportunity
- **Solution**
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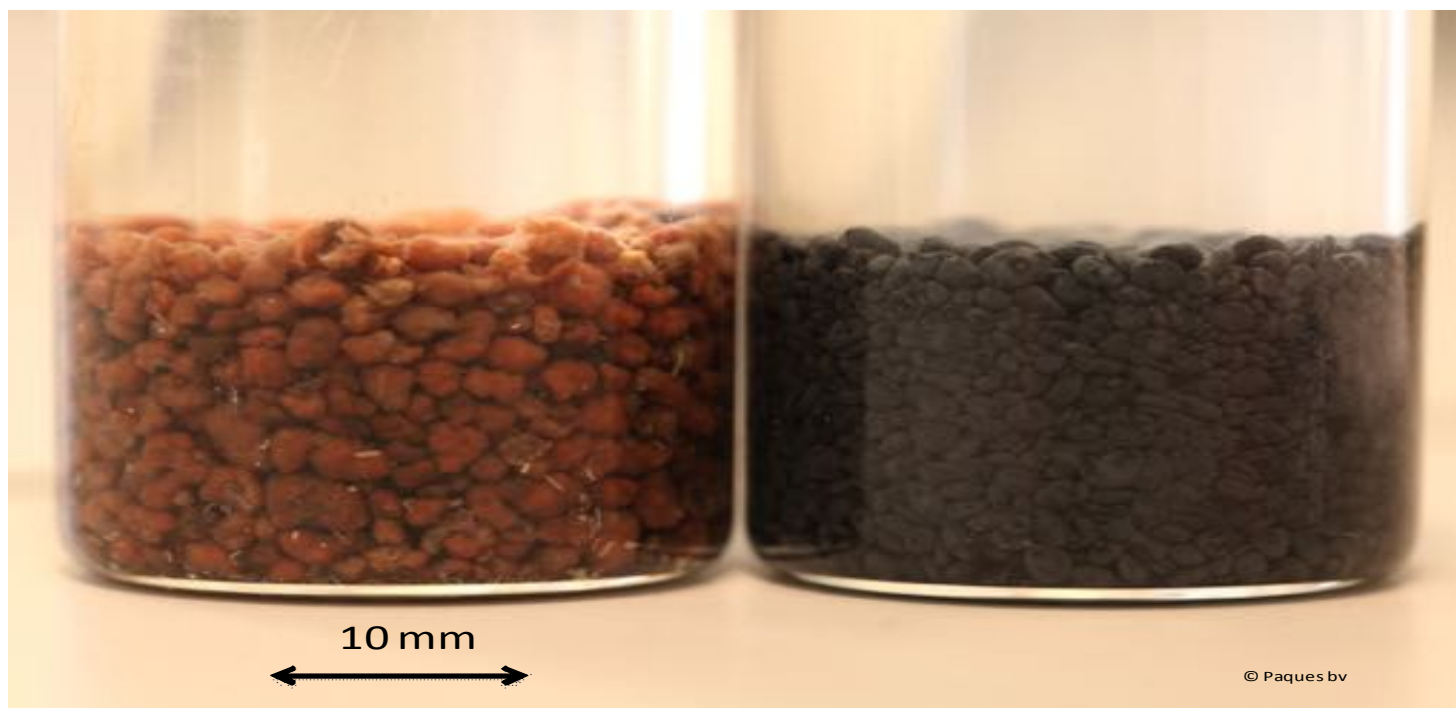


ANAMMOPAQ™

Sustainable Nitrogen Removal

- Anaerobic Ammonia Oxidation using Anammox bacteria
- Most Robust Deammonification Technology
- > 15 years of experience
- > 50 installations
- > Installed 250,000 lbs N/day

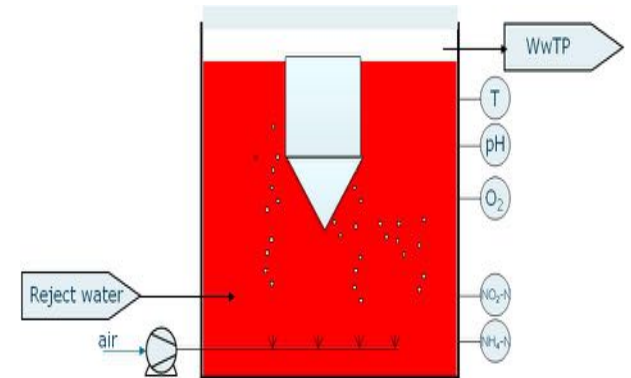
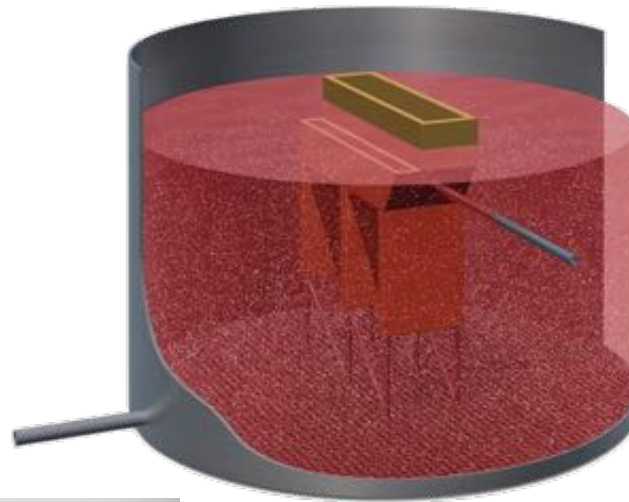




