

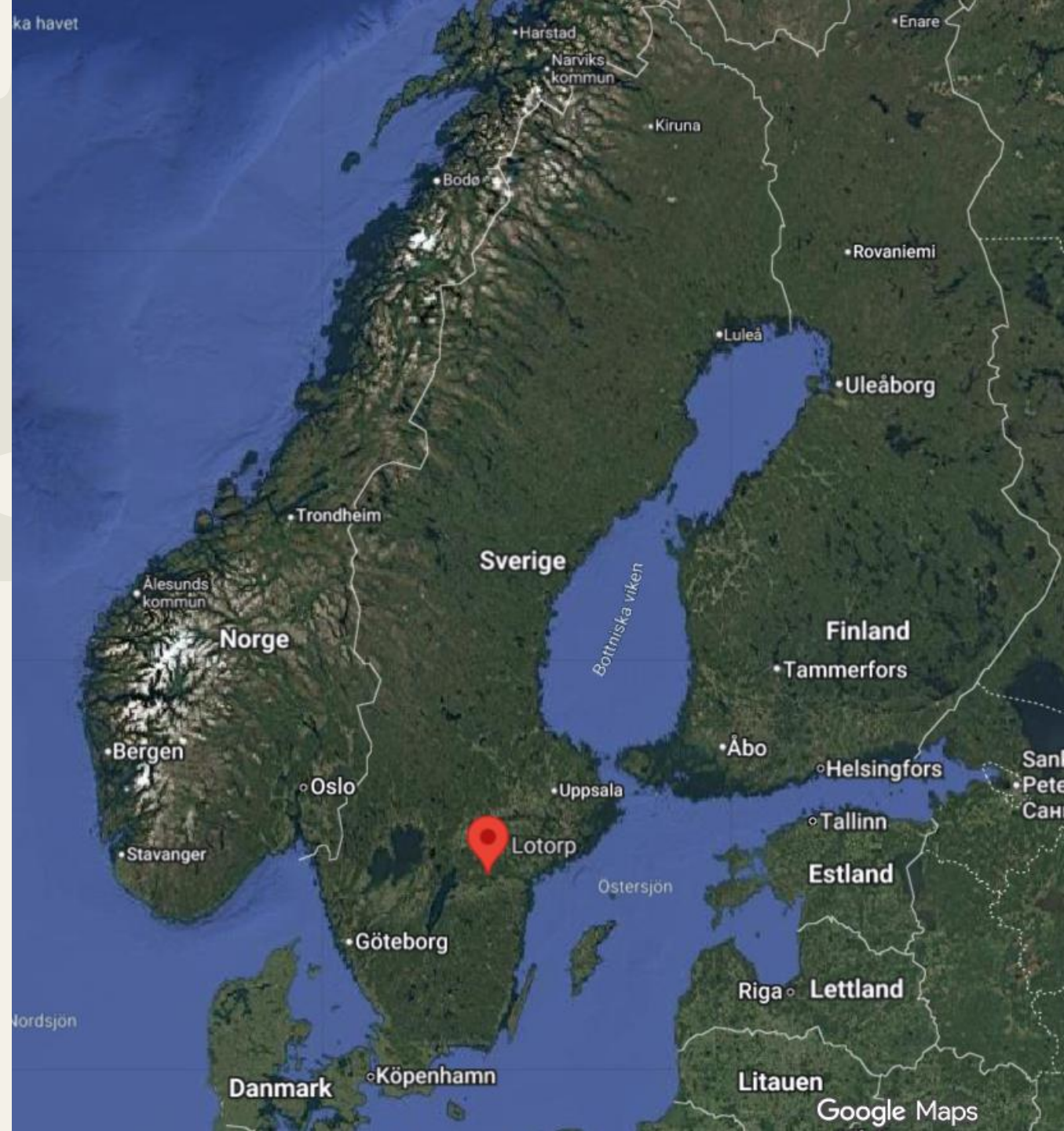


Can arsenic levels be reduced after remediation?

