Stabilisation and Solidification (ST/SO)

Mechanical and chemical factors influencing the success of stabilisation/solidification of contaminated sediments

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ST&SO
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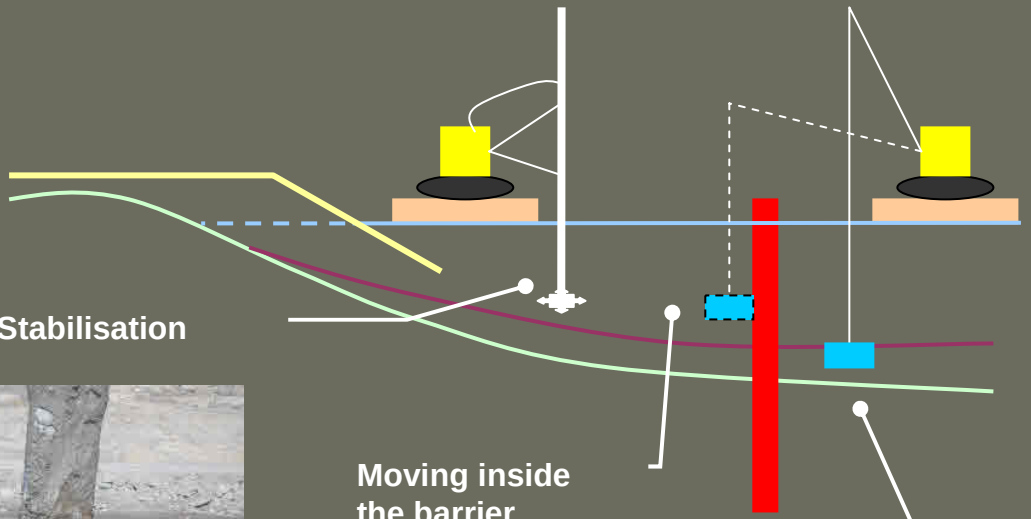
The advantages with the technology



The ST/SO project

- Cooperation between Norcem, NOAH, NGI, Skanska, Rambøll and DNV
- 3 year project supported by the Norwegian Research Council (BIA-project)
- EUREKA status
- Chemical and mechanical processes
- Recipe development
- Equipment development
- Pilot projects