Anammox Granules
Since 2002

Anaerobic Granules
Since 1978

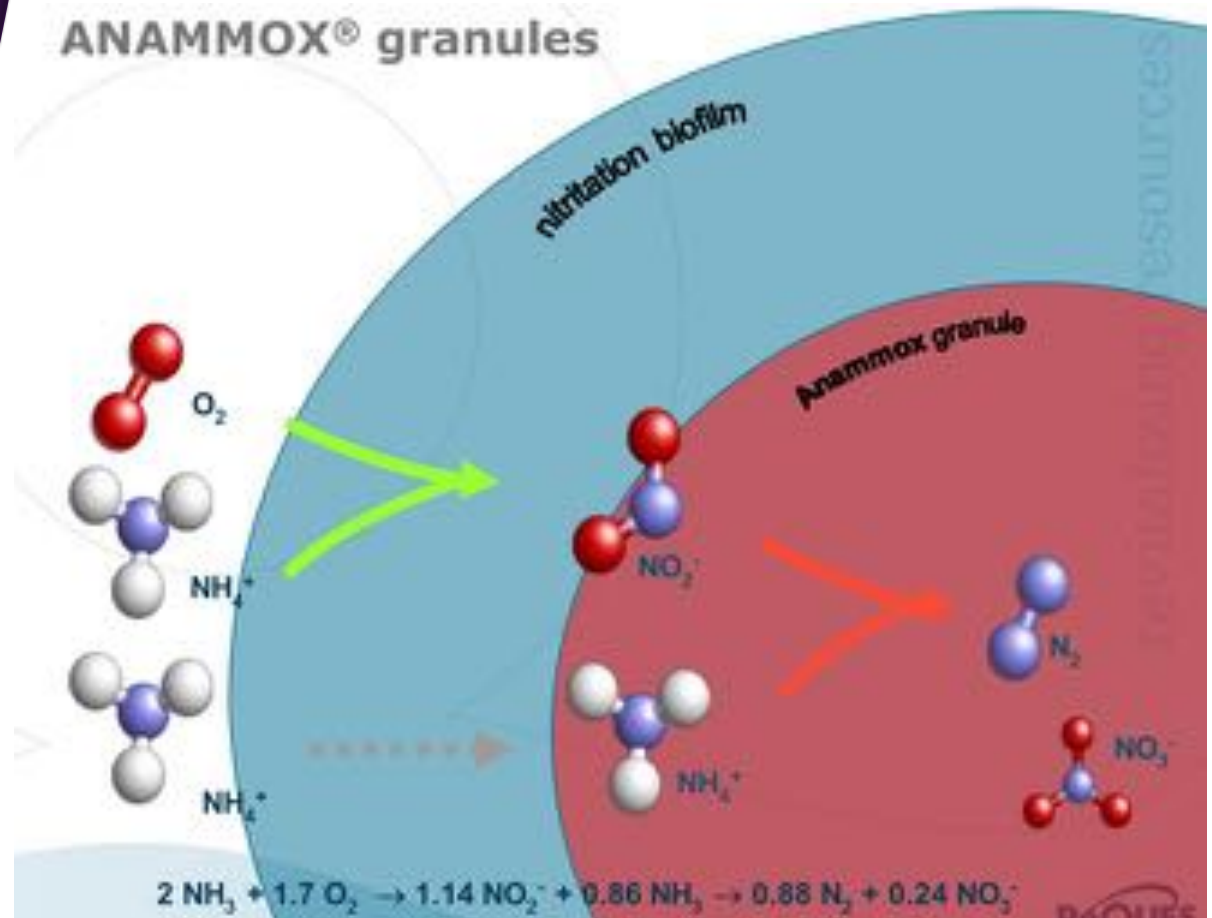


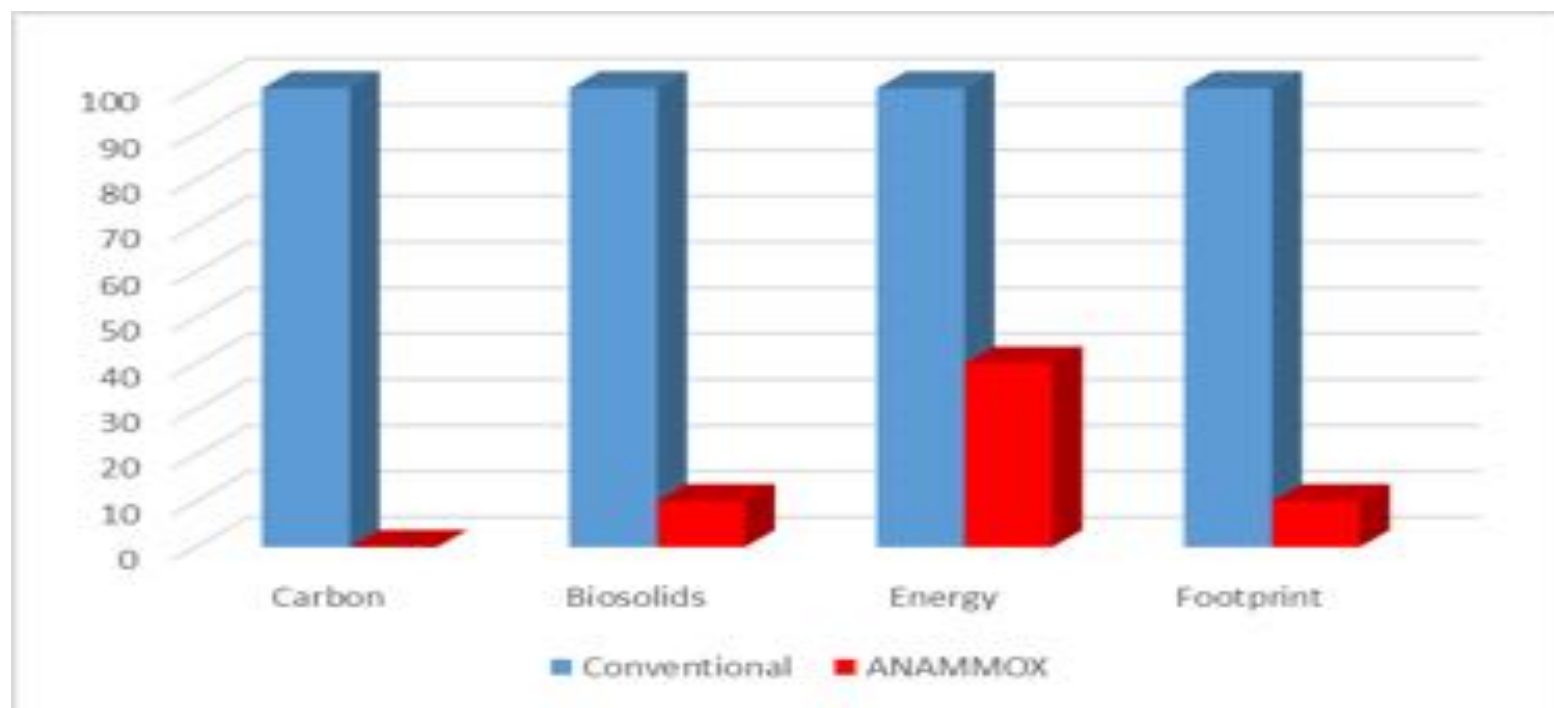


Ovivo is the exclusive licensee of Paques
ANAMMOX® technology for
North America

ANAMMOPAQ™ Sustainable Nitrogen Removal

- Anammox technology licenced to Paques - 1999
- First full-scale Muni Anammox WWTP in Rotterdam, NL
