



TBM tunnelling in difficult ground conditions

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Soft ground

Positive attributes

- If soil is right , TBM is right
- Treat at front
- Torque control
- Wear reduction



- Benefits at all stages !!!

Benefits of foam use



- Clean Cutter
- Clear belts
- Bunker fully utilised
- Vertical conveyor effective

- Cohesive soil turned “ grippy
“ not slippy.

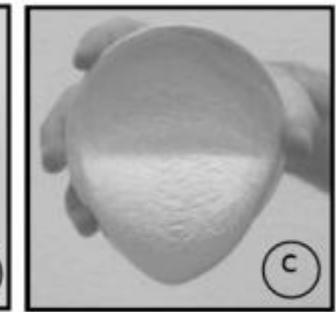
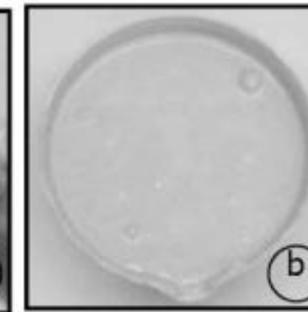
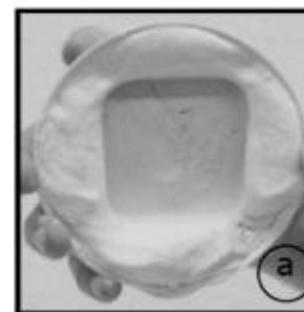
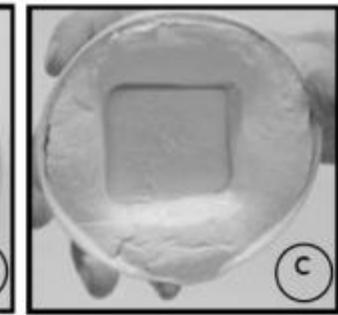
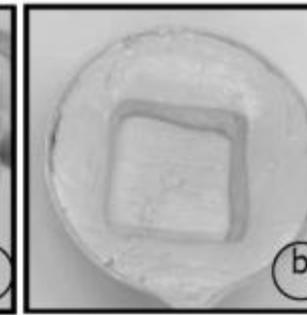
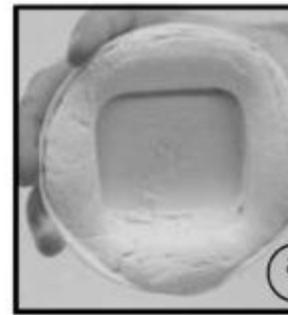
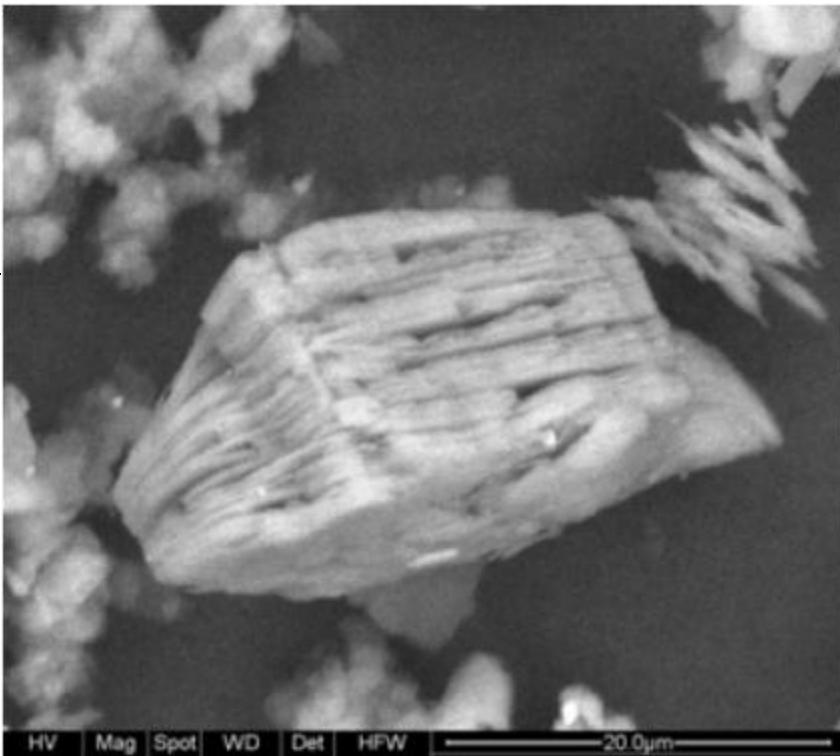
Rheosoil: anti clay agent



