

The Grenland fjords, Norway

Management approach to decide upon remediation of a complex fjordsystem

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Projectleader



County Governor
of
Telemark

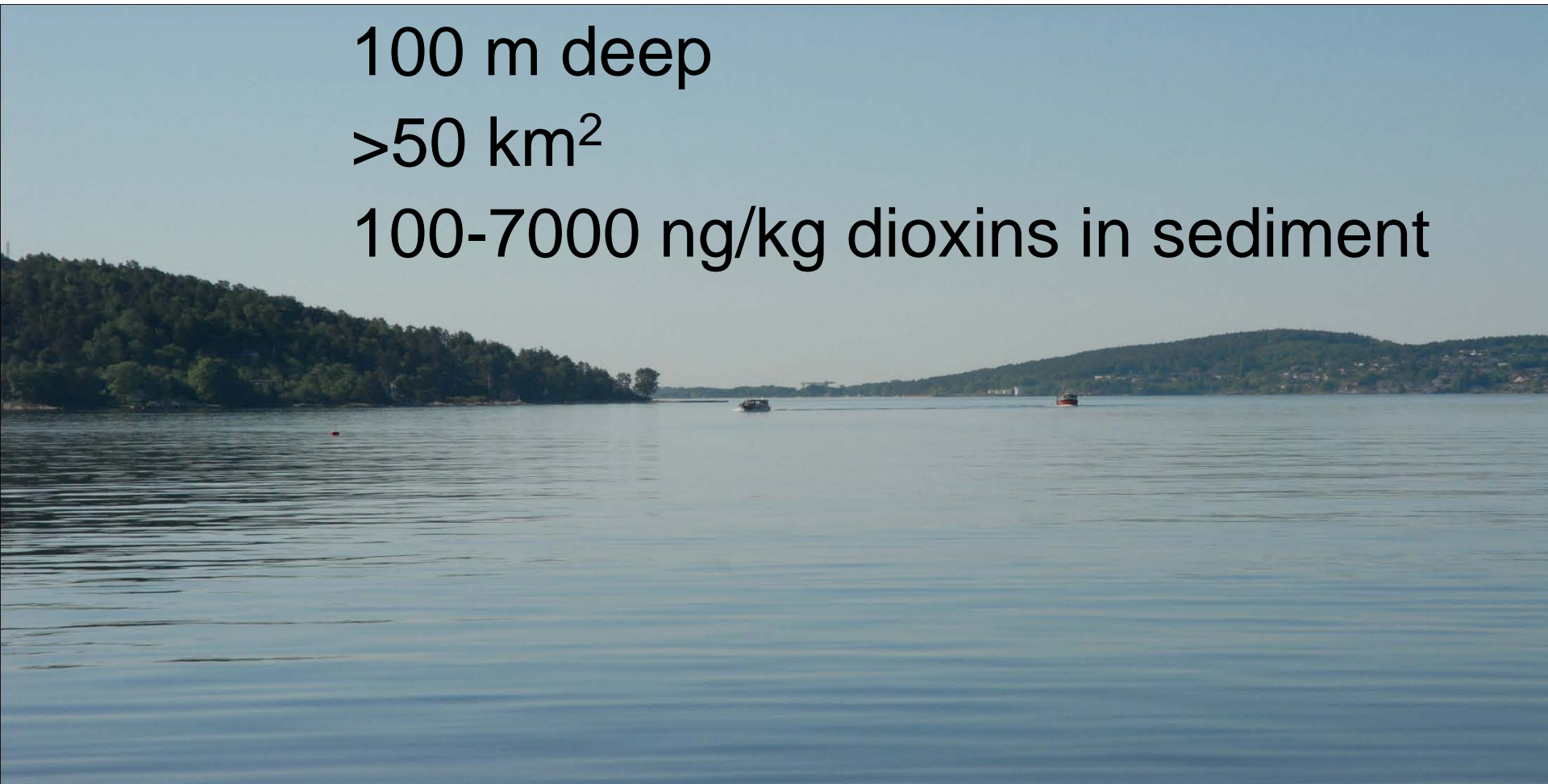
SedNet, Venice, 08.04. 2011

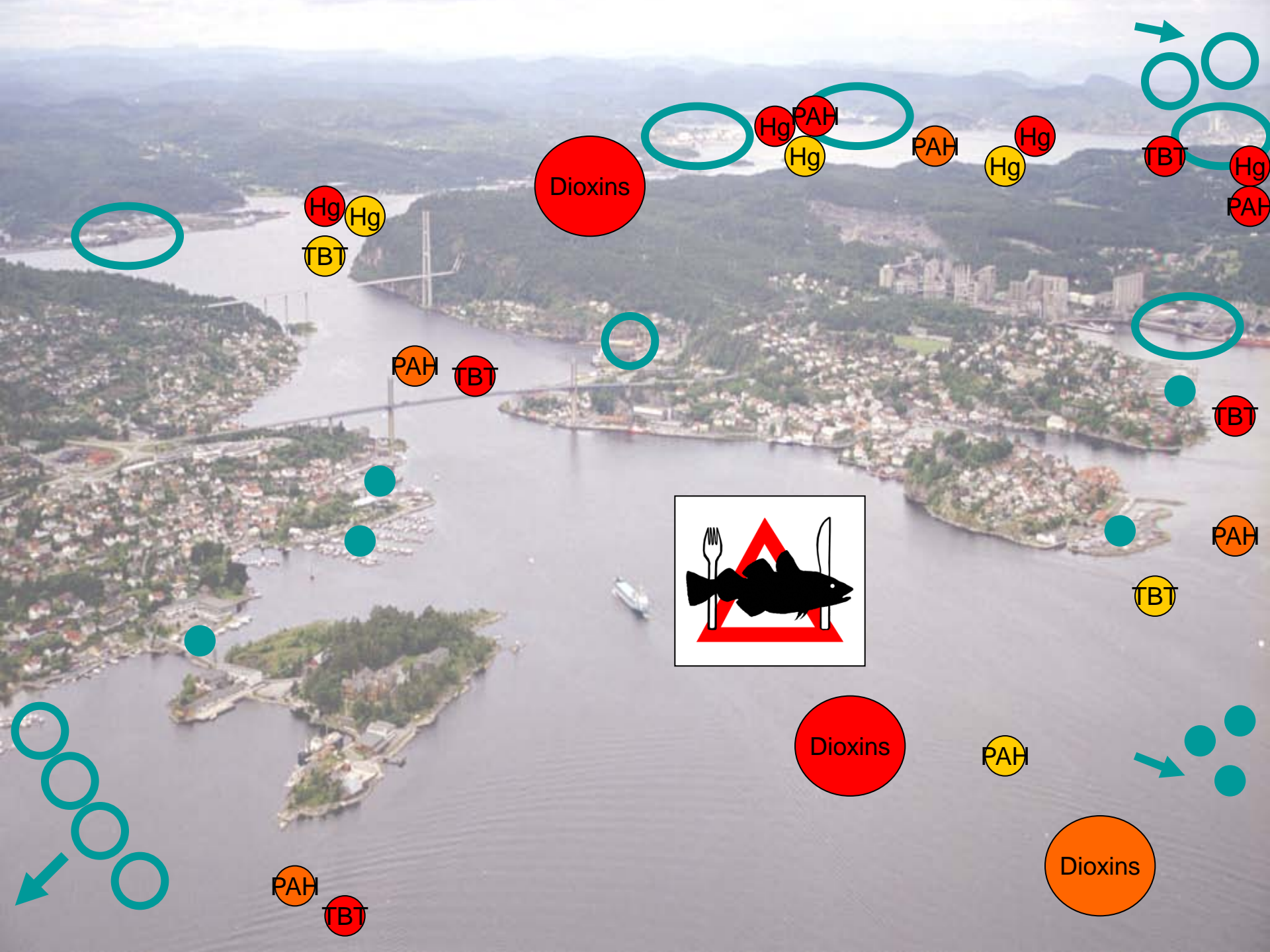
The challenge....