The challenges with stabilising sediments

Increase strength

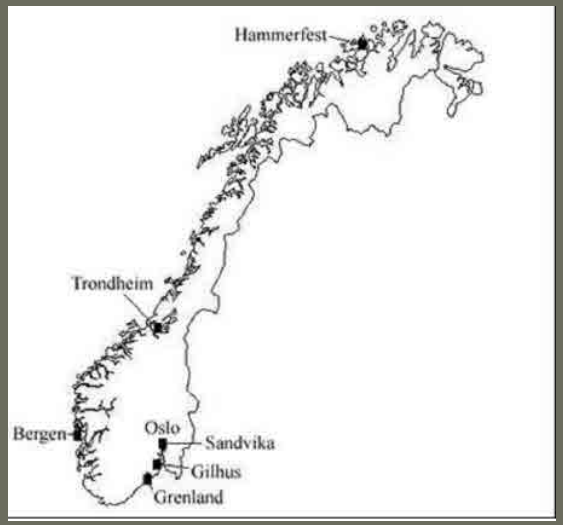
Reduce permeability

Reduce leaching

Reduce contaminant transport

Experimental setup

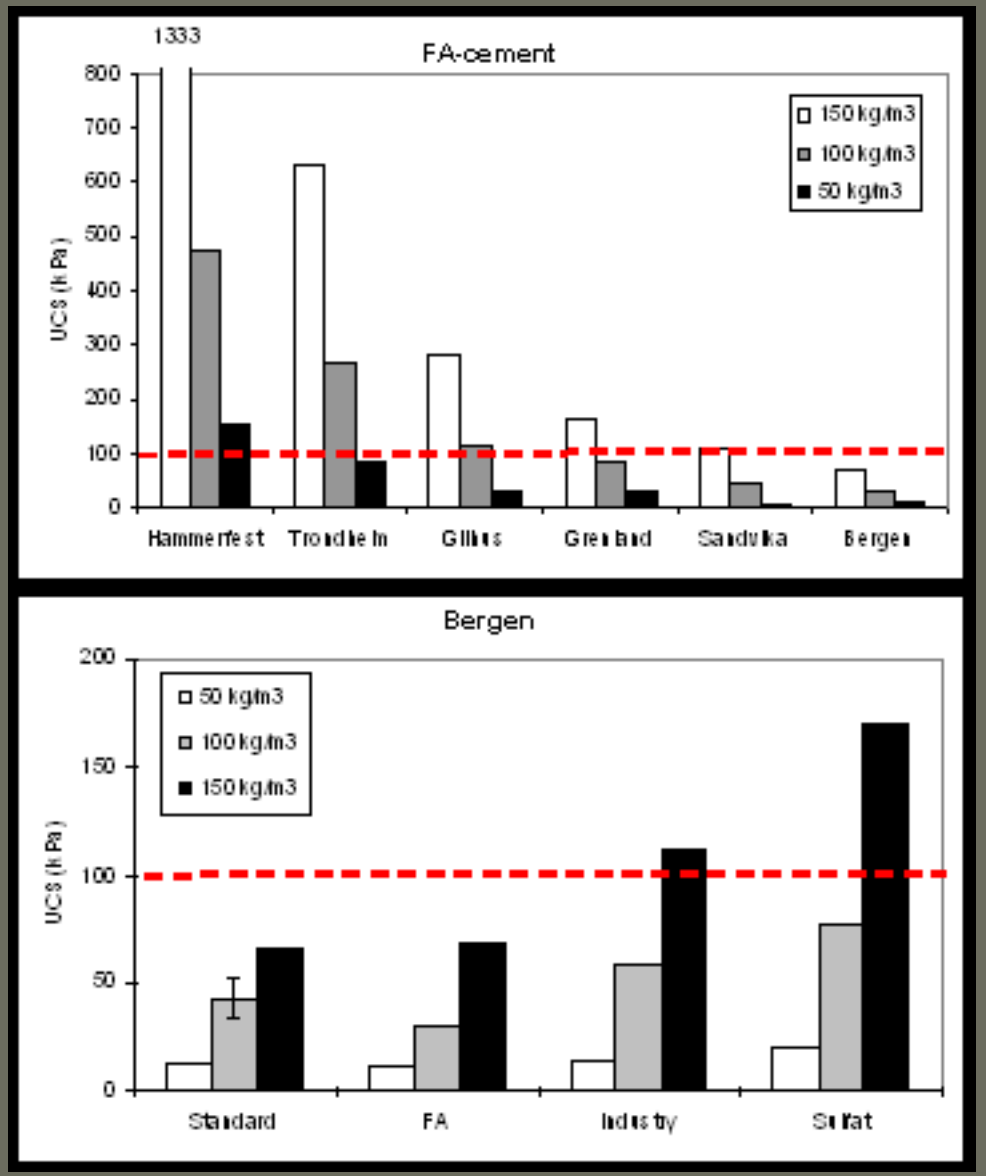
Sediment	Binder	Addition
Bergen Trondheim Bærum Hammerfest Grenland Gilhus	Standard cement Standard FA cement Industrial cement Sulphate resistant cement	Fly ash CKD Gypsum Slag Iron sulphide Activated Carbon Micro silica Sand (0-2 mm)



Approximately 150 mixtures stabilised and tested for mechanical properties (strength and permeability) and leaching (batch leaching test)