 - 2002 - Two stages
 - SHARON – ANAMMOX
 - Equivalent to ~47 MGD (2002)
 - Current flow ~ 62 MGD
- First full-scale, single stage
AnammoPAQ™ in Olburgen, NL (2006)
- >50 Plants treating > 115 tons N/d (2017)





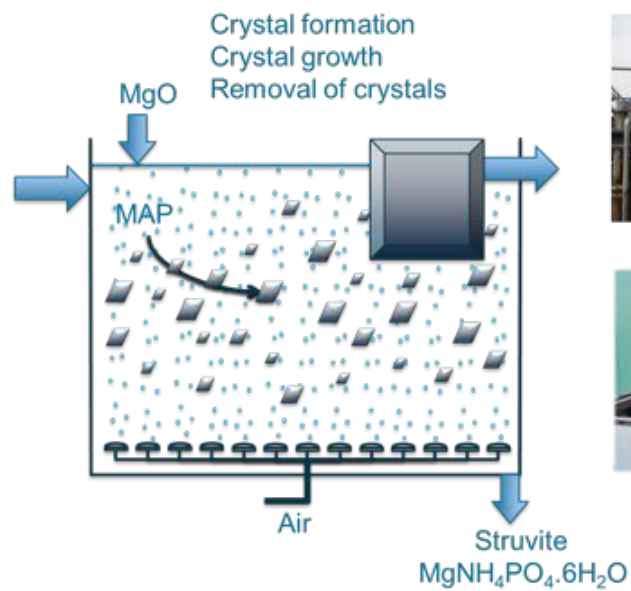




Topics

- Opportunity
- Solution
- **Treatment Considerations**
- Data and Case Studies
- Conclusions and Q&A