100 m deep

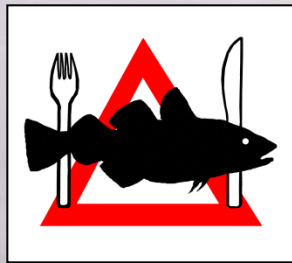
>50 km²

100-7000 ng/kg dioxins in sediment





Dioxins



Dioxins

Dioxins

Dioxins

Hg

Hg

TBT

PAH

TBT

Hg

PAH

Hg

PAH

Hg

Hg

TBT

Hg

PAH

TBT

PAH

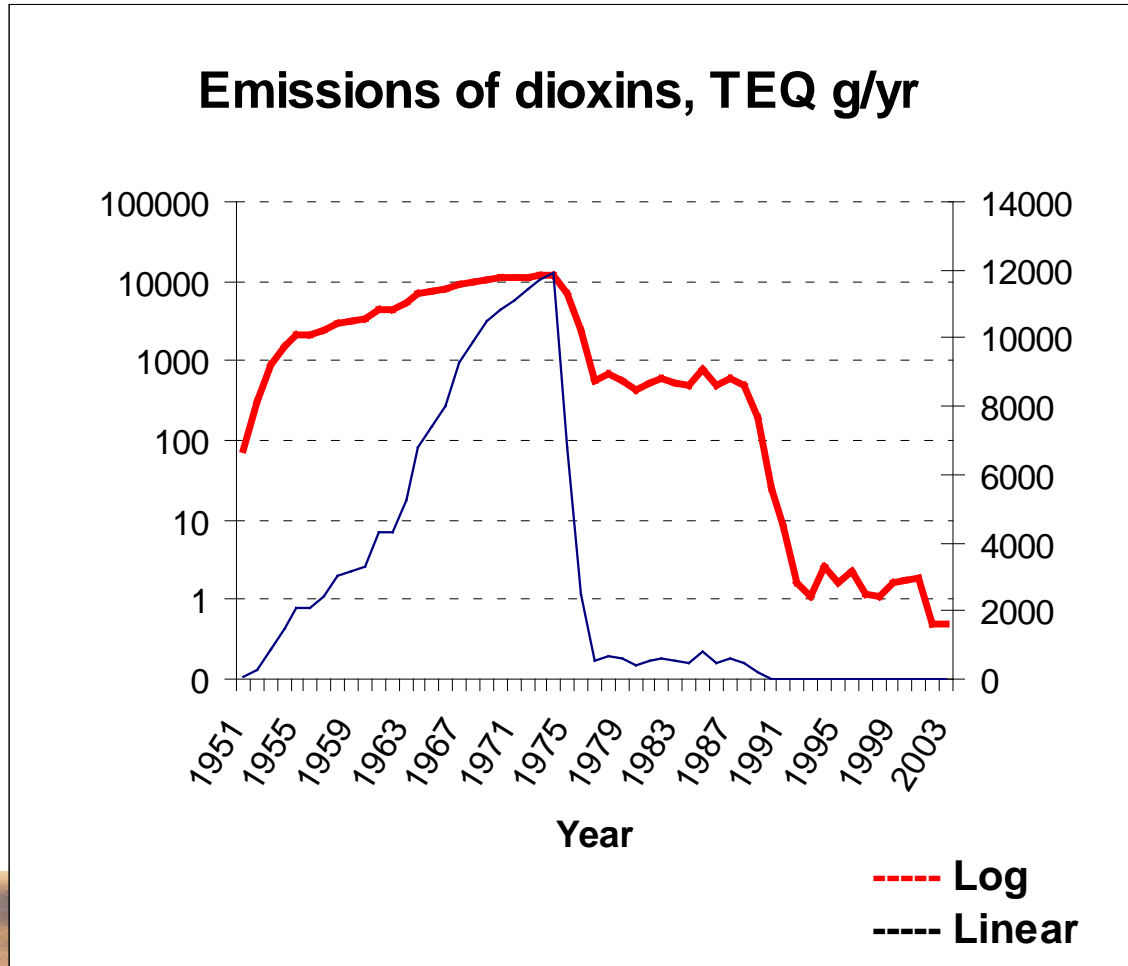
TBT

PAH