Nordrocs 2026

Lotorp - investigating the mobilization arsenic from different remediation options

- Pilot trials in two sets
 - Research project founded by SIG
 - For the client
- Project lead by LTU
- Pilot trials
- Project time 2023-2026
- Similar pilot trials at the same time



17th-20th century:

- Iron production and metal industry
- Metal wastes

1946-1962:

- Wood impregnation of telephone poles and railway sleepers
- CCA

1960's →:

- Construction of soccer a field

1980's →:

- Arsenic contamination is discovered and investigated (mainly from 2010's)
- Arsenic, copper, chromium
- The soccer field was covered by clean soil

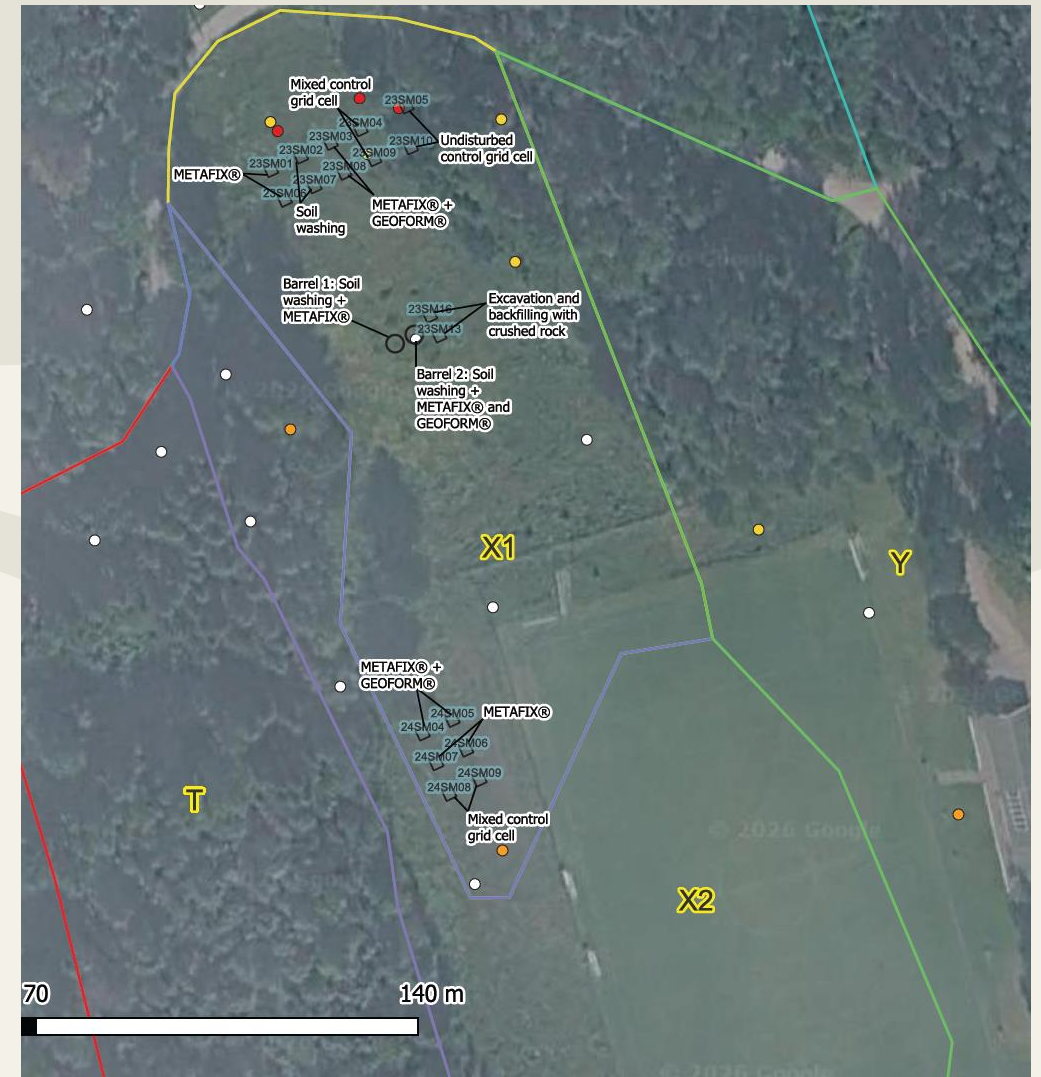


The site

- Acute toxic levels of arsenic in topsoil
- Low arsenic levels in groundwater
- Vertically flowing groundwater results in a local gw contamination
- Parts of the site is still used by the local soccer club

