VEOLIA

Suitable anaerobic technologies for Dairy resource recovery

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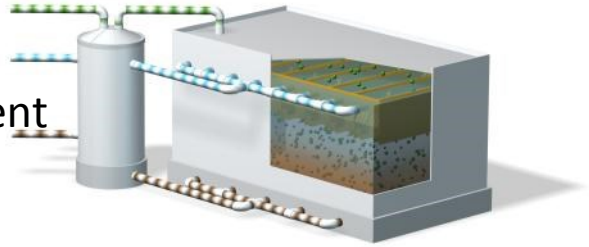
Biothane's Granular Technologies

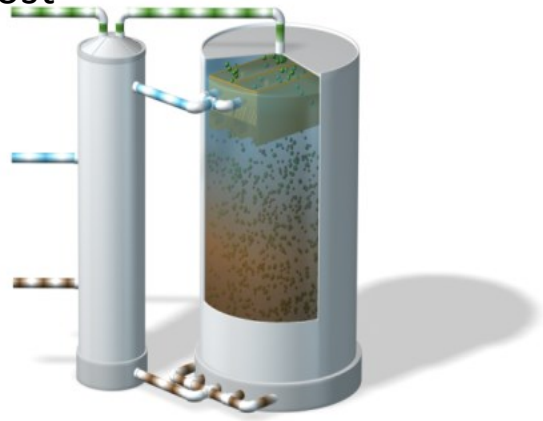
Biothane Advanced UASB

- Well proven technology with new three-phase-separator for all industrial wastewaters
- Robust, with high sCOD removal efficiency
- Restriction for SS (<1,000 mg/l) and FOG (< 100 mg/l) content



Biobed® Advanced ESGB

- High rate technology with new three-phase-separator for most industrial wastewaters
- Less volume , less foot-print with similar sCOD removal efficiency
- More sensitive regarding SS and FOG



Biothane's non-granular technologies

Biobulk CSTR

- Solid waste / waste slurry digestion
- With or without sludge recirculation
- Suitable for high COD / FOG / SS and low flows

Memthane® Anaerobic MBR

- New technology for high strength wastewater
- Using Cross-flow UF membranes
- Very High COD / SS removal efficiencies

Dairy effluent characterization

Milk Processing

- *Production cleaning, CIP*
- *High flow rates*
- *COD 1,500 – 3,000 mg/l (Proteins, Fat)*
- *TSS 300 mg/l,*
- *FOG 100 – 300 mg/l*
- *15 – 25 °C,*
- *Usually high P, high N*
- *Not always anaerobic applicable due to low SCOD*
- *Good biodegradability*

Cheese / Yogurt

- *Production cleaning, CIP, plus whey*
- *Low flow rates*
- *COD 1,500 – 10,000 mg/l (Proteins, Fat, lactic acid)*
- *TSS 300 mg/l*
- *FOG 300 – 1000 mg/l ,*
- *20 – 25 °C*
- *Usually high P, lower N*
- *Anaerobic applicable, sophisticated choice of technology*
- *Good biodegradability*
- *Additional COD source: acid whey (COD 60,000 mg/l, very well degradable)*

Ice-cream

- *Production cleaning, CIP*
- *Medium flow rates*
- *COD 3,000 – 20,000 mg/l (sugar, starch)*
- *TSS 100 mg/l,*
- *FOG 100 – 200 mg/l*
- *15 – 25 °C*
- *Usually lower P, lower N*
- *Anaerobic applicable*
- *Good biodegradability*