PAH

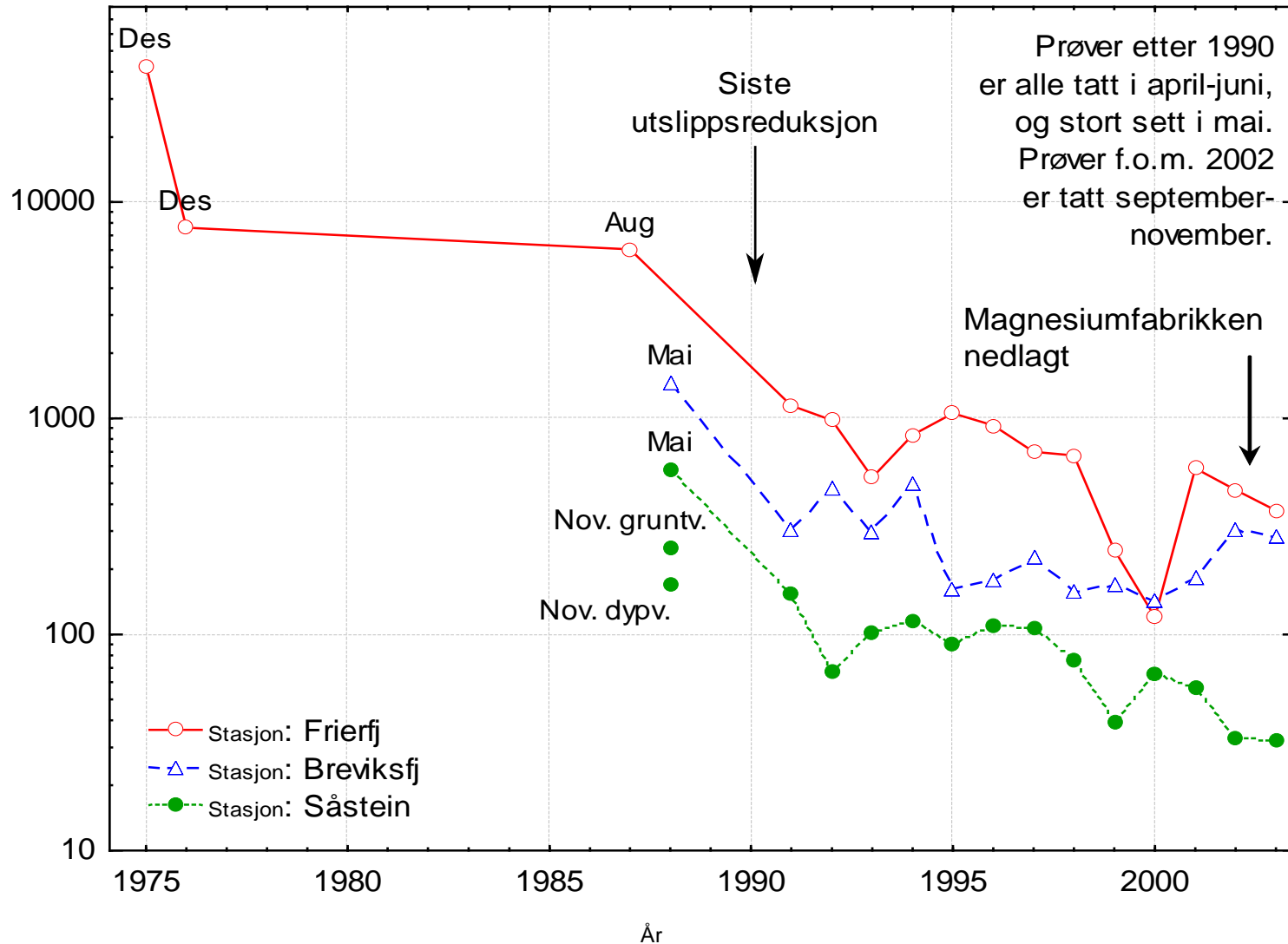
TBT

1951-2002: Norsk Hydro Magnesium plant



Development of dioxins in cod liver

Torsk (lever)

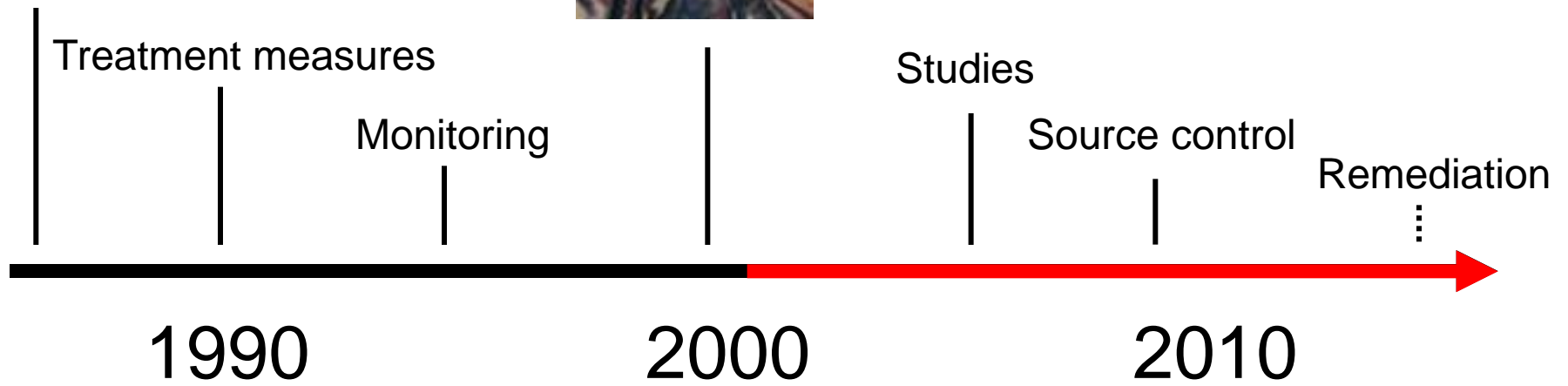


The story.....

Dioxins!



Still dioxins!!!



Project phases

Status:

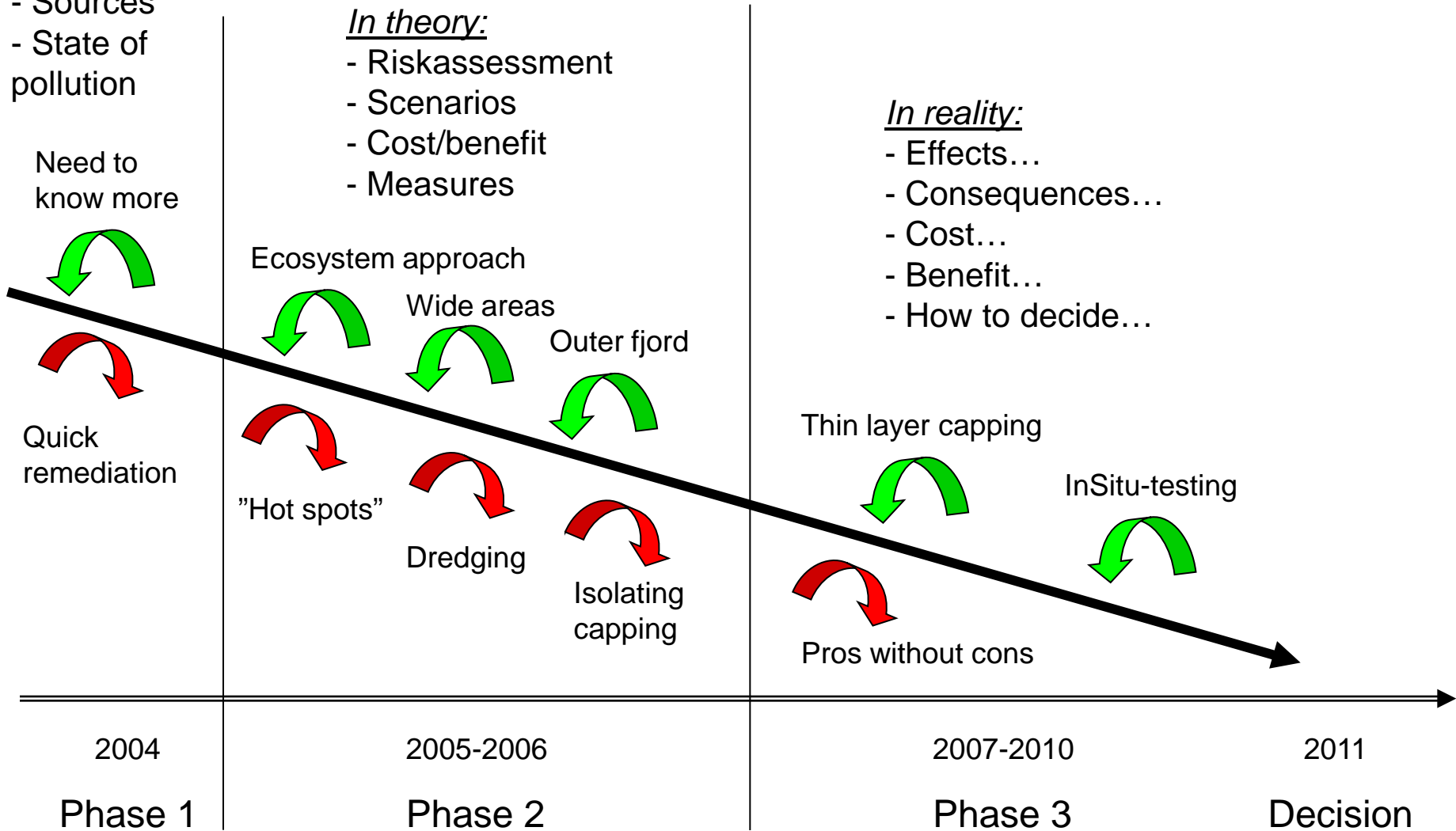
- Sources
- State of pollution

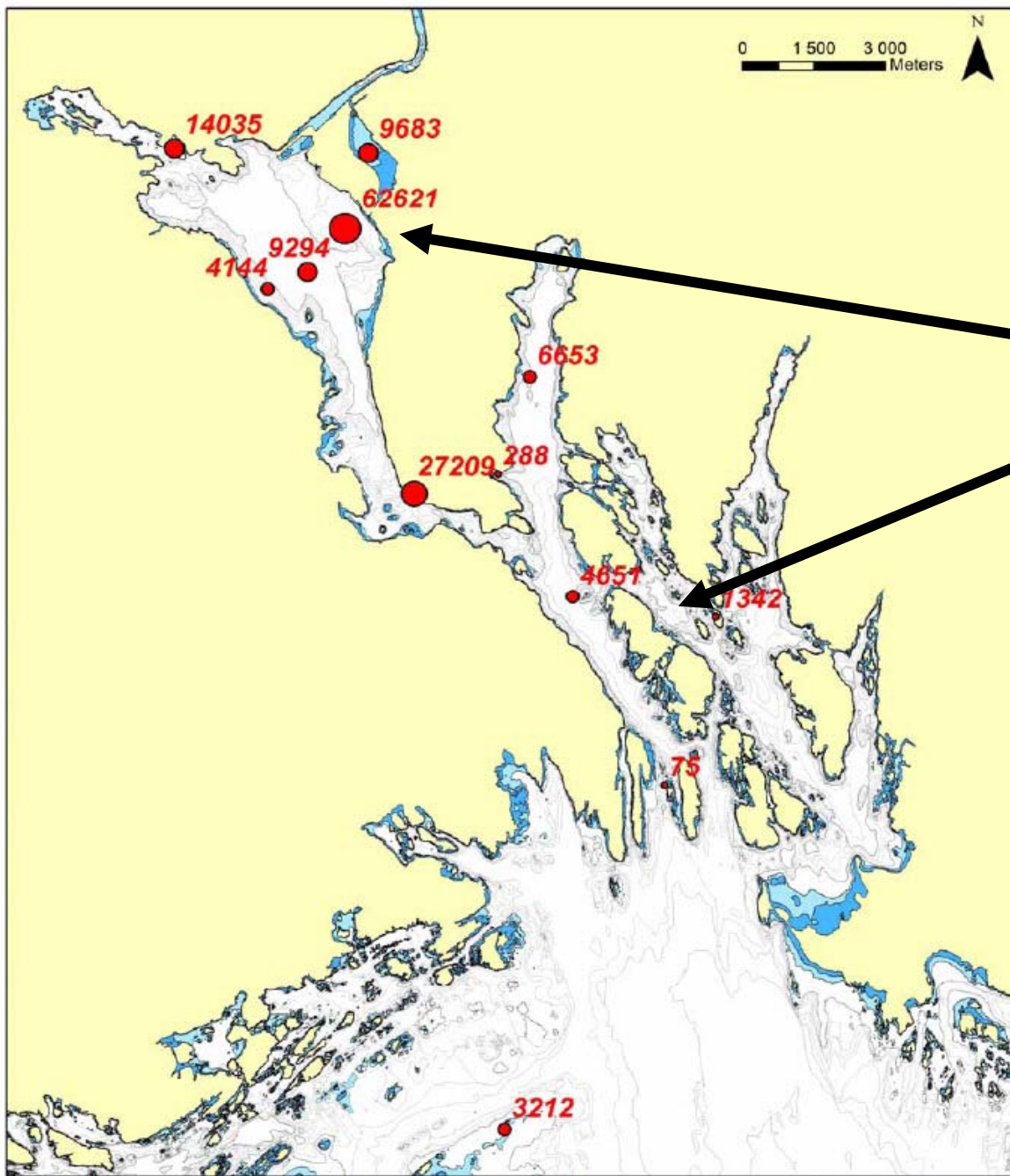
In theory:

- Riskassessment
- Scenarios
- Cost/benefit
- Measures

In reality:

- Effects...
- Consequences...
- Cost...
- Benefit...
- How to decide...





Risk assessment:

"Hot spots" close to plant

Lower risk in outer fjords

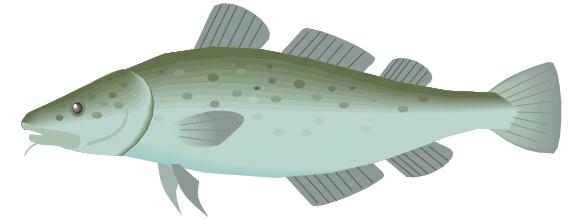
...but risk of human and ecological hazard in the entire fjord

Start in the inner fjords?

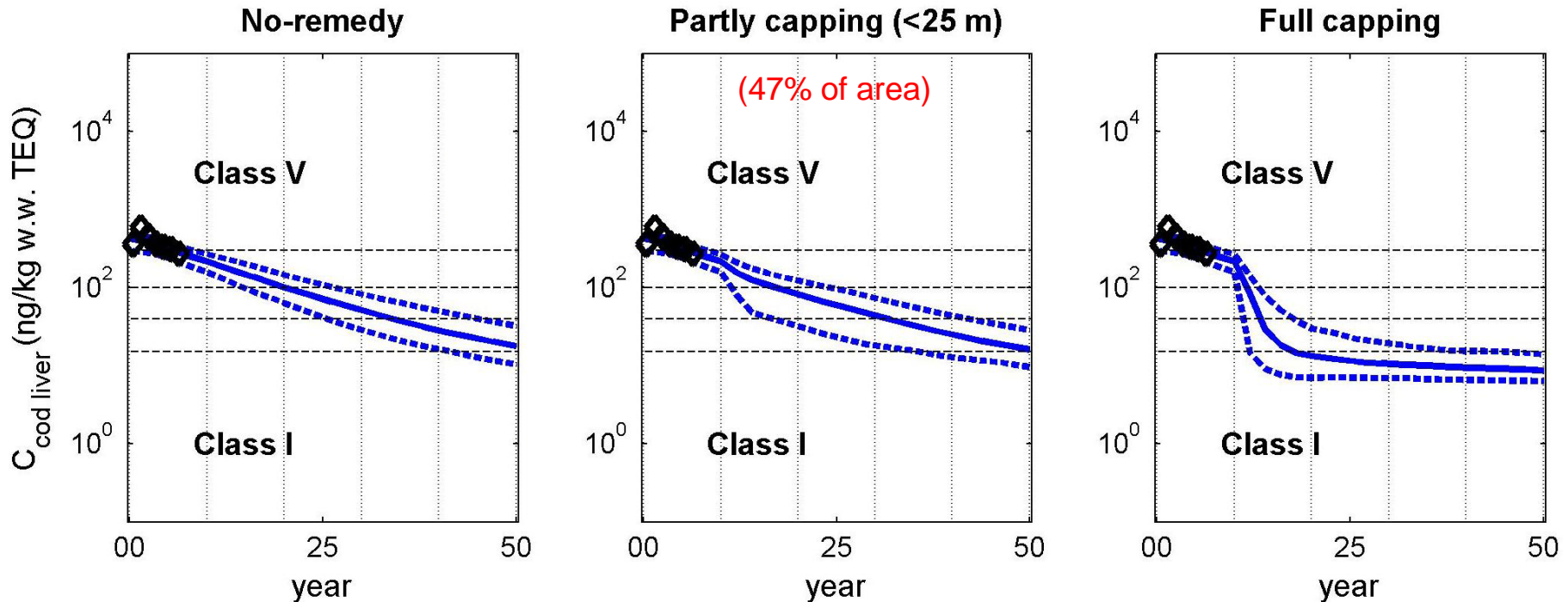
Figur 4. Beregnet risikobidrag trinn 1 fra maxverdien. Tallet angir antall ganger den totale risikoen overskrider grenseverdien for de forskjellige stoffene. Punktets størrelse er klassifisert i 4 størrelser med hensyn på risikobidraget.