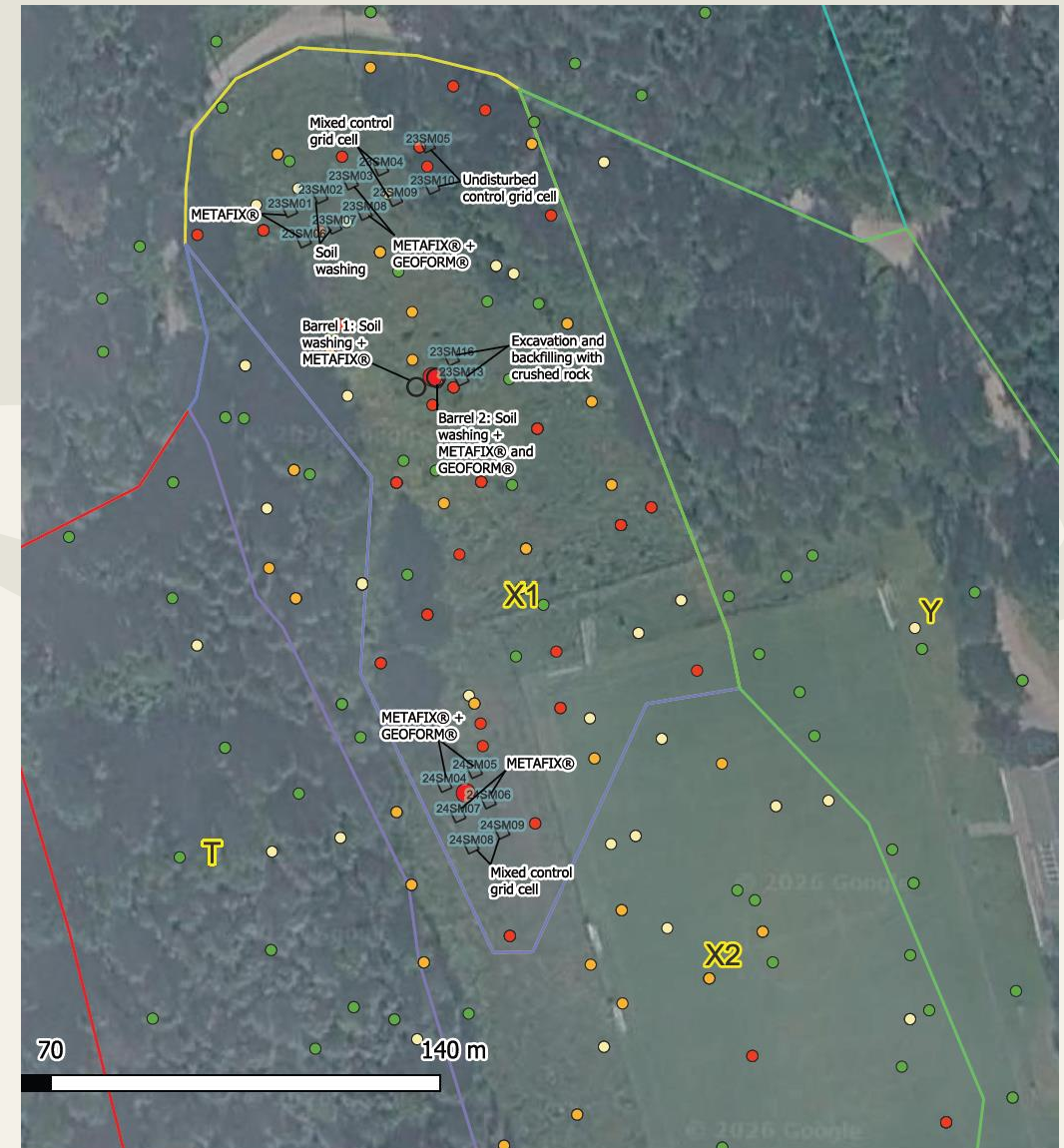
Levels of arsenic in groundwater →

- n/d – 2 $\mu\text{g/l}$ - low level/not sampled
- 2-5 $\mu\text{g/l}$ - medium level
- 5-10 $\mu\text{g/l}$ - high level
- >10 $\mu\text{g/l}$ very high level



Levels in soil

- n/d-10 mg/kg - less than neglectible risk (MRR)
- 10-24 mg/kg - residential site levels (KM)
- 25-99 mg/kg - industrial site levels (MKM)
- 100-999 mg/kg - acute toxic levels
- >1000 mg/kg - hazardous waste levels







Pore water sampling
