



Separation by flotation
with the MUSLING™ process
Jan Henrik Knudsen

The MUSLING™ - history

The first DAF-plant was constructed already in 1898:

- **1898** **DAF for oil, F.E. Elmore.**
- **1902** **DAF with dissolved air, G.D.Delport.**
- **1929** **Sulitjelma Mining Company. The largest DAF in the world in 1929.**
- **1981** **MUSLING™ was invented and patented.**
- **2001** **JO Water acquires the patent.**
- **2005** **MUSLING™ Generation 2 is patent pending.**
- **2005** **AnoxKaldnes acquires JO Water**

The MUSLING™

- The MUSLING® has been thoroughly documented and tested since 1981.
- In 2006 there are some 140 plants in operation.

aquateam RAPPORT

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Rapportnummer: 97-170
Tilgjengelighet: Åpen
ISBN nr.:

Rapportens tittel	Dato
Muslingen som koagulerings- og separasjonstrinn for biologisk rensat avløpsvann fra næringsmiddelindustri	01.12.97
Forfatter(e) (Sign)	Antall sider og bilag
Asgeir Wien	31
Bjørn Rusten	Årsv. sign.
	Bjarne Paulsrud
	Prosjektnummer
	O-96078

Oppdragsgiver	Oppdr. givers ref.
Brødrene Dahl AS	Per Egeberg

Ekstrakt: Det har vært gjennomført forsøk med Muslingen på avløpsvann fra rensesanlegget til AS Maarud. Den hydrauliske overflatebelastningen og slamoverflatebelastningen var mellom 9 og 12 ganger større i Muslingen enn i de konvensjonelle sedimenteringsbassengene ved Maarud. Det ble oppnådd tilnærmet samme rensesresultater som på Maarud rensesanlegg under forsøkskjøringen. Det ble oppnådd gode rensesresultater med hydrauliske overflatebelastninger opp mot 7,3 m³/m²h med vann fra lagune 2. Slamproduksjonen i anlegget var da ca. 12,6 kg TS slam produsert/m²h. Maksimal slambelastning, med gode rensesresultater, var 20,5 kg TS slam produsert/m²h. Den hydrauliske overflatebelastningen var da 4,9 m³/m²h med vann fra lagune 3. Ved høye slambelastninger vil Muslingen være begrenset av dispersjonsvannmengden. Forholdet mellom kg TS slam og dispersjonsvannmengde bør ikke overstige 15 kg TS slam/m³ dispersjonsvann dersom det skal oppnås tilfredsstillende rensesresultat. Avhengig av kvaliteten på vannet inn til Muslingen varierte JKL-doseringen mellom ca. 300 og 950 ml/m³ for å oppnå tilfredsstillende rensesresultater. Relatert til stoffbelastningen er dette lav dosering sammenlignet med tilsvarende forhold mellom JKL-doseringen og stoffbelastningen på kommunale anlegg. Med noe tekniske utbedringer av Muslingen forventes prosessen å ha enda større kapasitet enn vist i disse forsøkene, på samme type avløpsvann som man har ved AS Maarud sitt rensesanlegg.
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Stikkord - norsk	Stikkord - engelsk
Flotasjon	Flotation
Industriavløp	Industrial waste water
Potetindustri	Potato industry
Luftede laguner	Aerated lagoons

FE: F:\ASW\PROSJEKT\96078\TEKSTRAPPORT\BR2.SAM

Aquateam AS

Side 2-32
Revisjonsdato:

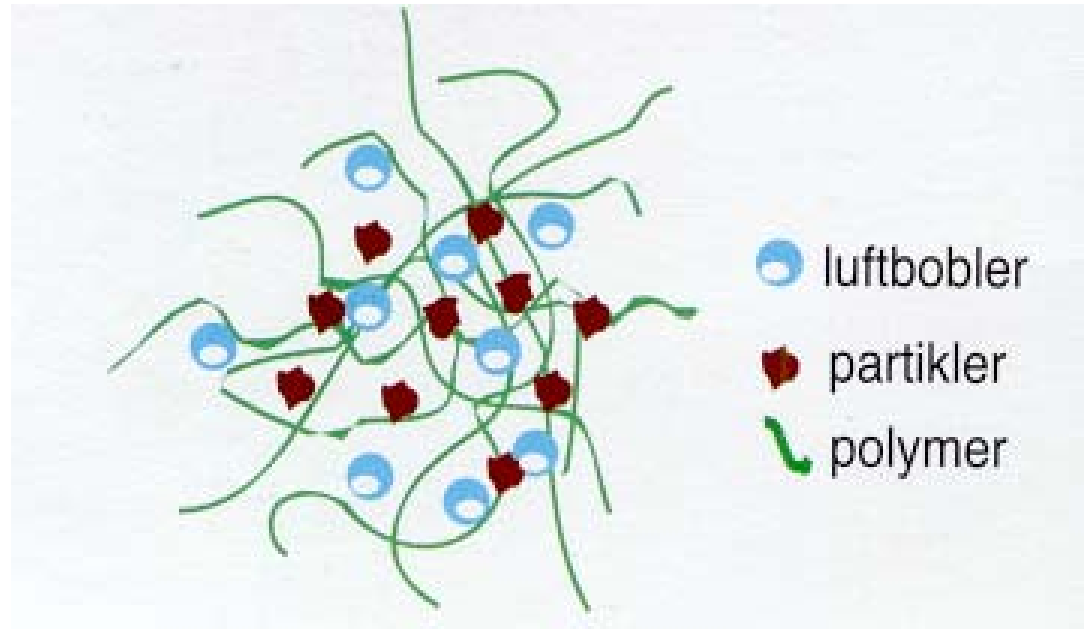
Dato: 01.12.97
Versjon: 1

Flotation I



- **Density**
- **Velocity**
- **You can't float rocks.**

Flotation II



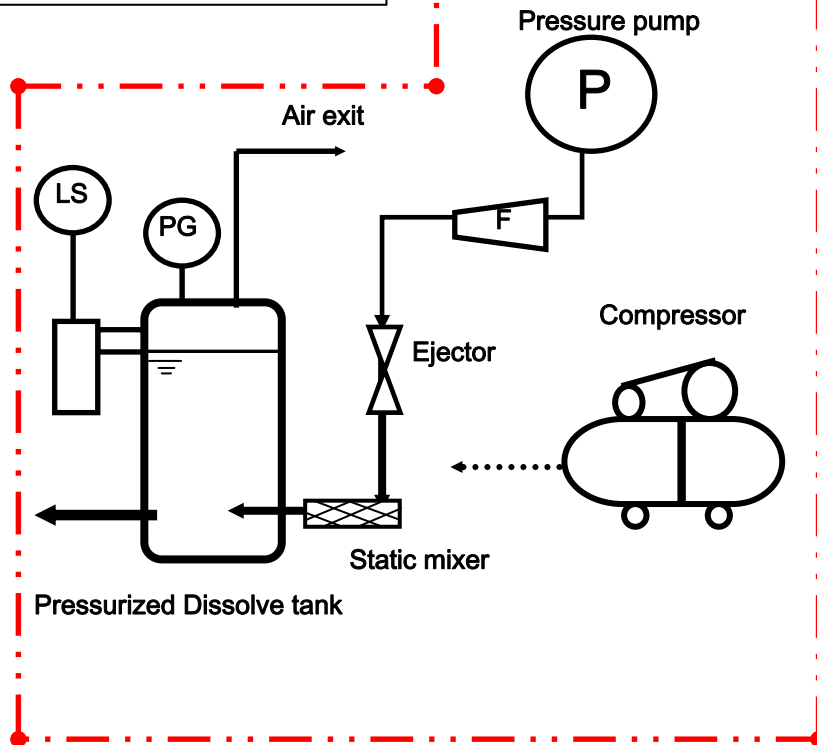
Dispersion water production NIKUNI – one step

- A NIKUNI pump is a turbine pump which can suck air for one-step dispersion water production.
- The dispersion water is produced without use of compressors, ejectors, pressure tanks.
- Pressure 4 bar.
- Energy consumption 0,4-0,5 kWh / m³.
- Bubbles 20-80 µm.
- Climbing speed 10-20 cm / min