(NIVA, 2005)

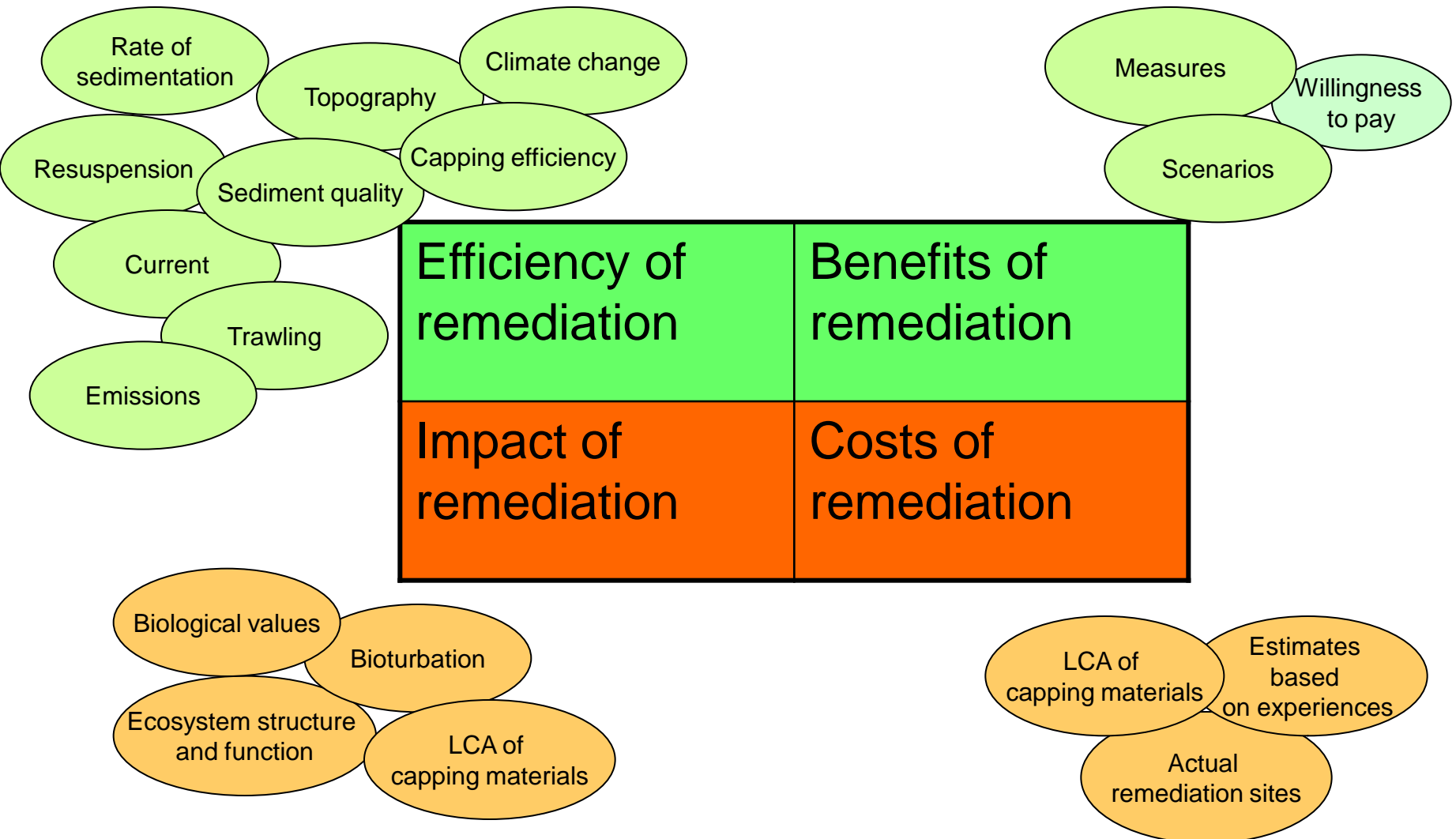
Sedflex; simulating the fate of dioxins in cod liver



! Capping in inner fjords had no effect in the outer fjords !