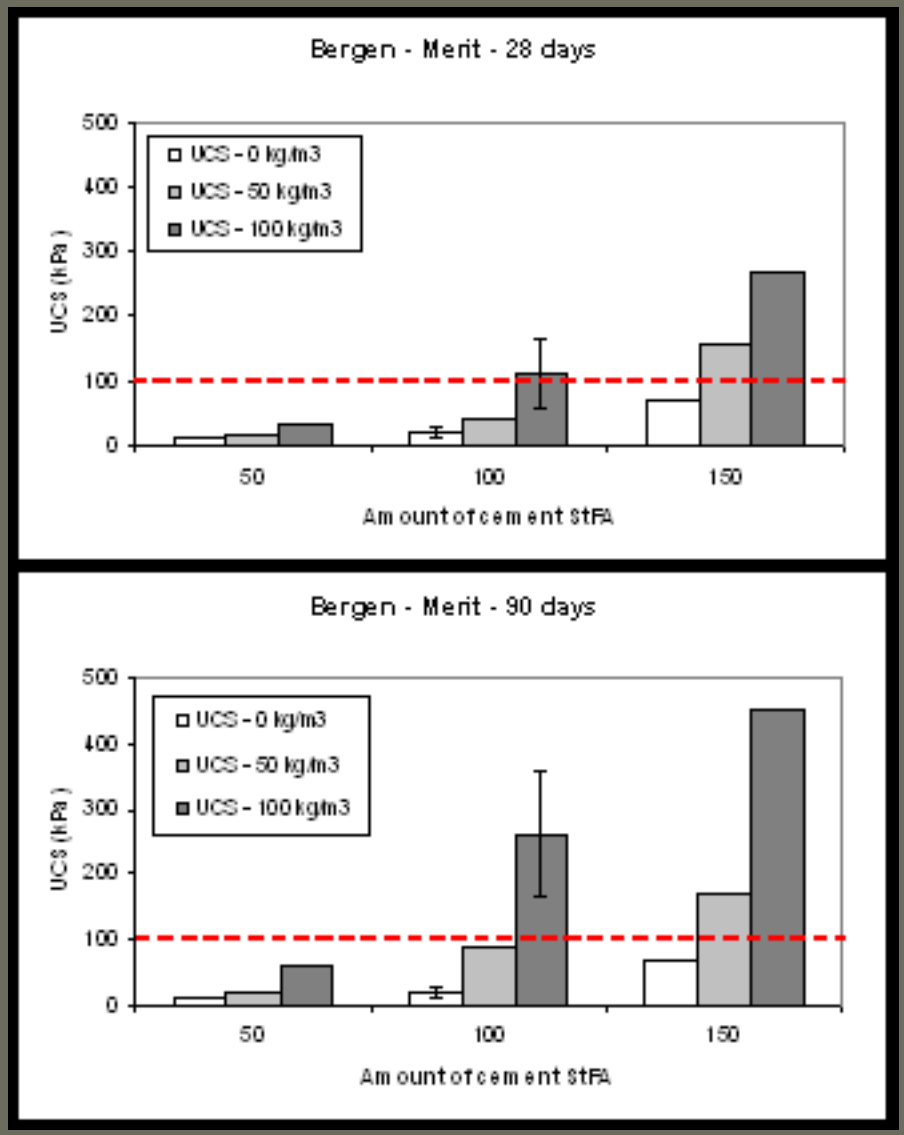
Strength

- Significant differences in UCS between sediments
- Some differences in UCS between the different cement types
- Treating very wet sediments with only cement addition is not feasible



Strength…

- Use of sand, CKD, fly ash and gypsum have little or moderate effect on UCS
- Use of slag (Merit) has good effect
- Merit show large increase in UCS also between 28 and 90 days of hardening