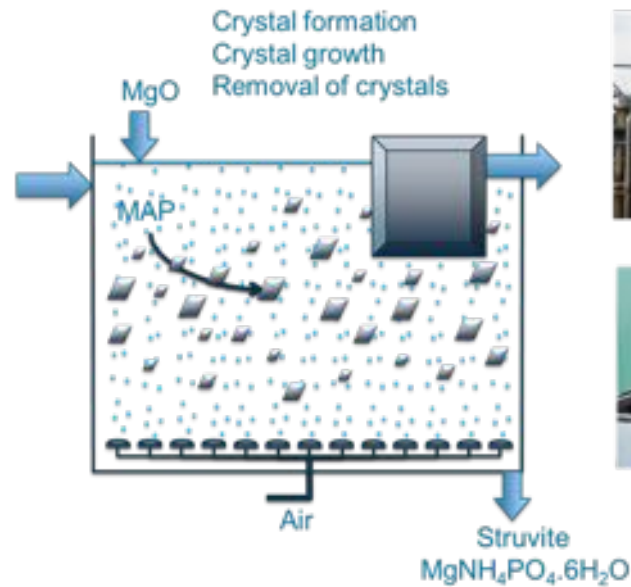
PHOSPAQ™ Phosphorus Removal/Recovery



Benefits of PHOSPAQ™

PHOSPAQ™

- PO₄-P removal
- BOD removal
- Neutralization of potential inhibiting components
- Alkalinity dosing (MgO) beneficial to ANAMMOX
- Prevention of downstream scaling (struvite)
- Fertilizer production



Greenfield Installation



Retrofit

- Using existing assets
- Pilot study in advance



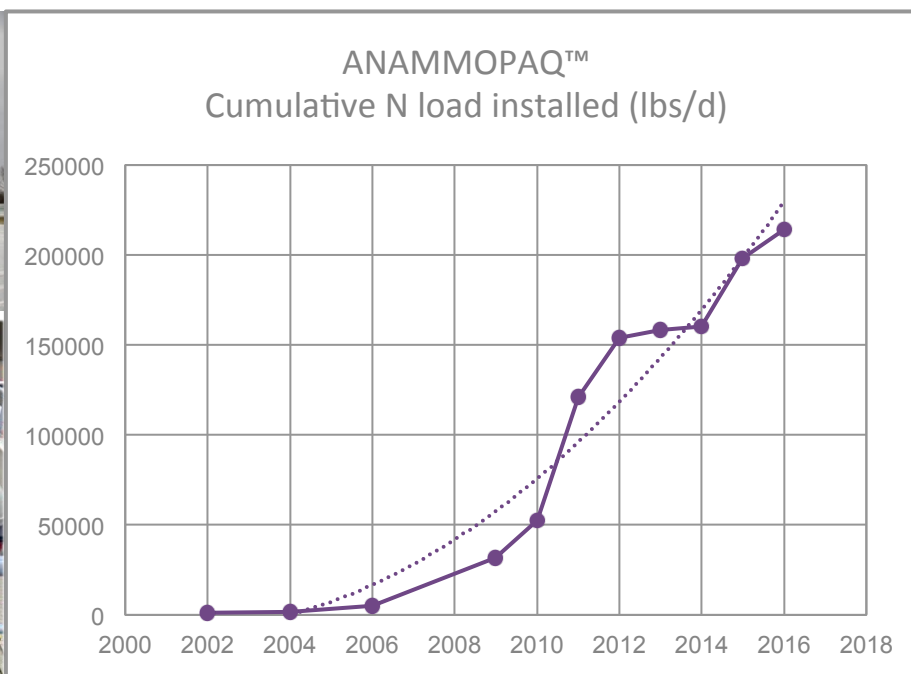


Topics

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- **Data and Case Studies**
- Conclusions and Q&A