Structuring the studies – basis for a decision





It's all about Logistics

all about Logistics

www.vcklogistics.nl

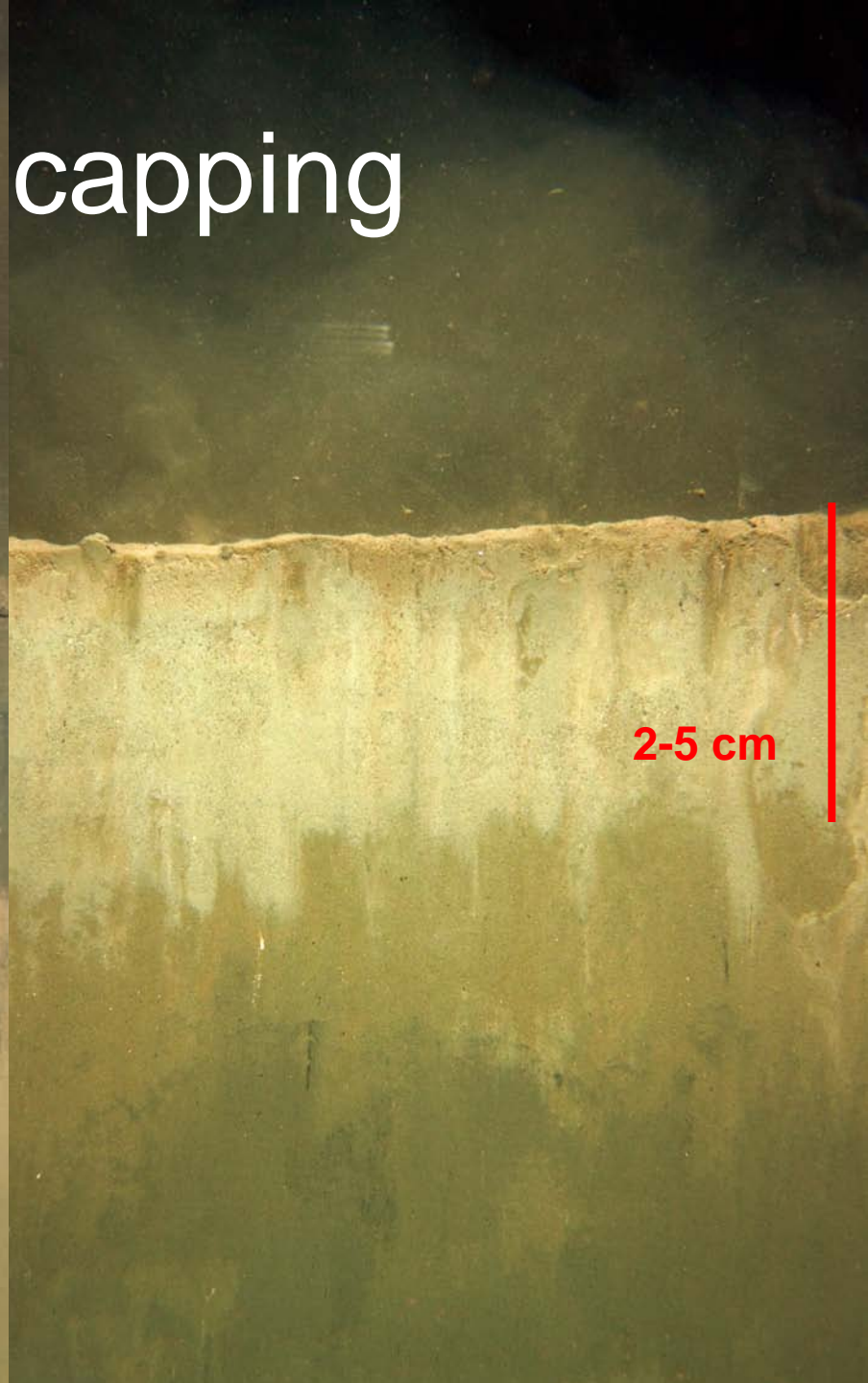
www.vcklogistics.nl



ARENA



Thin layer capping



So far it looks good.....

...but.....

Scientific based decision

.....how to conclude?

.....who is to decide?

.....what are the measures?

- Stakeholder involvement
- Authorities ... in dialog with industry

Have to be realistic!!

Aknowledgements

NGI Norwegian Geotechnical Institute	Espen Eek, Gerard Cornelissen, Amy Oen, Magnus Sparrevik, Arne Pettersen
NIVA Norwegian Institute for water research	Kristoffer Naes, Morten Schanning, Bjørnar Beylich, Ian Allan, Trine Bekkby, Eli Rinde, Tuomo Saloranta, Hans C. Nilsson, Jarle Molvaer, David Barton
DNV Det Norske Veritas	Gjermund Gravir, Jens Laugesen

Thank you for your attention!

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