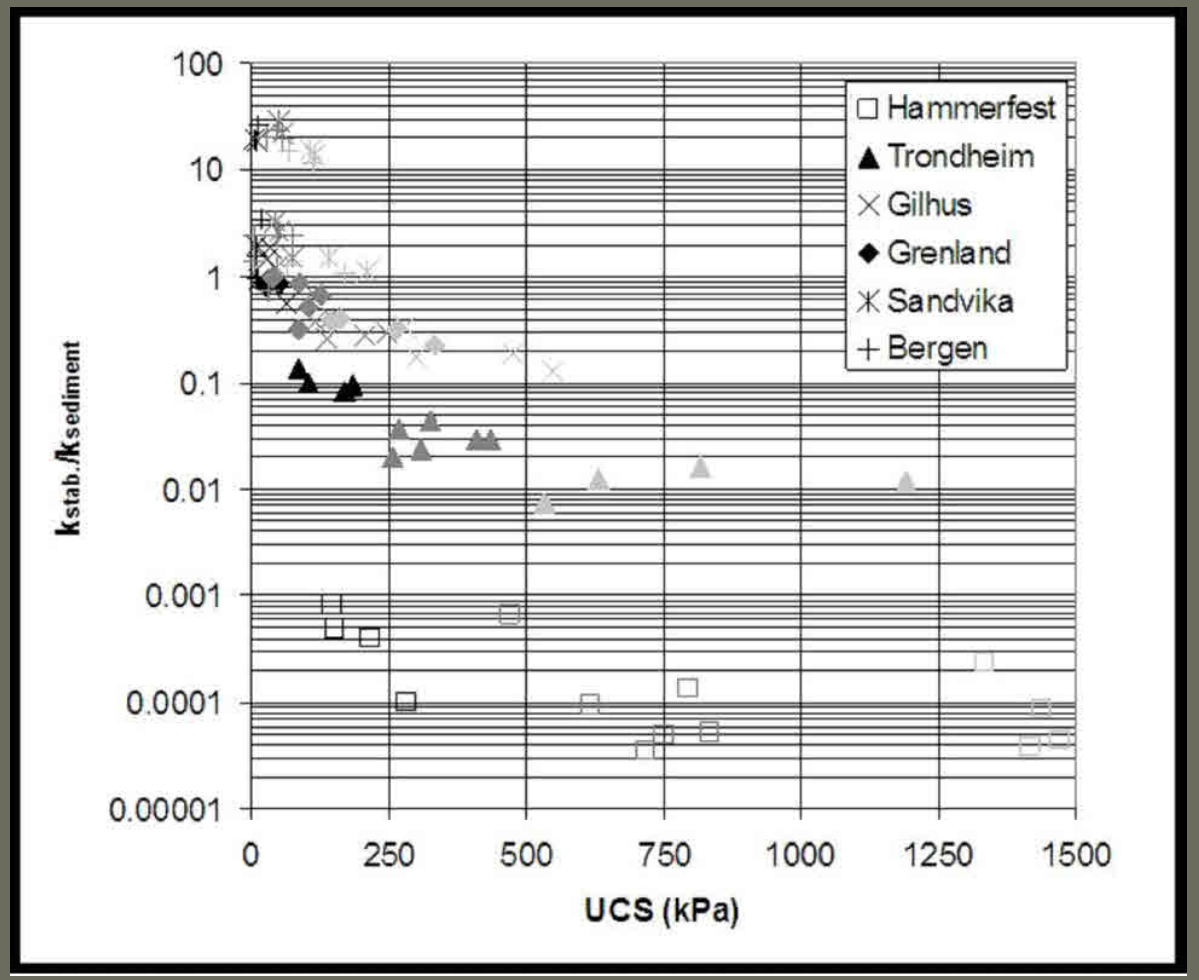


Conclusion - strength

Satisfactory mechanical strength is generally achieved by cement addition only. For wet sediments, additions like Merit is necessary. Alternative is dewatering. The amount of binder should be adjusted from case to case depending on the requirements for UCS

Permeability

- Permeability reduction is depending on material porosity
- Additions only beneficial for materials with the ability to reach high mechanical strength