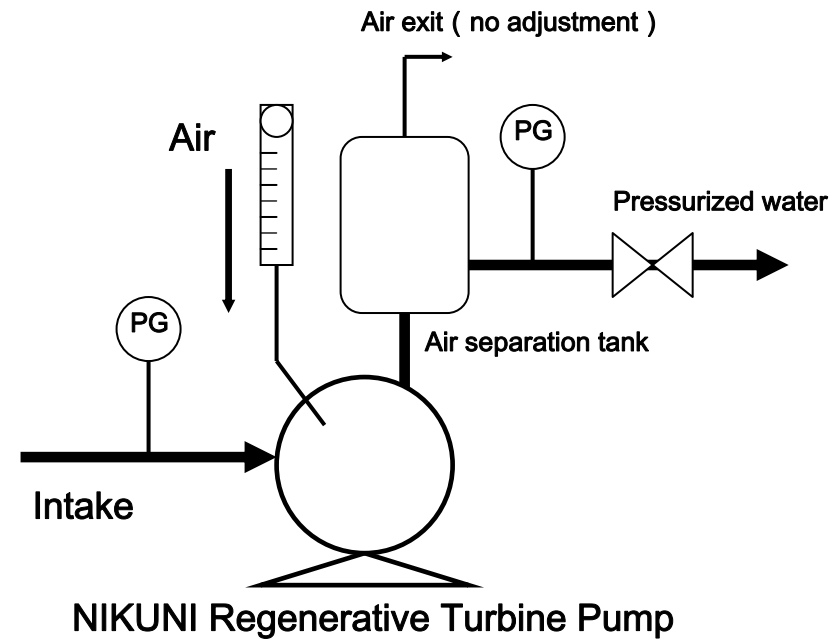


NIKUNI one step

CONVENTIONAL METHOD

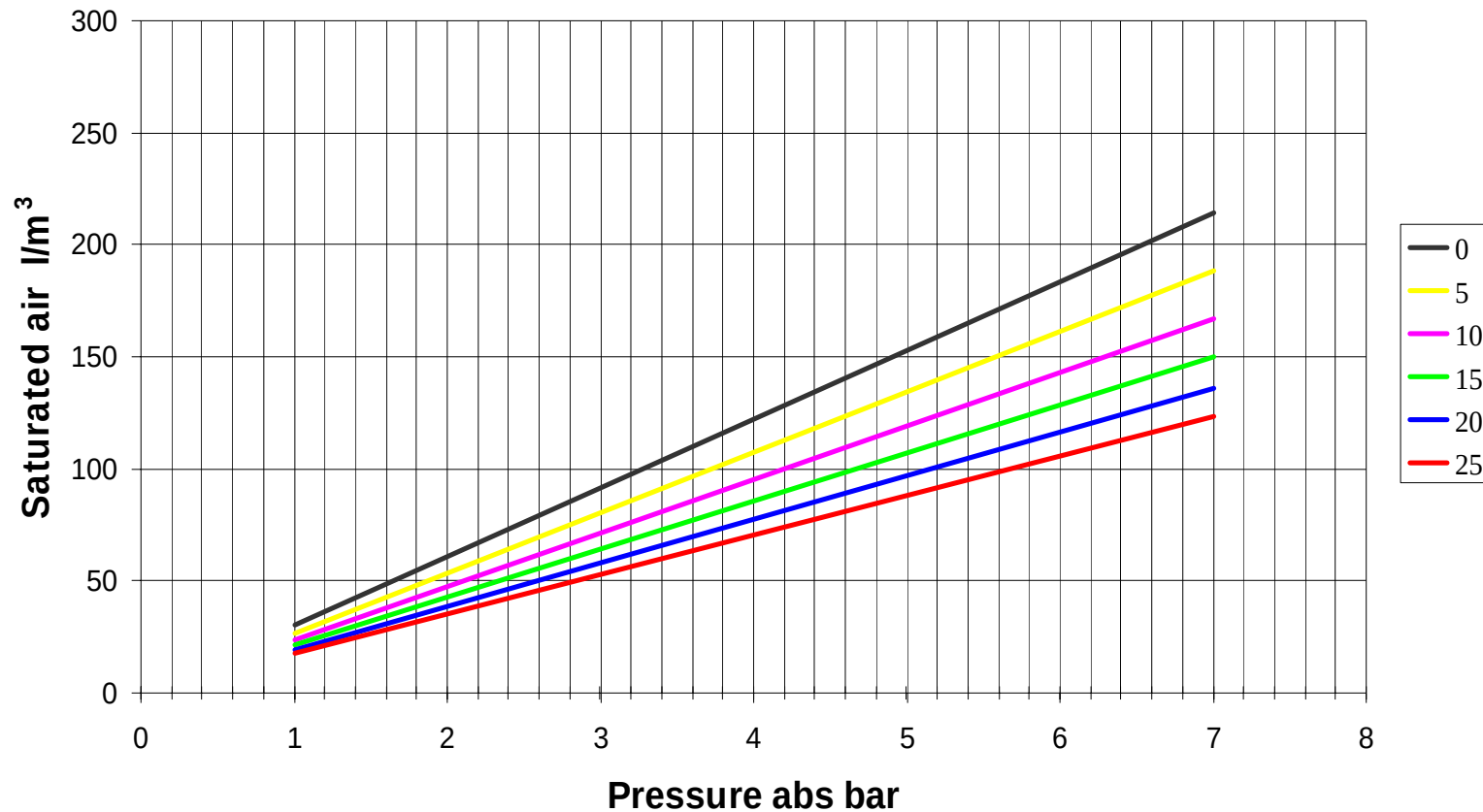


NIKUNI METHOD



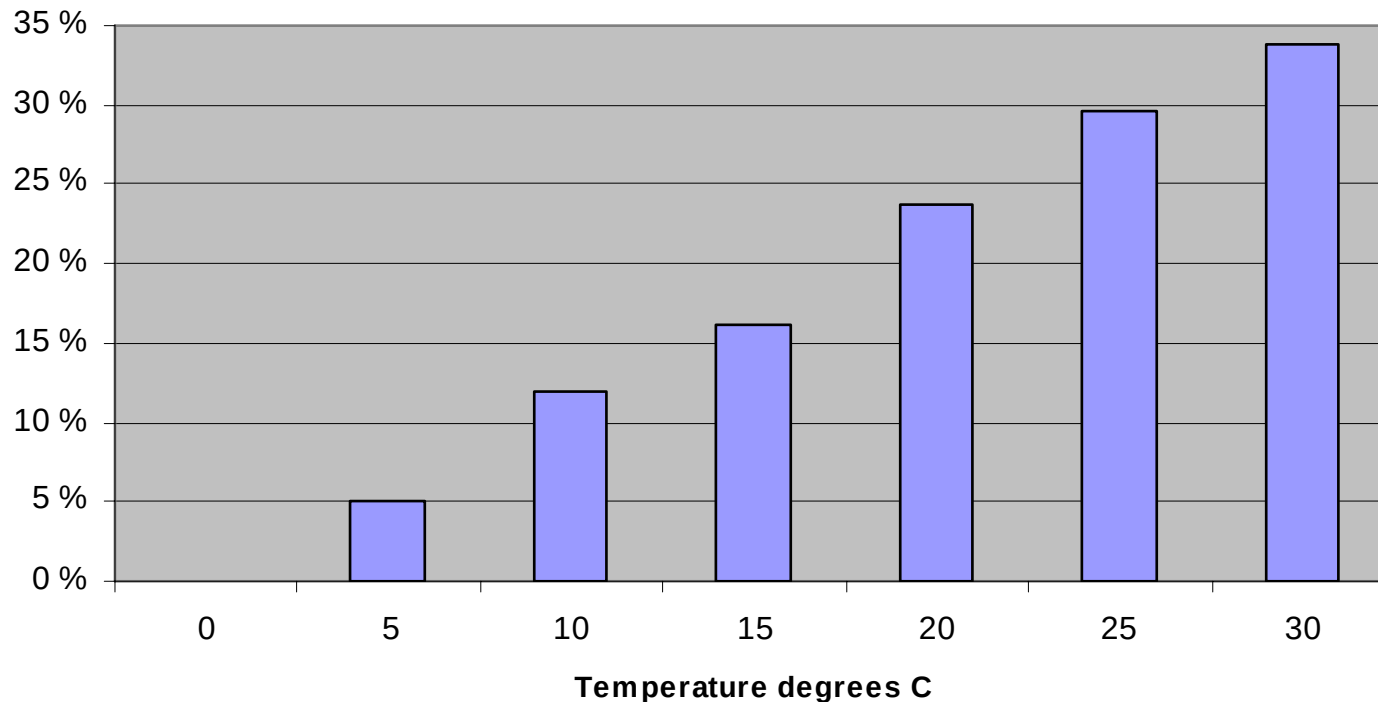


Dispersion water production

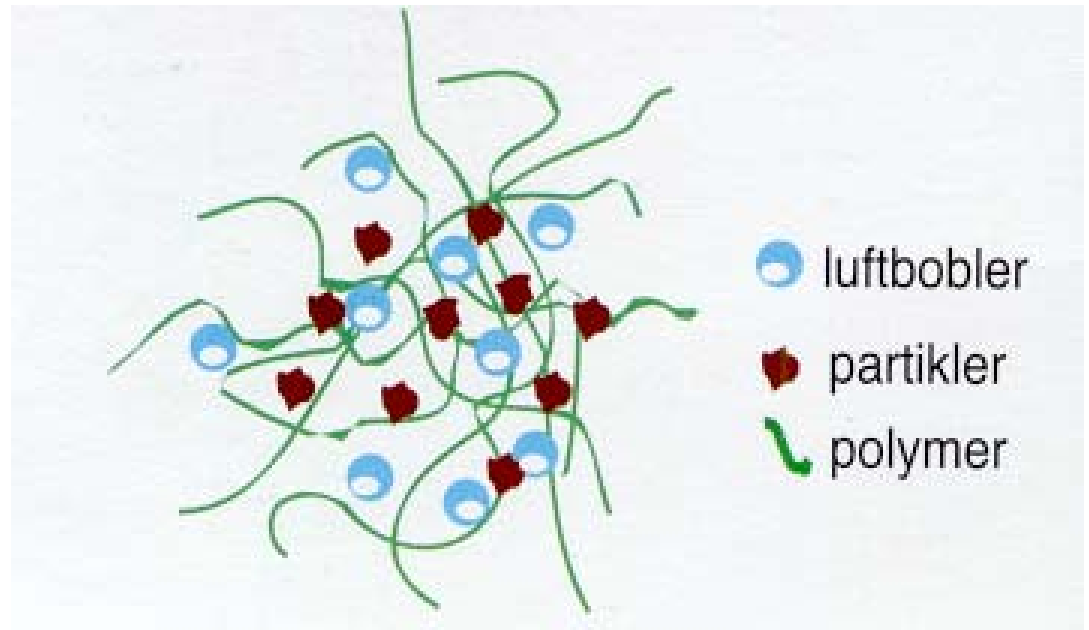


Dispersion water production