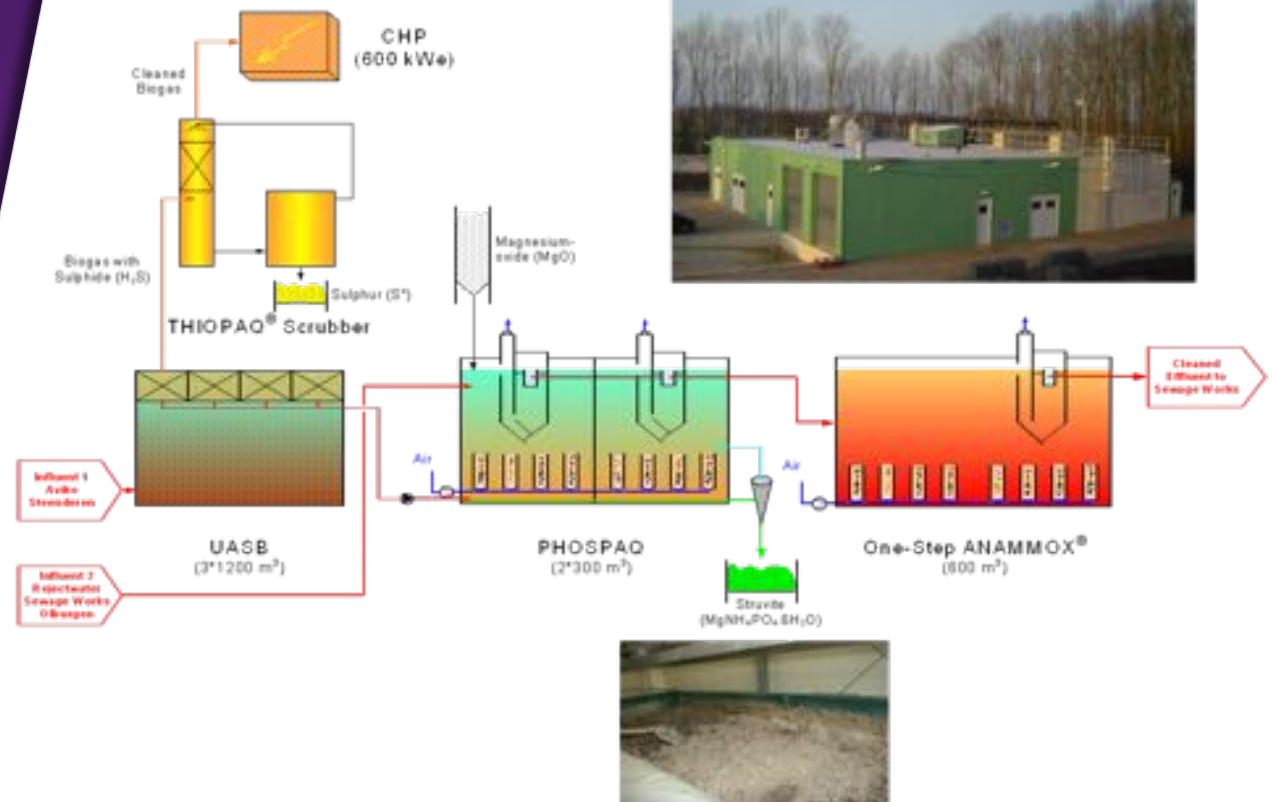


ANAMMOPAQ™ – Installed Base - > 50 Installations and > 250,000 lbs-N/d Cumulative Treatment Capacity

