

Landfill leachate treatment in cold climate

Examples from Troms county
in North Norway

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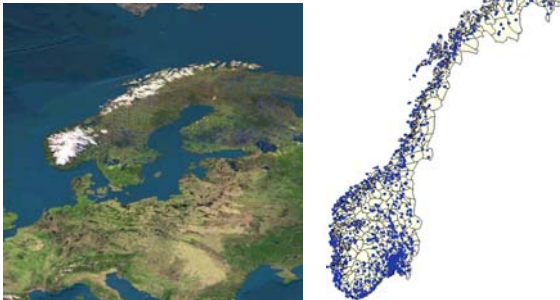


Leachate contamination







Size of the problem

>1150 landfills
< 100 in operation in 2004

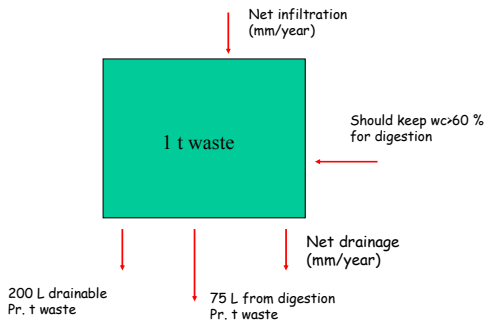




Leachate treatment i Norway

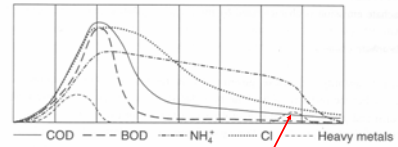
- Totally 100 municipal sanitary waste (MSW) landfills i use
- About 35 MSW landfills discharge raw leachate to sewers
- About 30 MSW landfills use on-site biological treatment - mainly aerated lagoons
- New regulations require liner to collect/control leachate and leachate treatment is compulsory

What is leachate



Trends in leachate concentrations:



Emission of sulphides? Solubility products:

Adsorbed	Medim ads.	Not adsorbed
HgS	ZnS	As
Cu ₂ S	NiS	Cr
PbS		
CdS?	FeS	
	MnS	

A gravel pit in a glaciofluvial terrace

A representative location for a municipal landfill



Buktamoen - former leachate treatment

1. Infiltration in open pond



Buktamoen Landfill - Profile in the glaciofluvial terrace



Buktamoen, seepage of leachate



2. Collection, pumping and recycling to pond

Buktamoen - former leachate treatment

- Results:
- Poor treatment performance
 - Increased hydraulic loading
 - Increased concentrations



Buktamoen - former leachate treatment

Production of leachate in the landfill : 5 000 m³/year
Pumped from the collection ditch : 100 000 m³/year



Buktamoen - former leachate treatment



Snowmelting in early spring

Buktamoen – Leachate concentration

BOD:	1500 mg/l (157)
BOD/COD:	>0,5
NH ₄ -N:	350 mg/l (96)
Tot-P:	3 mg/l (2.5)
Chloride:	1500 mg/l (309)
Phenol:	100 - 1000 mg/l (26)
PAH:	0,2 - 2 mg/l (3)
BTEX:	200 - 2000 mg/l (22)

Leachate treatment options I:

Filtres

- Active carbon
- Bark/compost
- Peat/turf

Technical

- Membranes
 - Ultrafiltration 1-10 bar
 - Reverse osmosis 60-300 bar

Biological/technical

- Sequential batch reaktor (SBR)

Leachate treatment options II:

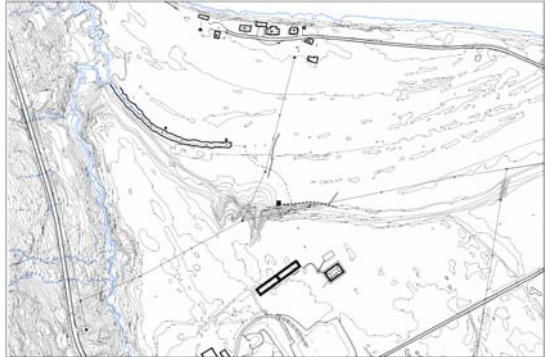
Natural systems

- Dams and wetlands
- Filtres
 - Bark/compost
 - Peat/turf
- Infiltration & natural attenuation
- Irrigation
- Recirculation

Why select natural system technology ?