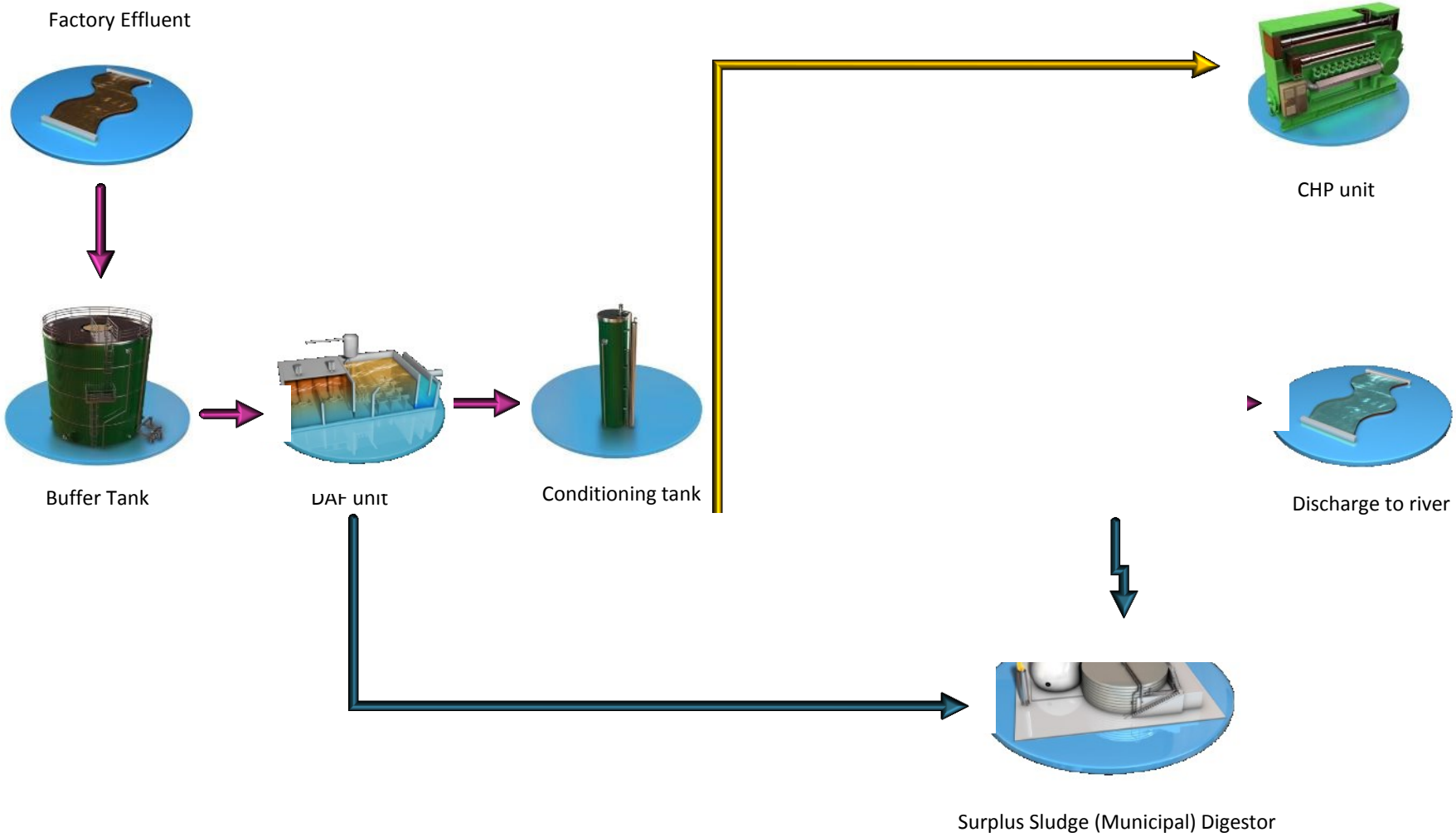
Case Study 1 - Ice-cream, Germany 2003

- Effluent from Ice-cream production
  - *High in COD*
  - *Fluctuations in FOG and COD content depending on production*

- Flow 800 …1,300 m^3/d
- COD 3,000… 25,000 mg/l

- Pre-treatment
- Granular sludge reactor (Biobed EGSB)
- DAF-float to municipal digestor
- Anaerobic effluent to municipality
- Municipal Sludge Digestor

Case Study 1 - Ice-cream Germany 2003



Case Study 1 - Ice-cream Germany 2003

- <u>Operational results – COD reduction</u>

- DAF unit: total COD removal: 25 – 30 %
- FOG removal: 60 – 70%
  - *to municipal sludge digester*

- Anaerobic: total COD reduction: 70 – 75%
- soluable COD reduction: 80 – 85%

- Total COD reduction: 83 %,

- Biogas conversion in EGSB plant: 70% of the total COD = 2,000 Nm^3/d plus extra biogas due to floating sludge in municipal digester.