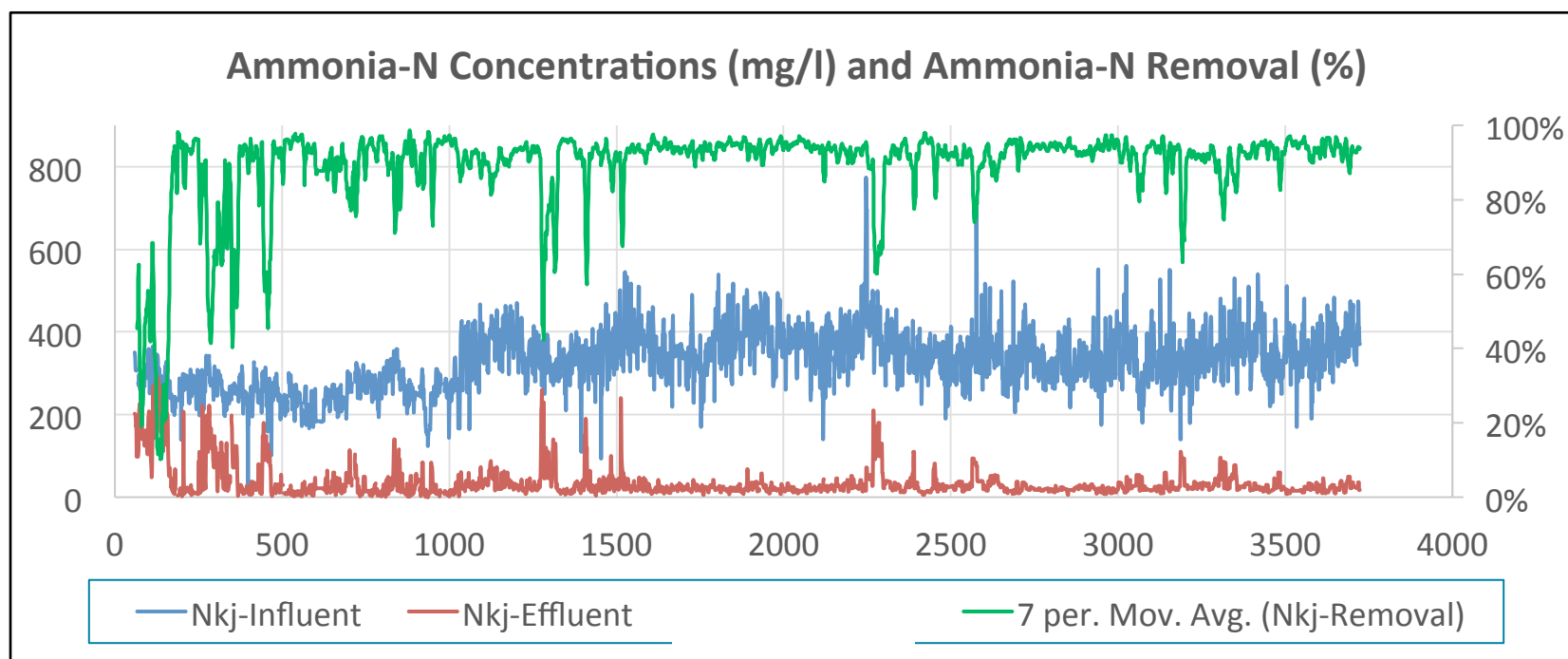


Case Study - Olburgen, NL

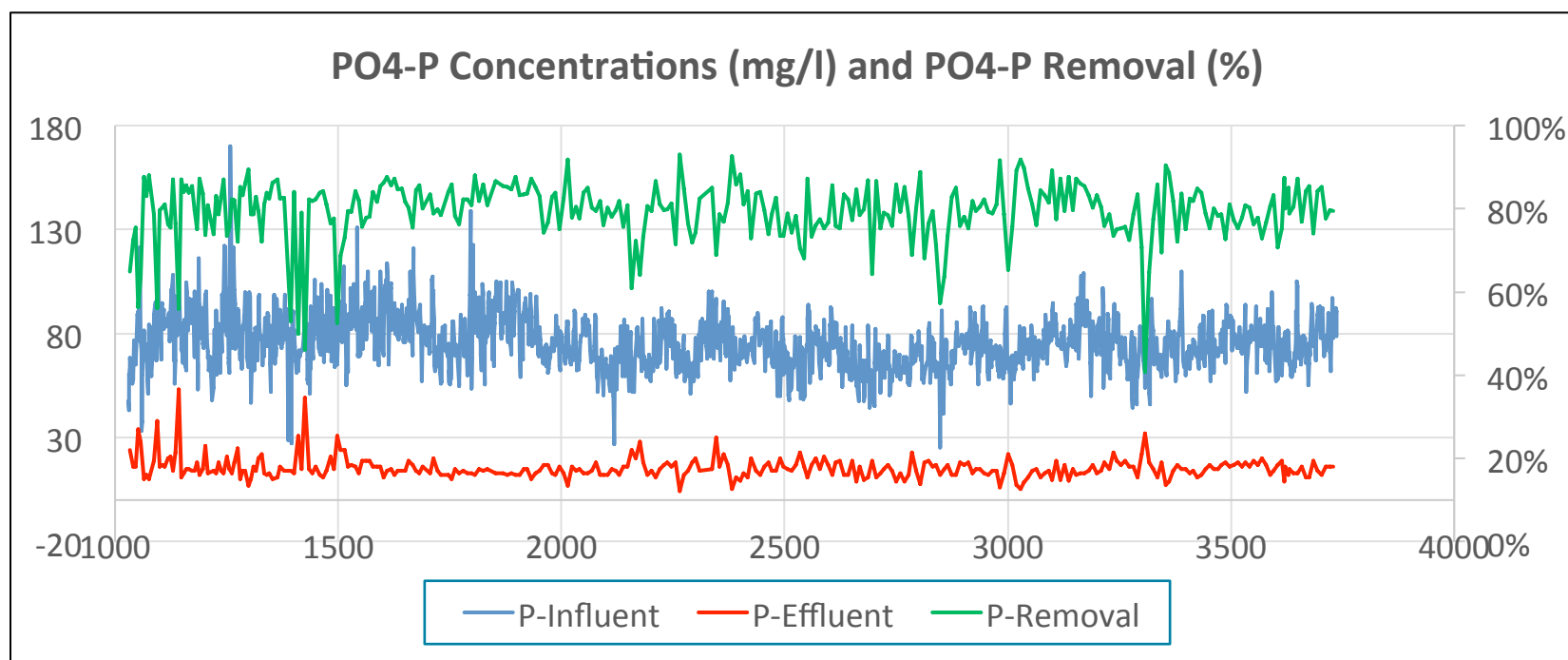
- Muni + Potato Processing
- Started in 2006
- 2,650 lbs. N/day (16 MGD equivalent)
- PHOSPAQ™ + ANAMMOPAQ™