Necessary increase of dispersion water volume as a function of water temperature

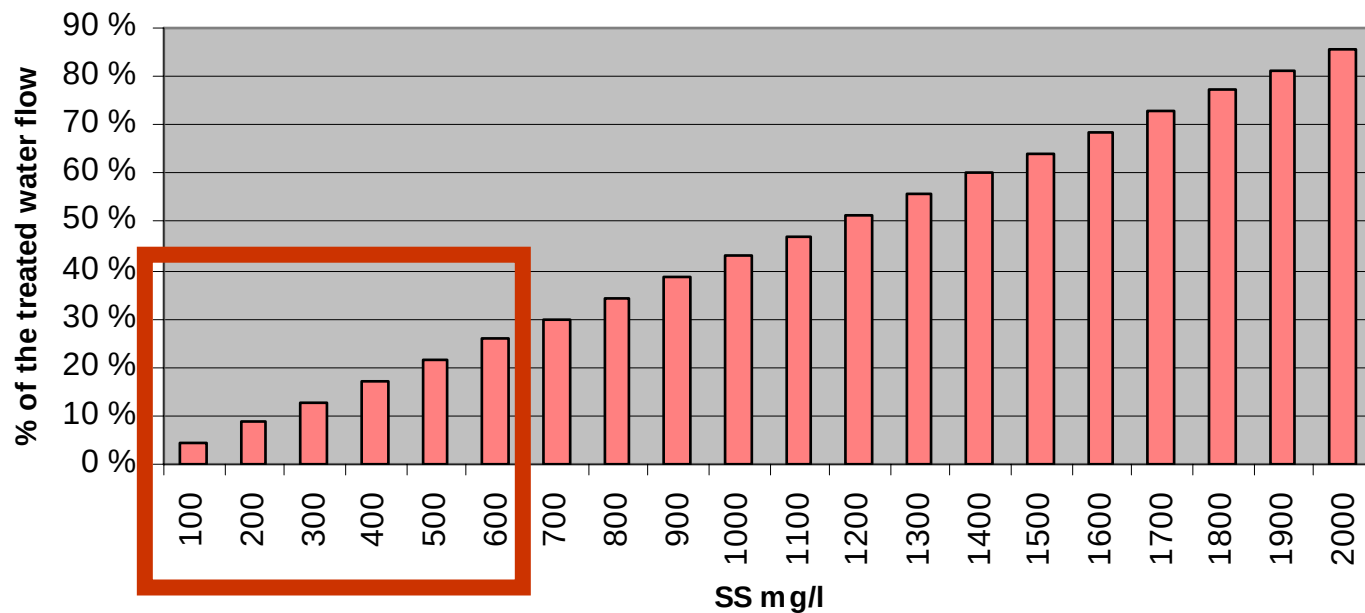


Flotation II



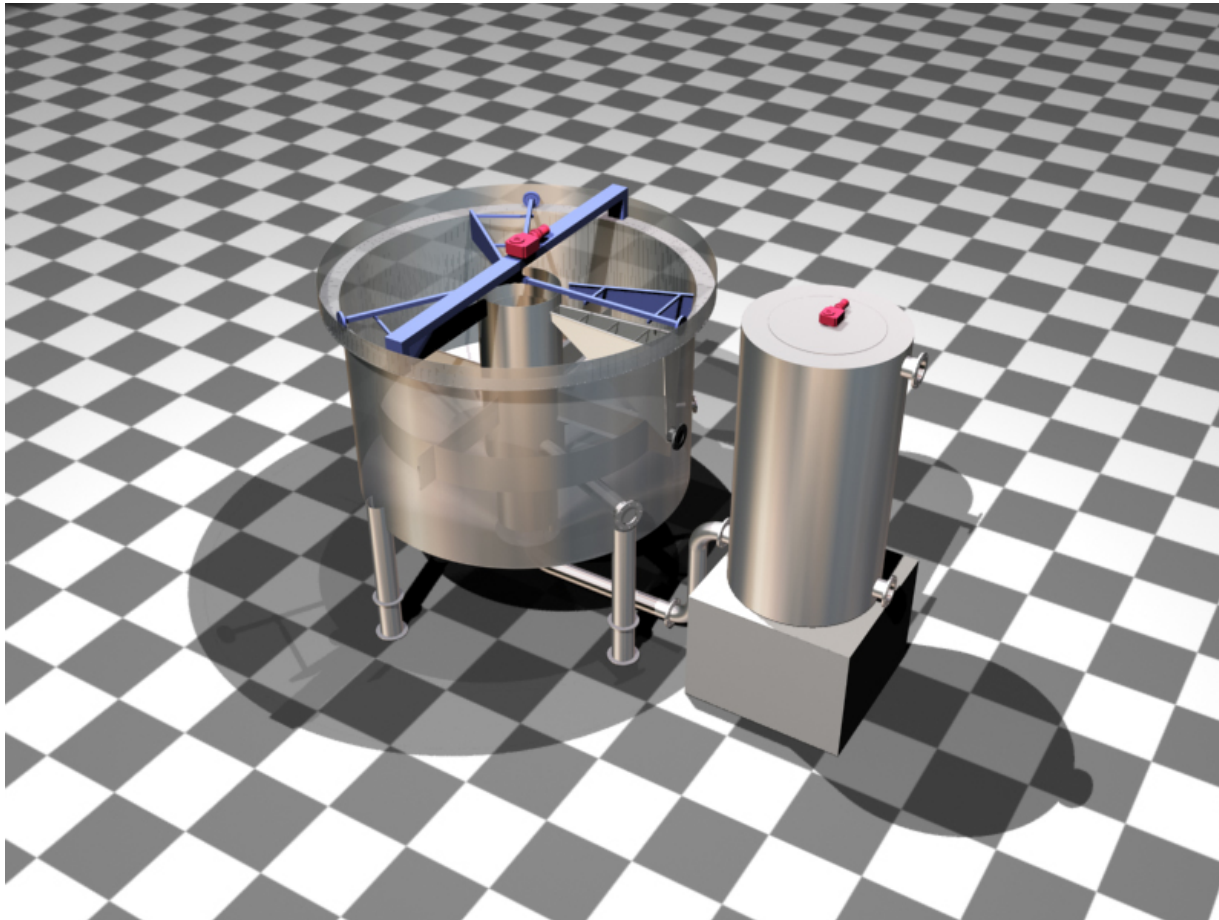
Suspended solids

Necessary dispersion water in % of treated water flow
at 6 bars and 7 degrees C



■ Volum dispergeringsvann ved L/S=0,03