- Rheosoil – single component
- Simple foam generators
- No bunker/vertical conveyor
 - Clean muck cars
 - Constant muck away
- Production.

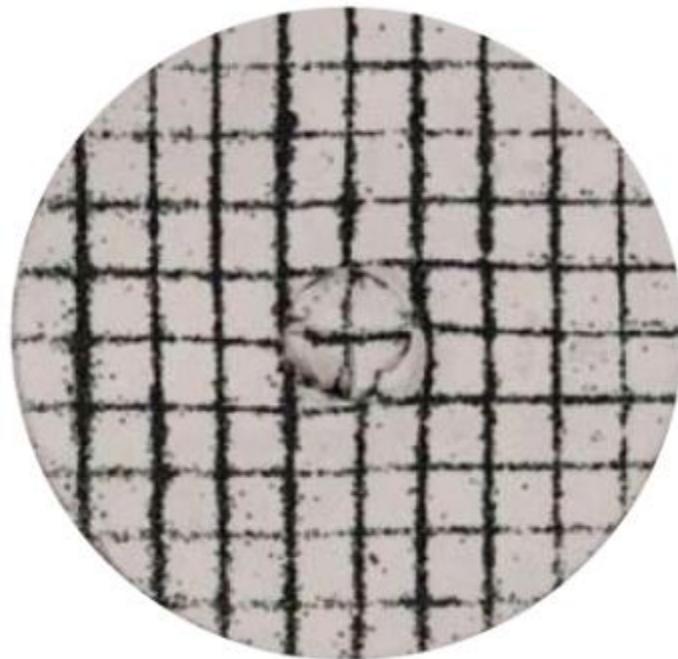
Clay behaviour

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Clay behaviour shear vane

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Clay & water



Clay & RHEOSOIL solution

Problems with clay clogging in Sochi

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10m Herrenknecht TBM, tunnel #5

Problems with clay clogging in Sochi



Use of water, no foam

Very big lumps, conveyor belt damaged

Problems with clay clogging in Sochi



Use of more water,
Transport & handling difficulties

Problems with clay clogging in Sochi



Use of Rheosiol 143, perfect consistency, high advance rates
Clean cutterhead



Hard rock

wear examples ...