Case Study 2 – Mlekovita Dairy Poland 2011

- Dairy north-east of Poland – production extension, retrofit of existing plant
- Production of milk, butter, yogurt, cream, cottage cheese
- Presence of acid whey waste stream

- High Flow = 5,000 m³/d, low temperature 20 – 25 °C
- COD load: 30,000 kg/d
  - *Highly fluctuating depending on production cleaning cycles*

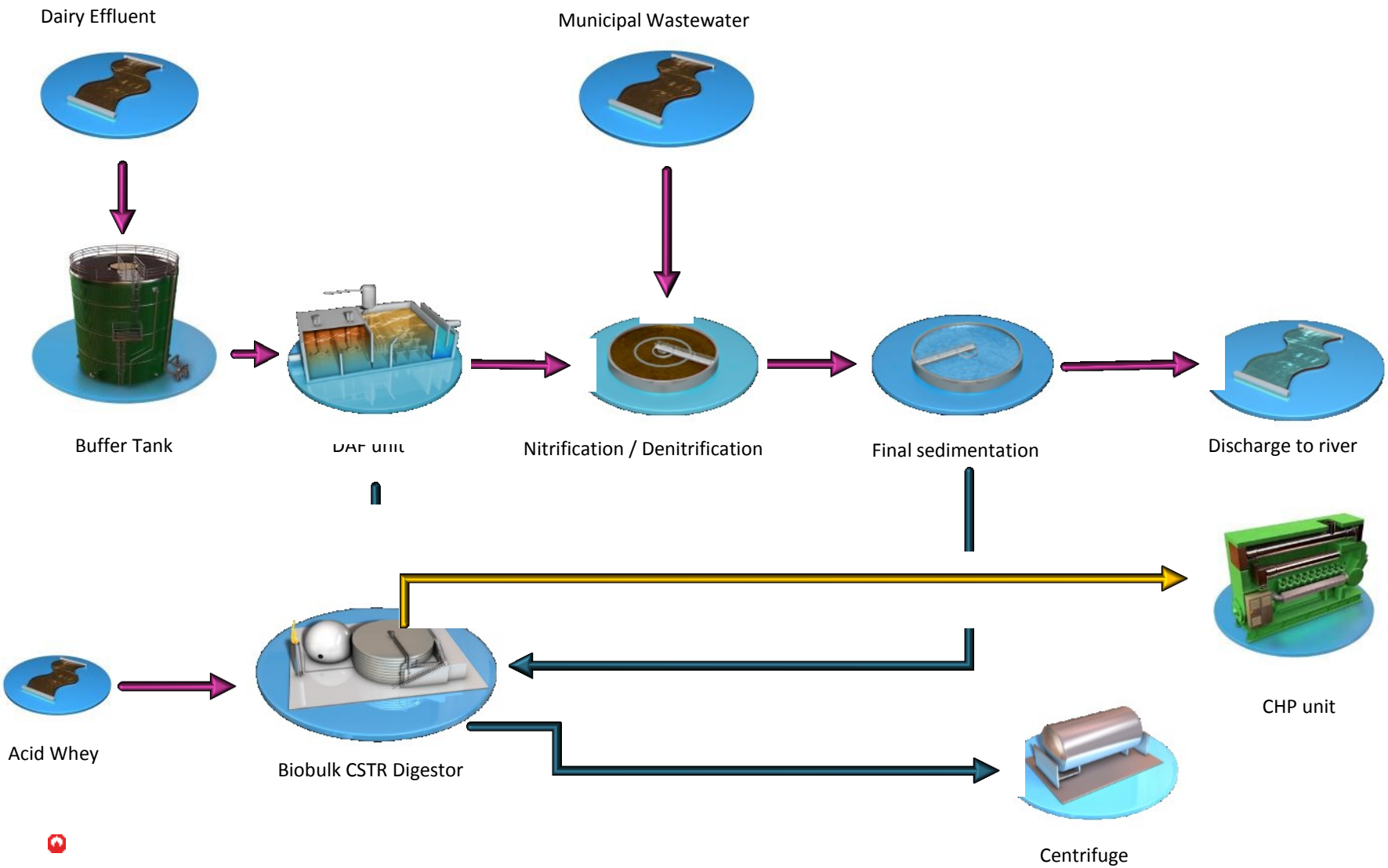
Process choice:

- Optimized DAF separation step

- CSTR process for DAF float, acid whey and aerobic surplus sludge
  - *7000 m³ reactor*
  - *20 tCOD/d*

- Use of existing aerobic wwtp

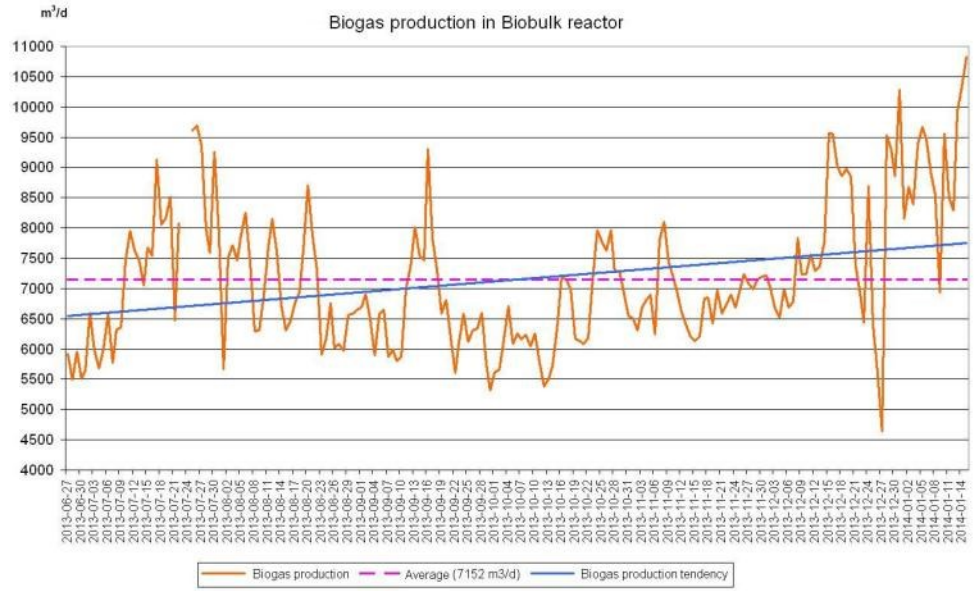
Case Study 2 – Mlekovita Dairy Poland 2011



Case Study 2 – Mlekovita Dairy Poland 2011

- Operating results of the anaerobic system with COD load of 18,000 kg/d

- TCOD reduction 63 %
- TSS reduction 40%
- Biogas production: 7,150 m³/d and 60 - 65% CH_4



Case Study 3 - Arla Dairy, UK

- Co-operative for processing of 1.1 billion liter fresh milk / year
- ARLA: “Arla is aiming for the dairy to be world‘s first zero-carbon emission milk processing facility using cutting edge renewable energy solutions“
- Design Phase 1: COD removal – biogas production