N Removal



P Removal in PhosPAQ™

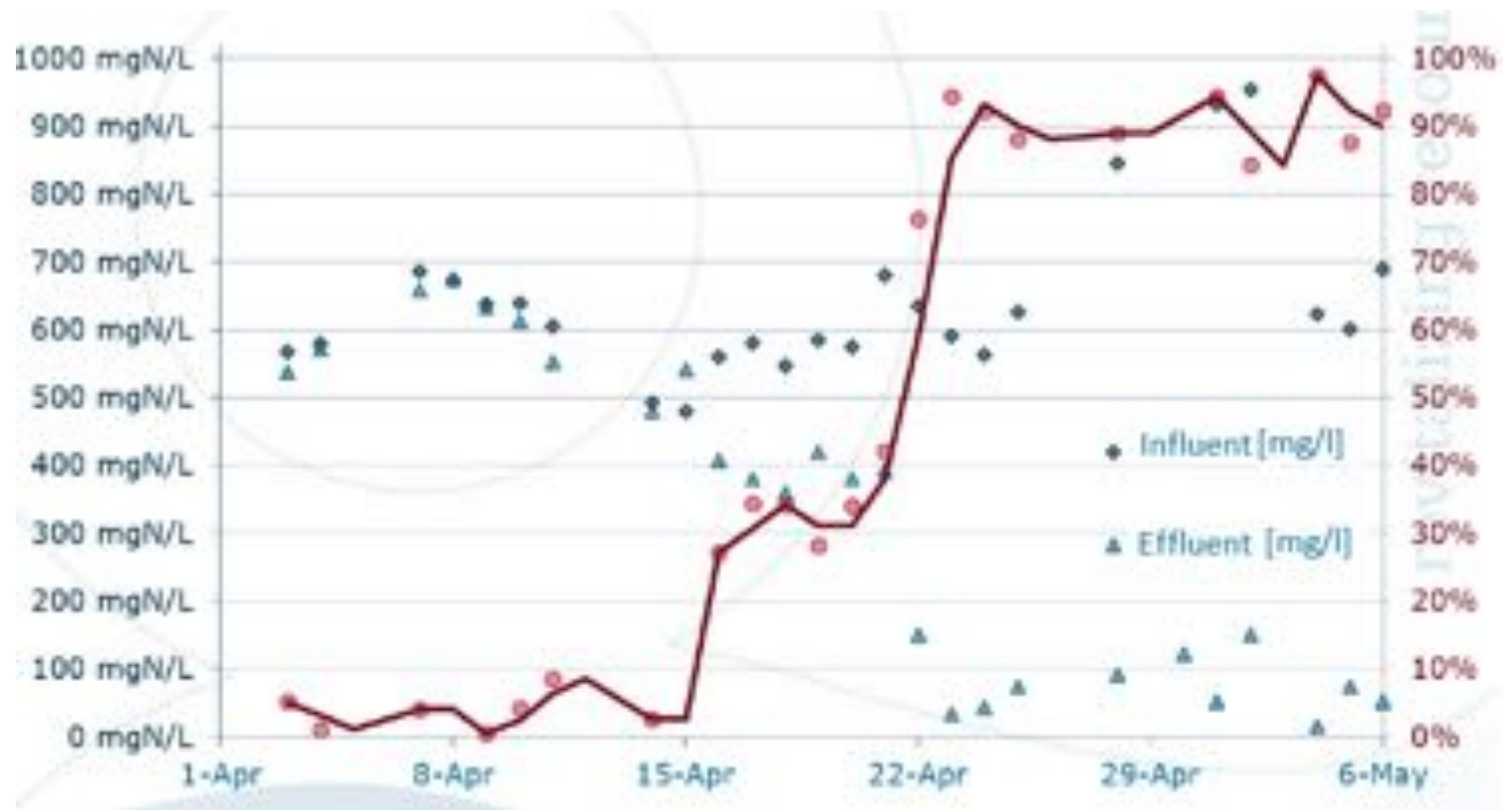


Case Study – Rendac, NL

- Rendering plant
- Largest in Europe
- 6,000 kg N/d (13,000 lbs. N/d) – 80 MGD equivalent
- Modular design