MUSLING™ - Generation 2



MUSLING™ - generation 2

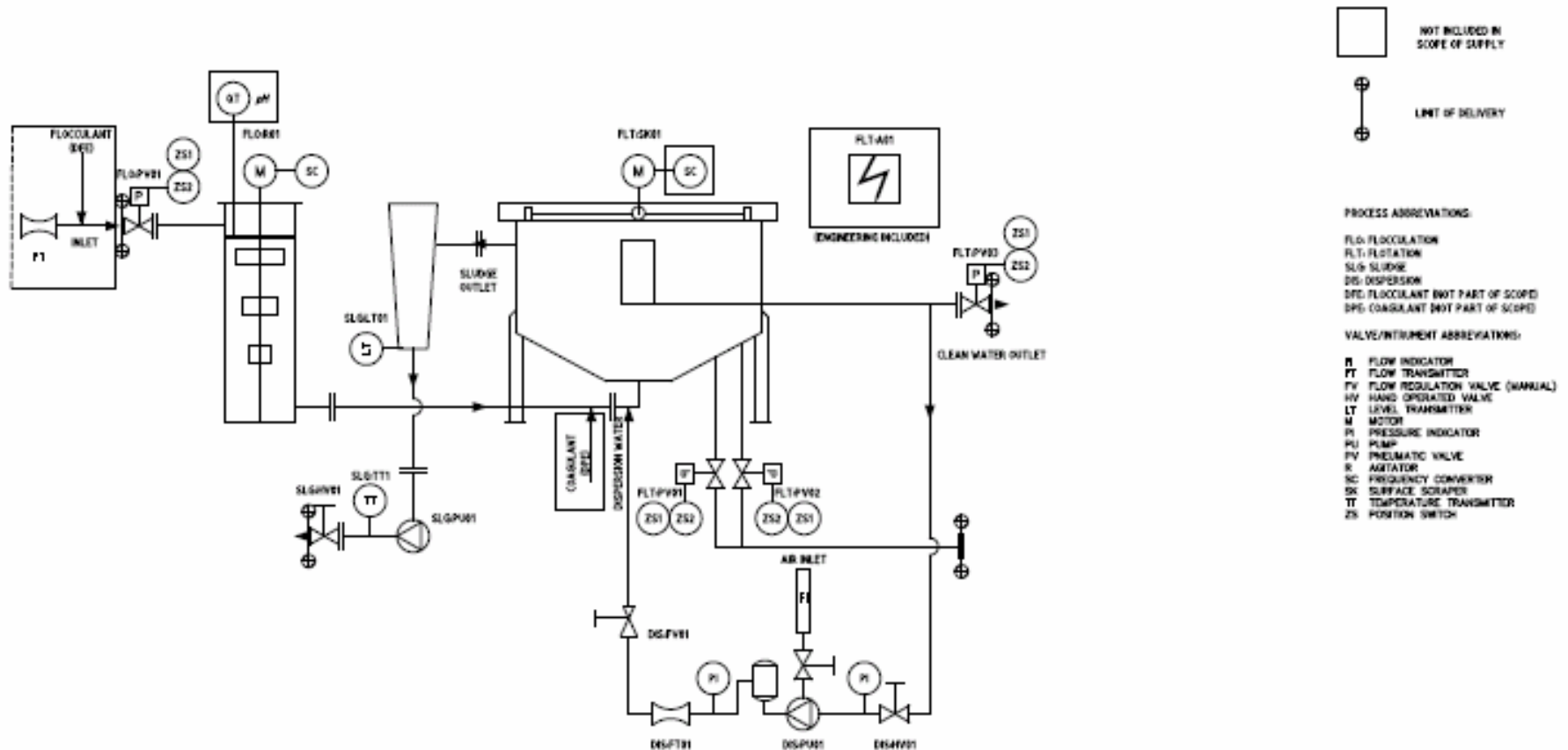
- **Inlet**
- **Chemical dosing - flocculation**
- **Dosing dispersion water**
- **Hydraulic distribution**
- **Acceleration area**
- **Separation area**
- **Decanting area**
- **Outlet**
- **Sludge hopper**