- Large areas are often available
- Requirement of large buffer volumes
- Often large distance to the municipal sewer
- Low demands for operation and maintenance
- Remove several important pollutant parameters

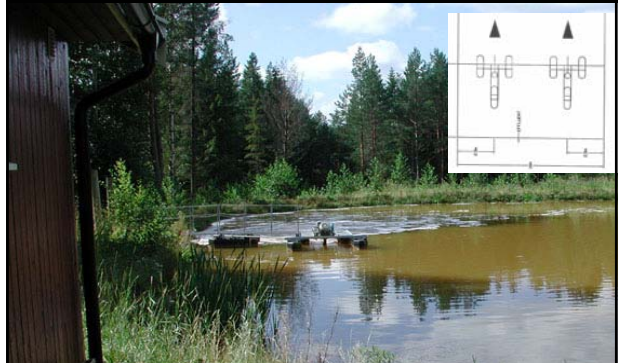
Buktamoen – Treatment og leachate



Buktamoen – aeration dam



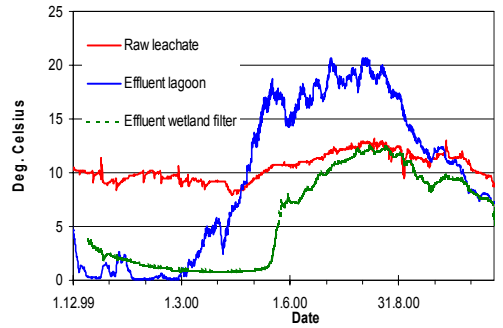
Aerators



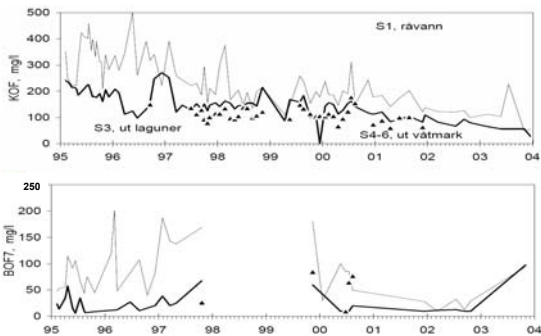
Buktamoen – the wetland



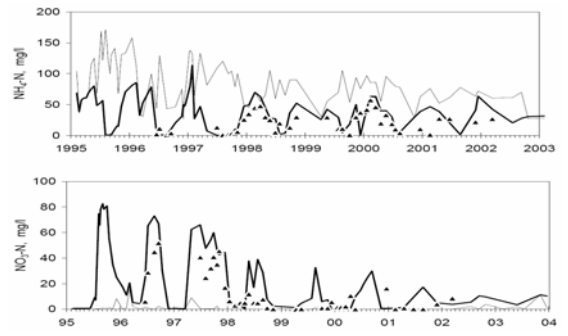
Temperature - Bølstad MSW landfill leachate



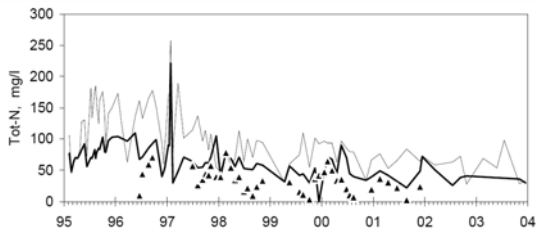
Bølstad - Reduction of COD and BOD



Bølstad – Oxidation of nitrogen



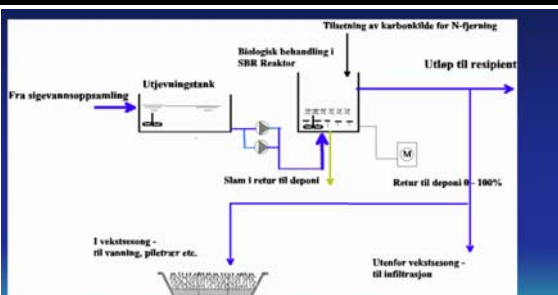
Bølstad – Reduction of total nitrogen



Experiences - Aerated lagoon and sedimentation:

Organic matter	50 - 90 %	season dependent
NH ₄ -N	50 - 95 %	season dependent
Tot-N	30 - 50 %	season dependent
Fe	> 75 %	
Pathogens	High	
Toxic pollutants	Variable	

Leachate treatment by SBR-reactor



The concept of WaterCare

Leachate treatment - cost estimates

- The Buktaemoen natural treatment system: € 140 000
- SBR-reaktor for Buktaemoen probably: € 300 000 (including additional costs)

Skibotn - Leachate from composting of MSW

COD: 65.500 mg/l

BOD: 41.400 mg/l

N_{tot} : 2.370 mg/l (probably NH₄-N)

Too high concentrations for aerated pond in winter. Could the temperature from the compost be used to heat a tent over the pond ?

SBR-reaktor ?