0,5 mbgl and 1 mbgl



Treatments:

- Excavation with following backfill with coarse materials
- Sieving (mimicing soil washing)
 - With and without MetaFix and/or GeoForm
 - Coarse material in barrells and fine material in excavation
- MetaFix
- MetaFix + GeoForm
- Control mixed
- Control undisturbed
- Duplicates

Soil mix



90% WHC



60% WHC

Remediation products

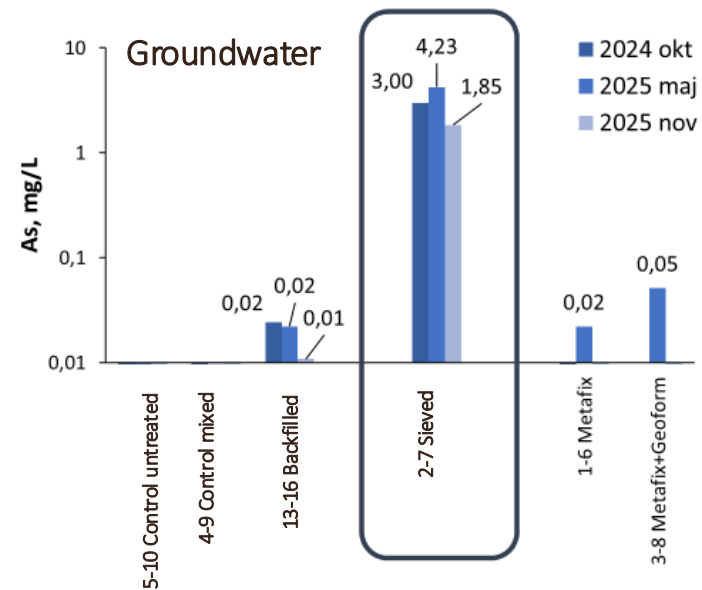
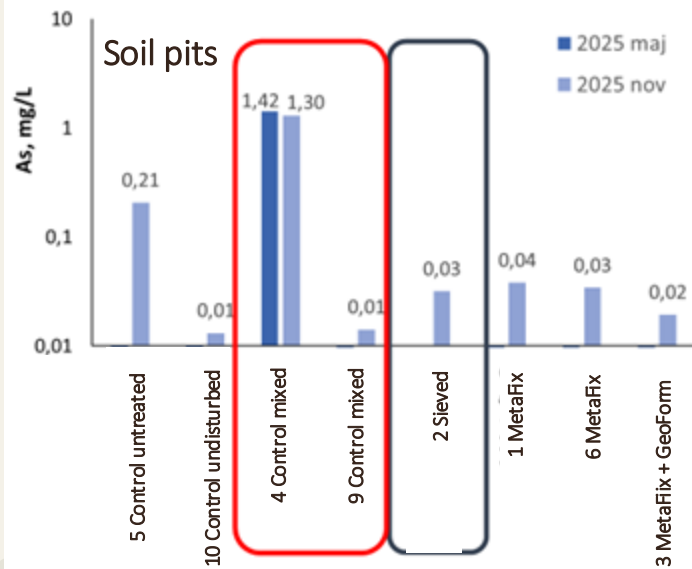
- applications and advantages