Case Study 3 - Arla Dairy, UK

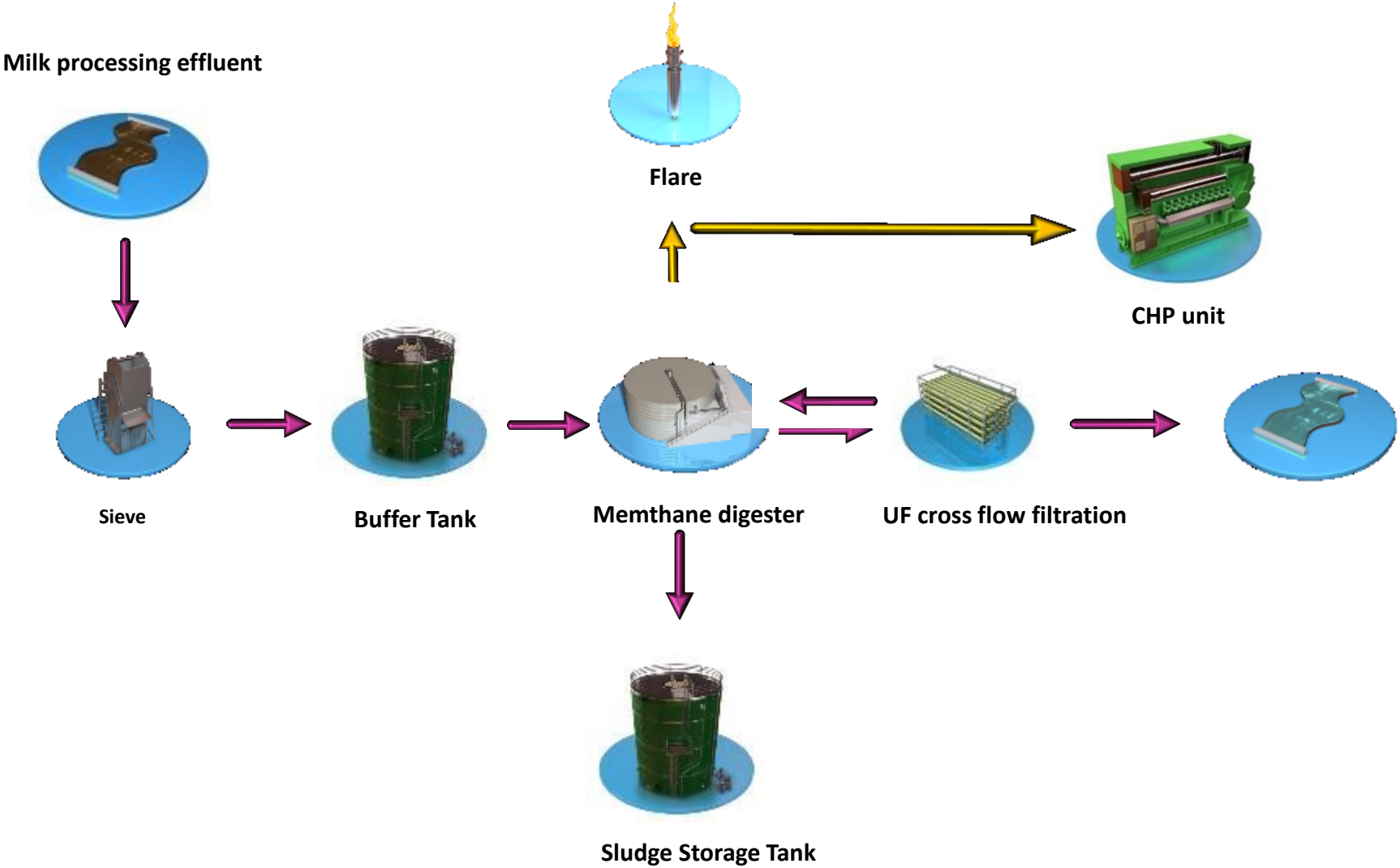
Process choice:

- **Memthane® Anaerobic MBR**
  - *700 m^3 reactor*
  - *5 tCOD/d*
  - *3 external cross-flow membrane skids for 550 m^3/d*