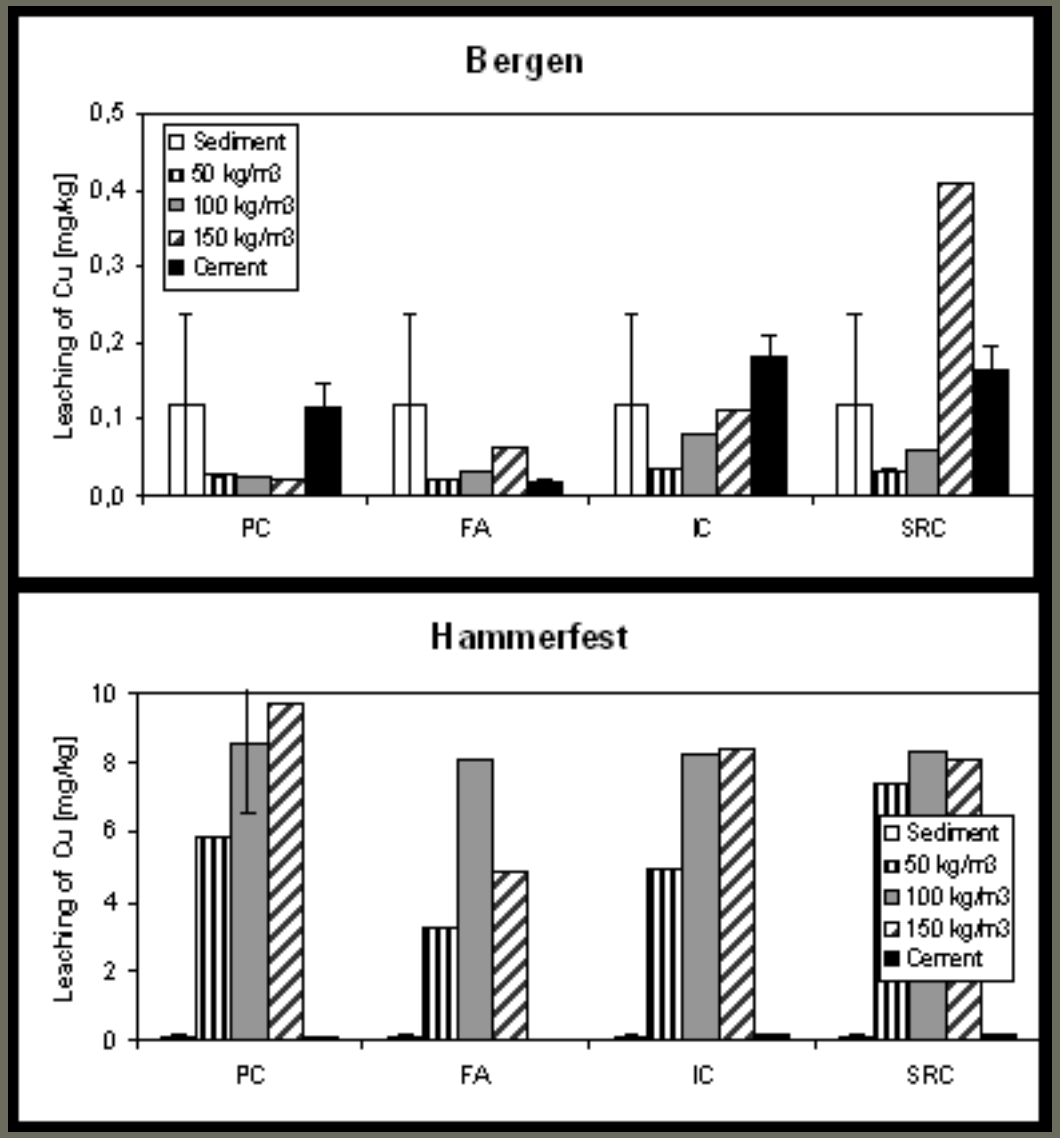


Conclusion - permeability

The ability to reduce permeability is strongly influenced by the grain size distribution of the material

Leaching (heavy metals)

- Low contaminant levels compared to waste
- General decrease or unchanged with ST/SO, but exceptions do occur
- AVS measurements confirm less available sulfide in Hammerfest
- Reduced leaching by addition of iron sulfide