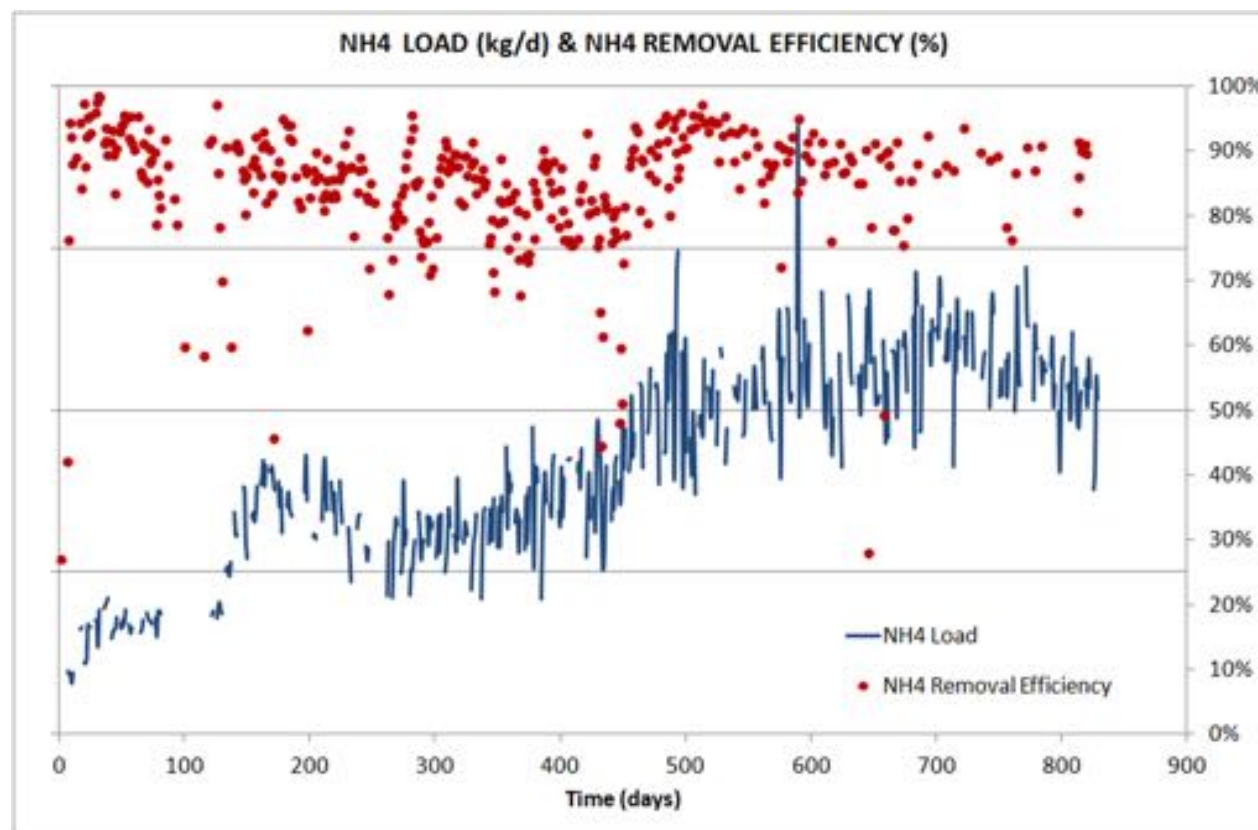


Startup time
< 4 weeks!

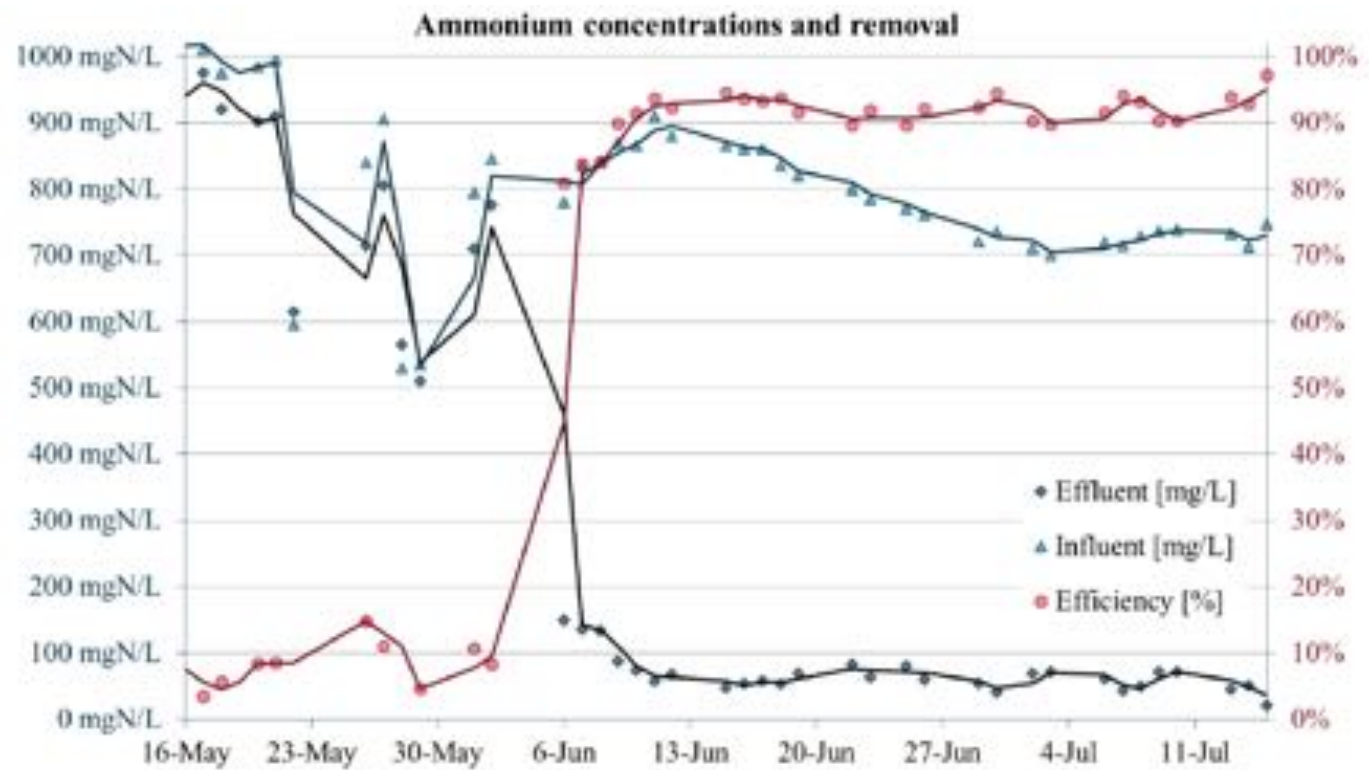


Efficiency > 92 %
Ammonia-N

Efficiency > 85 % TN



Startup time
< 4 weeks!





Topics

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- **Conclusions and Q&A**



Conclusions

ANAMMOPAQ™ process is a mature and robust technology

15+ years of experience (> 115 t N/d 250,000 lbs N/d installed)

NH₄ Removal efficiency: Up to 90-95 % NH₄-N

Short start up time

Compact footprint (Granular Sludge)

Stable, easy to operate



In Case of Questions Please Contact

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