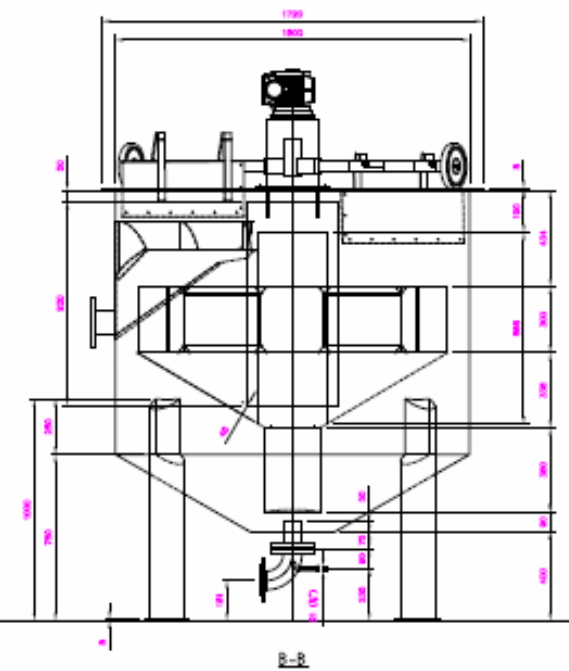
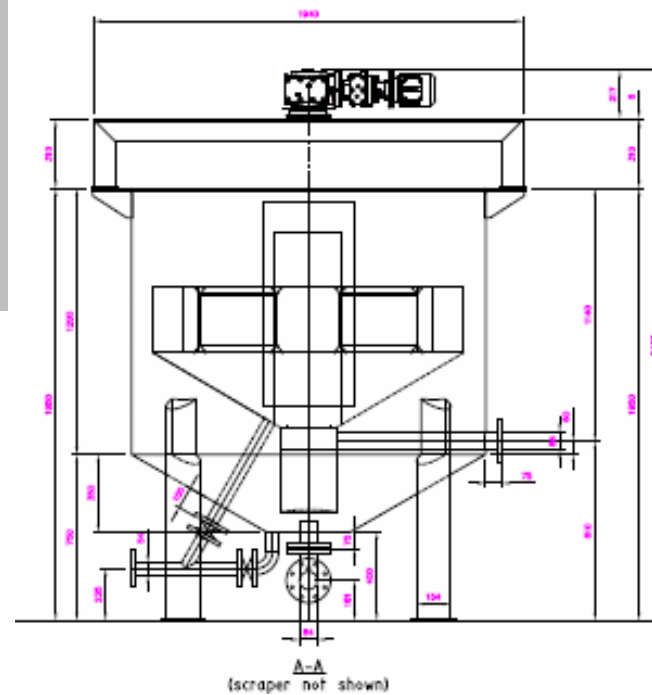
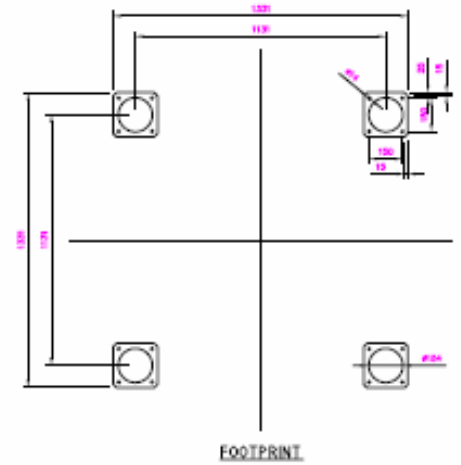
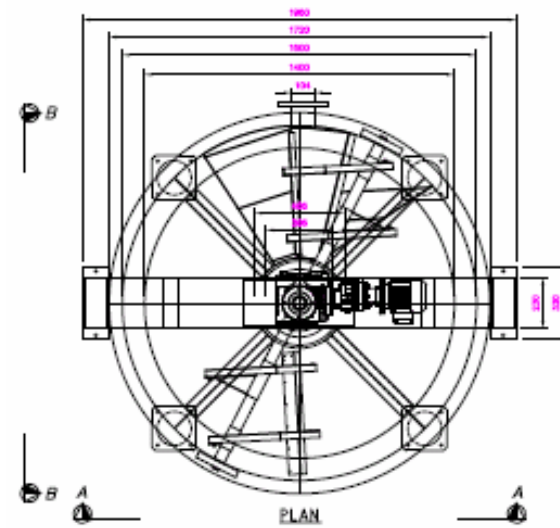
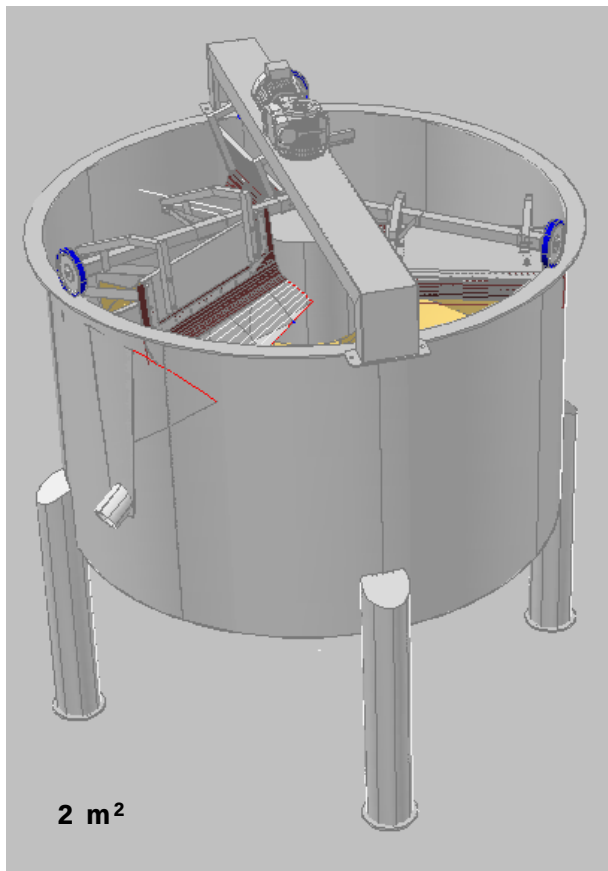


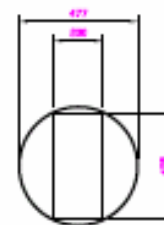
MUSLINGEN™



Typical P&ID







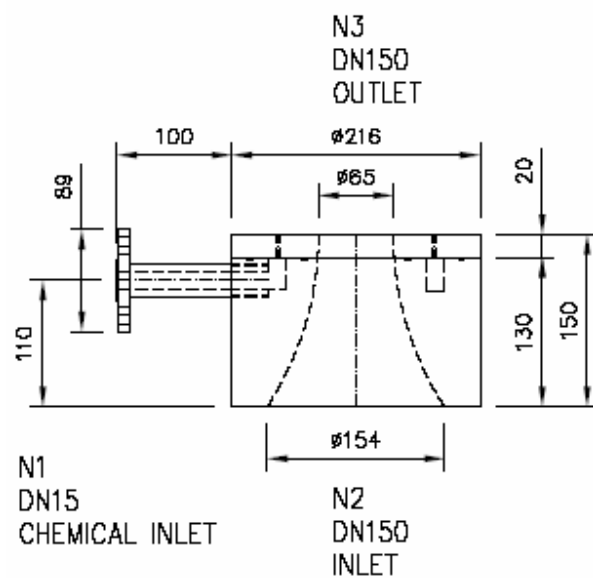
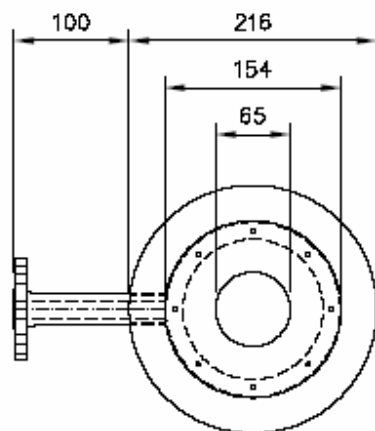
Technical drawing of a building facade showing dimensions and structural elements. The drawing includes a side elevation of a multi-story building with various window types and a door. Dimensions are provided in millimeters (mm) and meters (m). Key dimensions include:

- Total height: 6000 mm
- Height from ground level to the top of the main facade: 1700 mm
- Width of the main facade section: 4770 mm
- Width of the upper section: 2037 mm
- Width of the lower section: 1900 mm
- Window heights: 1800 mm, 1500 mm, 1200 mm, 1000 mm, 800 mm, 600 mm, 400 mm, 200 mm
- Door width: 1200 mm
- Door height: 2000 mm
- Other dimensions: 400 mm, 300 mm, 200 mm, 100 mm, 50 mm, 25 mm, 12.5 mm, 6.25 mm, 3.125 mm, 1.56 mm, 0.78 mm, 0.39 mm, 0.19 mm, 0.09 mm, 0.04 mm, 0.02 mm, 0.01 mm