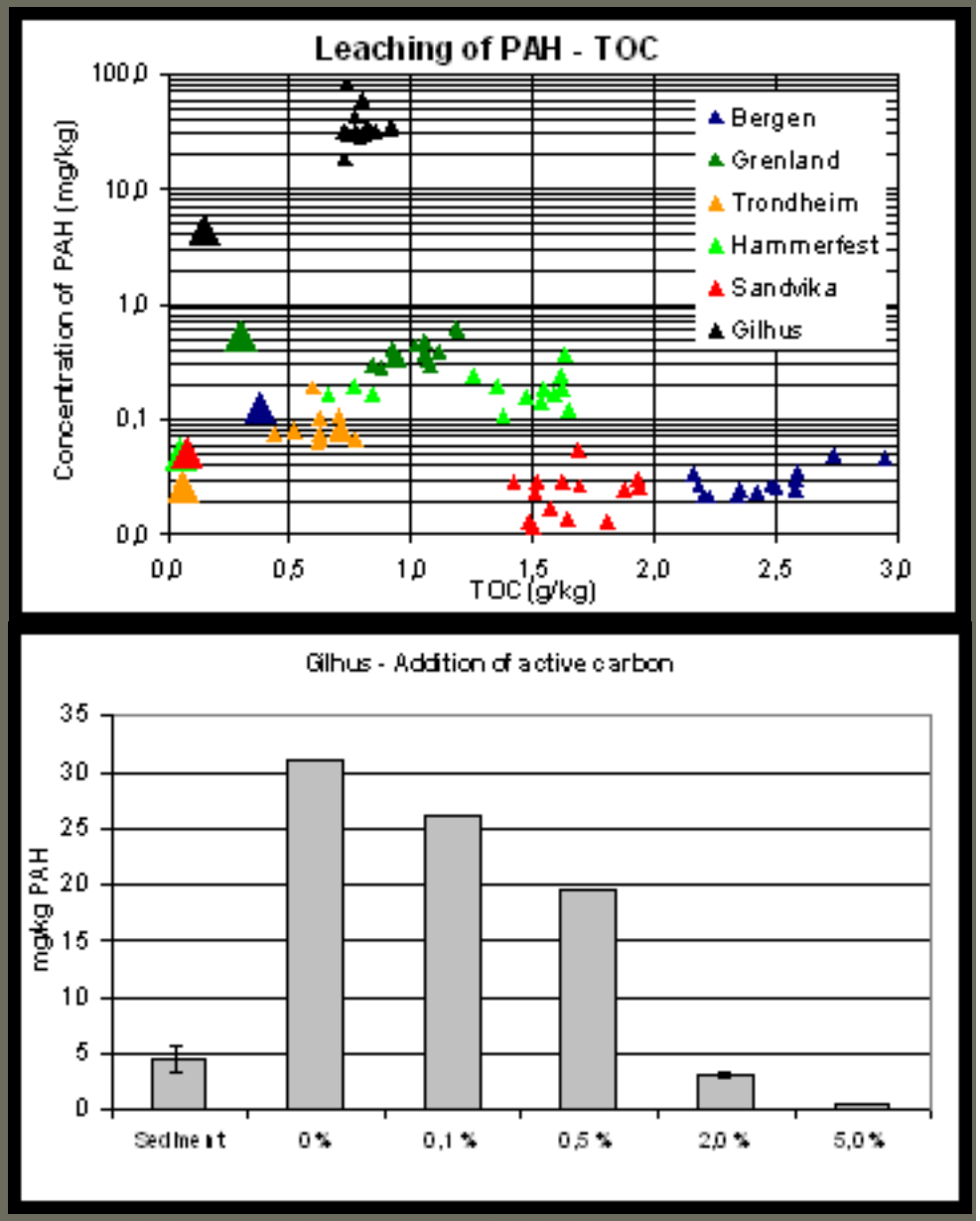


Conclusion - leaching of heavy metals

Reduced leaching is observed, but exceptions do occur**.** Leaching behavior is affected by sulfide levels in sediment. Addition of Iron sulfide may be beneficial