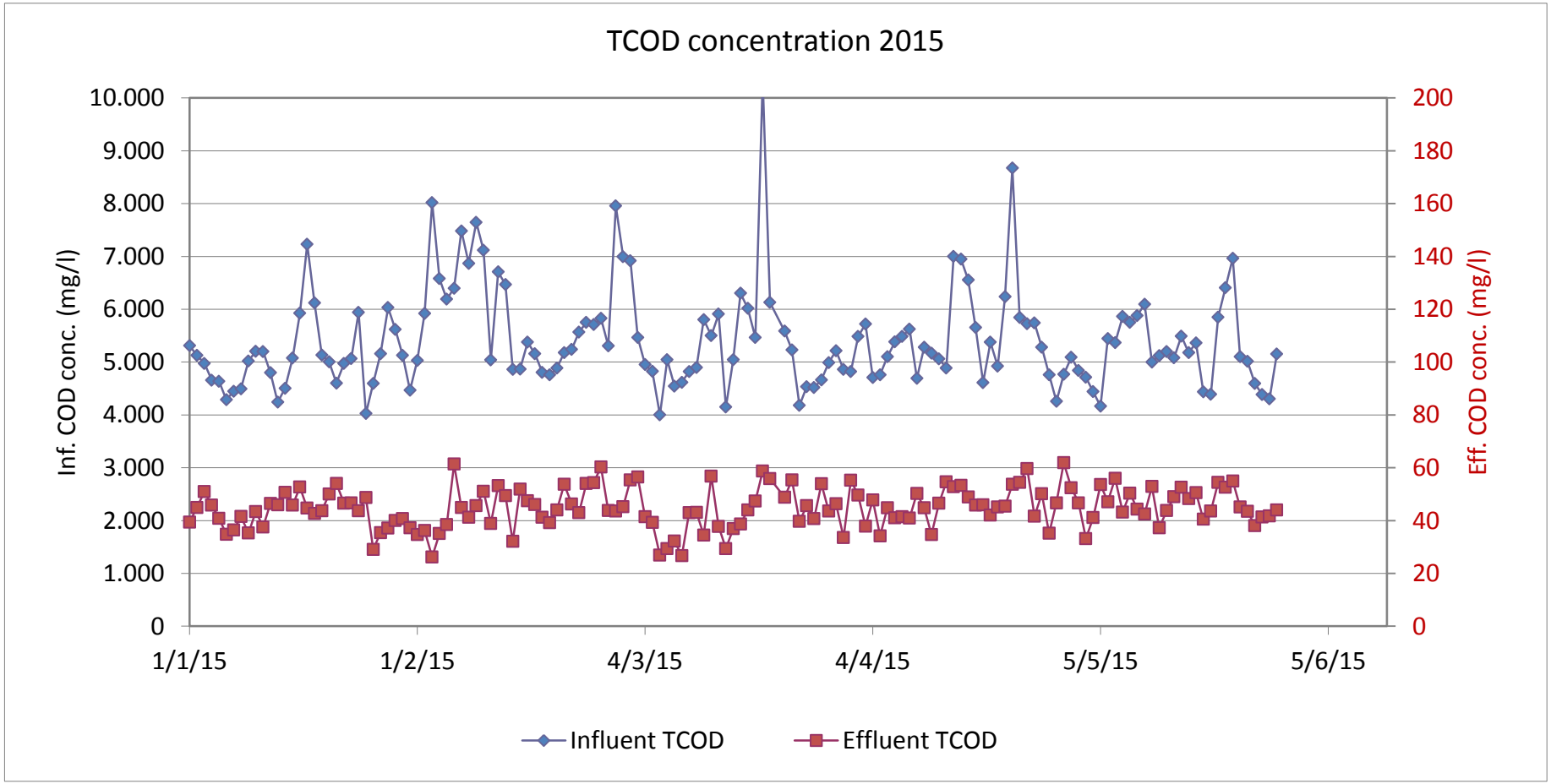
Design Phase 2:

- *AnMBR extension due to production increase*
- *Advanced N – removal with Anitamox ® deammonification MBBR process*
- *Advanced P - removal*

Case Study 3 - Arla Dairy, UK



Case Study 3 - Arla Dairy, UK



Permeate TCOD < 100 mg/l, TCOD removal > 99%
Producing >10% of Arla‘s energy consumption out of their residues

Thank you for your attention
Questions?

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