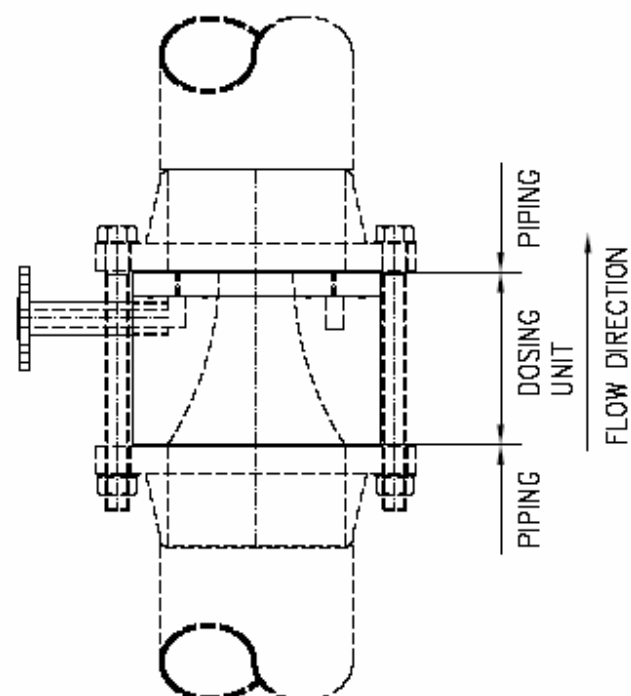
FLOCCULATOR TYPE
JOW-FLOCK 6-477
CAPACITY 6,25 M³/H (150 M³/D)

OUTLET
DN80/PN10

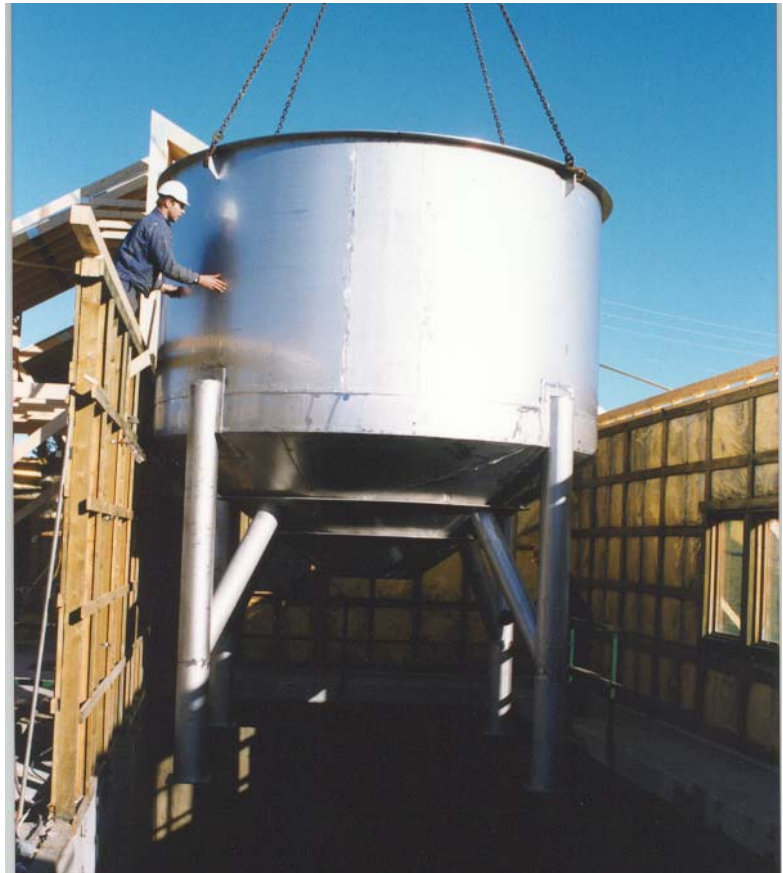
B-8



INSTALLATION IN PIPE



MUSLING™



Bortelid RA, Åseral kommune



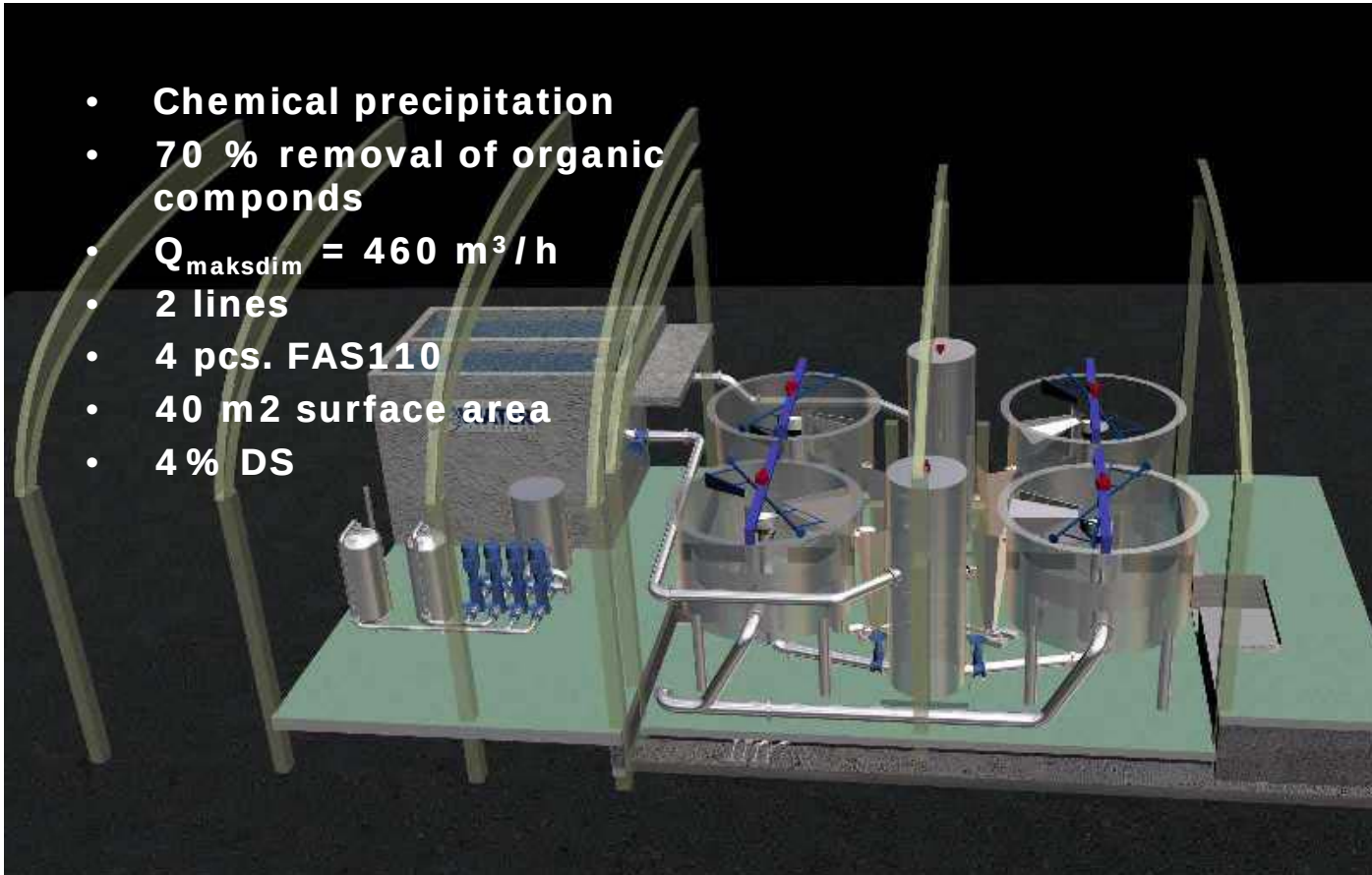
- **Mountain cabins**
- **30 m³ / h**
- **3 m² surface area**
- **3 % DS**