MetaFix® I-7A

- Elemental iron, sulphides, oxides, activated carbon
- Precipitation of As with iron sulphides as FeAsS
- Adsorption of arsenate/arsenite on iron oxides
- Adsorption of organo-arsenic compounds on activated carbon
- Soil mixing or slurry injection
- Designed to be effective even under conditions of high/low pH or high salinity
- Does not alter native soil/groundwater pH
- Does not alter native soil/groundwater pH

GeoForm® ER

- Organic carbon, nutrients, sulphate, elemental iron, ferrous iron, pH buffer
- Precipitation of As with iron sulphides as FeAsS
- Facilitates bacterial sulphate reduction to sulphide (HS^-)
- Soil mixing or slurry injection
- Water needed for effective microbiological processes
- Does not alter native soil/groundwater pH
- Resistant to pH and redox changes

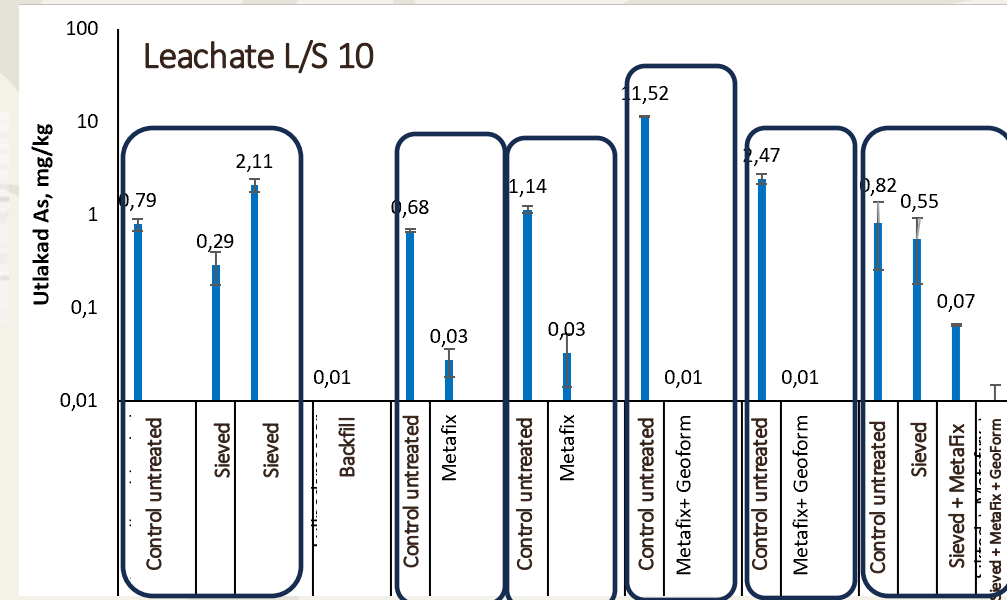


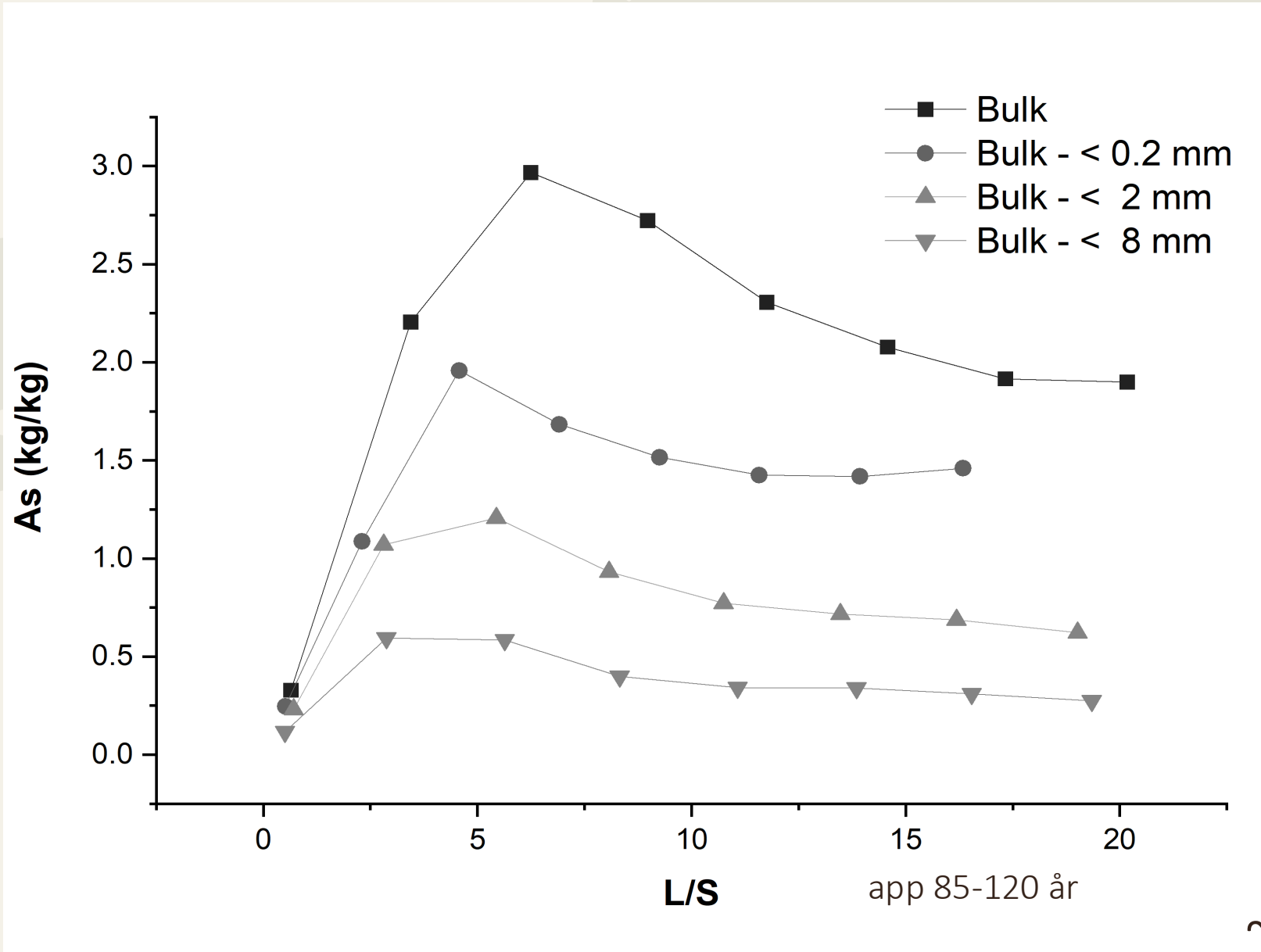
- Sieving reduces the levels of arsenic in pore water, and in leachate, also with MetaFix
- Despite that, the arsenic levels in downstream groundwater increased (longevity unknown)
- Stabilized soil with MetaFix gave the lowest concentrations



Amount of course particles remaining

Amount of arsenic leaching





~ 20-30 years
Peak leachate

- Disturbing the soil causes a temporary increase in As leaching

Ongoing activities

- Final evaluation of the pilot trials
- Remediation design, including:
 - Excavation
 - Soil mix
 - Injection
 - Covering
 - Options used as single or in combination
- Remediation of the soccer field before 2028

Other sites

- Many former sawmill sites in Sweden and Finland
- Is excavation and soil washing suitable methods for soil-bound contamination of arsenic?
- Remedial options for stabilizing arsenic and reducing the leachage to and transport with groundwater
- Arsenic sites differ – tailored remediation required for each site!



Site team:

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Pär Lindahl, *Reagerat*



A large, dark green silhouette of a tree with a thick trunk and a wide, spreading canopy, positioned on the right side of the slide.

Thank you!



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