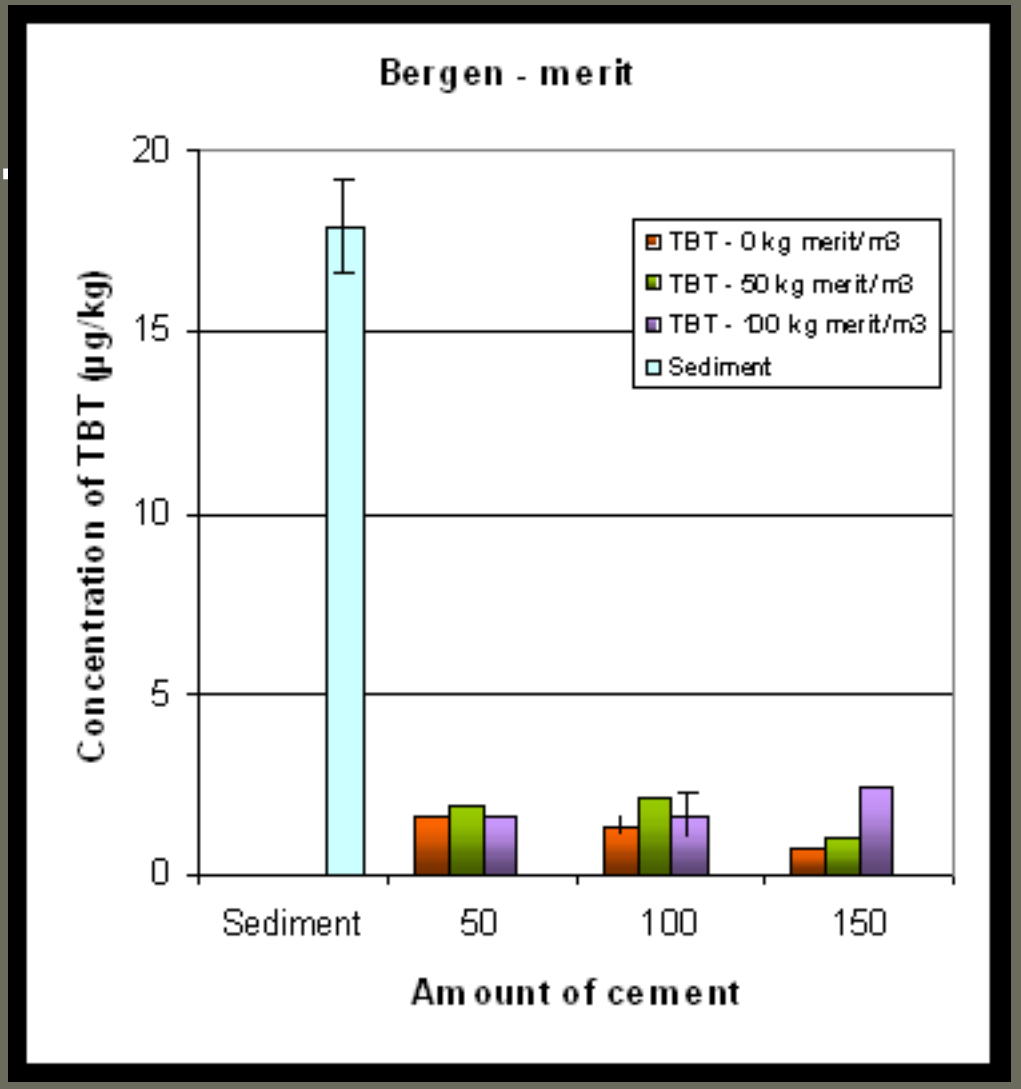
Leaching (Organics and TBT)

- Non linear response in TOC/PAH. The origin of the PAH source is important
- Possible pH effect on organic matter
- Active carbon is effective to reduce concentrations of PAH in stabilised material



Leaching (Organics and TBT)…

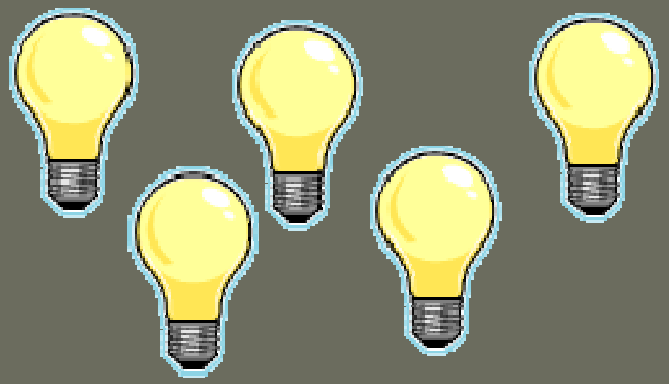
- Indications that STSO reduces TBT leaching
- The effect is visible in highly TBT contaminated sediments
- The effects is seen with and without additions



Conclusion - leaching of organic contaminants and TBT

STSO affects leaching of organic contaminants. Effects like adsorption and oxidation may be important processes. Addition of active carbon may be feasible to reduce leaching of organic contaminants

Conclusions



- STSO is an effective method to reuse contaminated sediments locally for land reclamation. Cost effectiveness is important
- Also very wet materials may be possible to stabilise by use of a combination of slag and cement.
- Contaminant transport is governed by permeability and leaching. Both parameters should be assessed and optimised in the design process for each project
- The leachability is governed by sediment type and contaminants in the sediments. ST/SO is not always favorable with respect to leaching
- Iron sulfide and active carbon may be effective additions to reduce leaching. Long term effects should be considered

Thank you for your attention