Bortelid RA, Åseral kommune



Heistad RA, Porsgrunn kommune

- Chemical precipitation
- 70 % removal of organic compounds
- $Q_{maksim} = 460 \text{ m}^3/\text{h}$
- 2 lines
- 4 pcs. FAS110
- 40 m² surface area
- 4 % DS



Heistad RA, Porsgrunn kommune



Vårnes RA, Stokke kommune

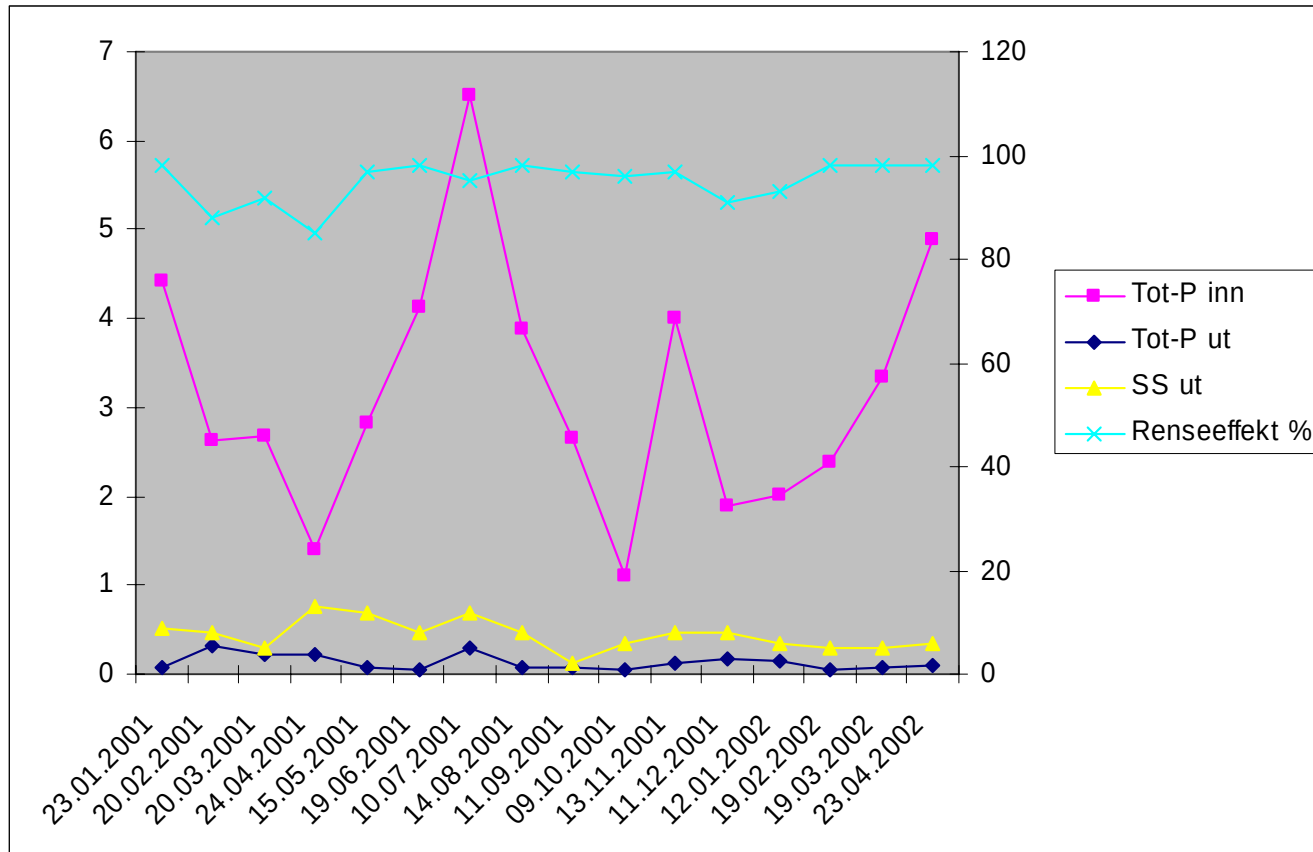
- Chemical precipitation
- 250 - 500 m³/h
- 3 pcs. MUSLING™ FA110
- 30 m² surface area
- 3 % DS
- May 2000



Vårnes RA, Stokke kommune



Vårnes RA, Stokke kommune



Logotypes

MUSLING[®]
G E N E R A S J O N 2

MUSSLAN[®]
G E N E R A T I O N 2



AnoxKaldnes



AnoxKaldnes



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AnoxKaldnes

**SPAR MILJØET
-BRUK MEG OFTE!**



AnoxKaldnes