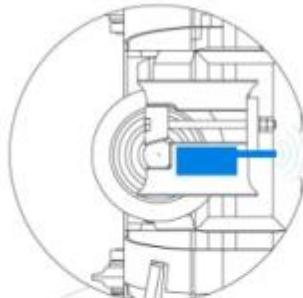


NTNU personal on site

Dust Monitor

Robbins Cutter Instrumentation System

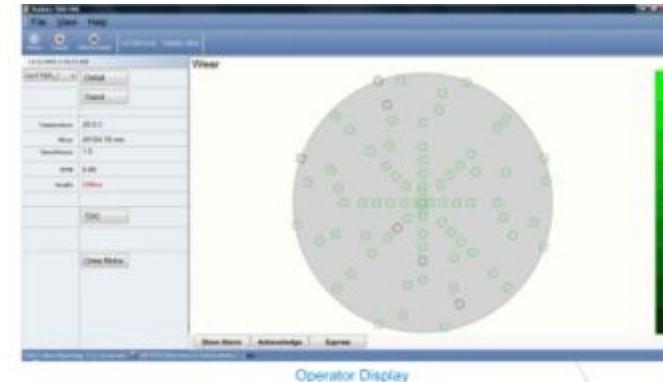
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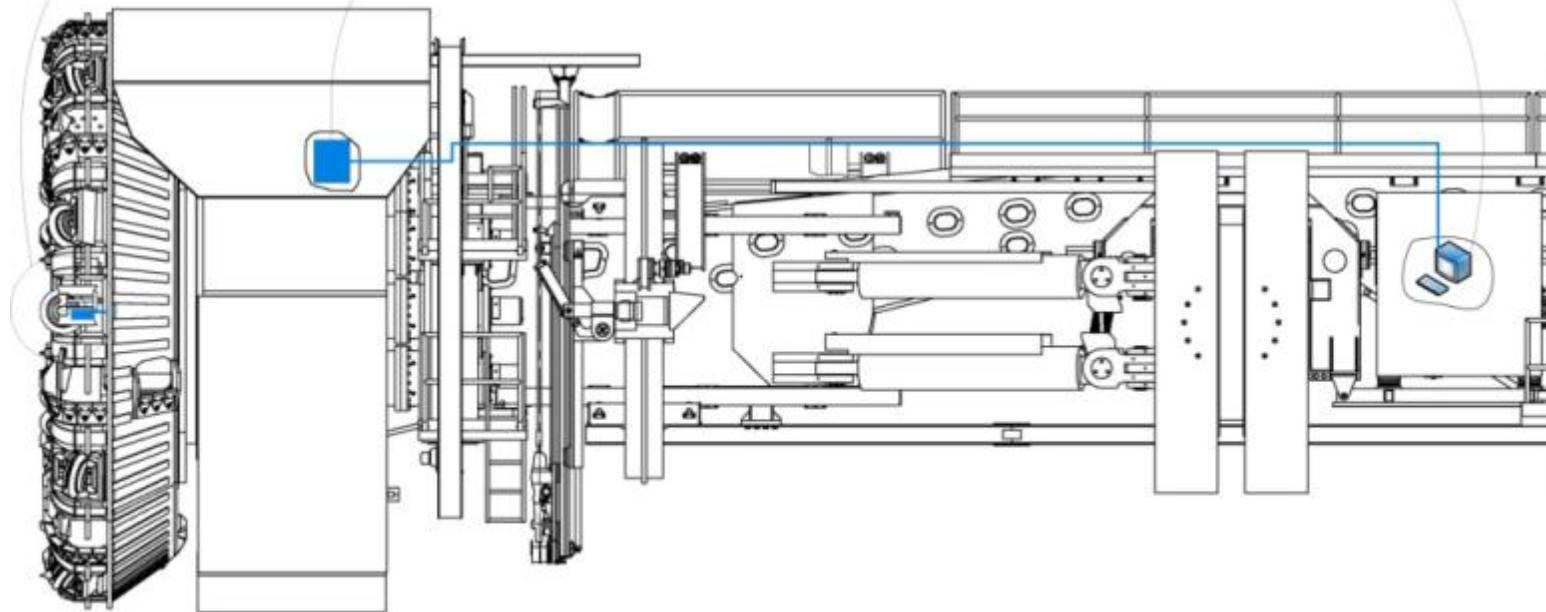
Cutter Sensor



Data Receiver



Operator Display



MEYCO
Expanding Horizons Underground

Problems with clay clogging in Sochi

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Problems with clay clogging in Sochi



Use of MEYCO ABR5
Perfect consistency, no free water

Hard rock / soft ground mix
Lots of water against clogging
Huge handling difficulties



MEYCO® ABR 5 Benefits

without ABR



disappearance of dust
longer life time of electronics,
healthier working conditions

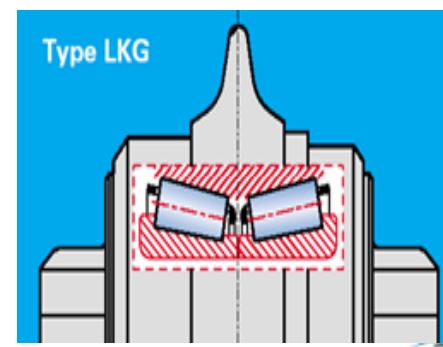


clean & cool cutters
easy & quick to change
no muck clogging



drastic reduction of cutter
temperature,
no cutter blockage any more
around 15% wear reduction
reduced downtime

with ABR



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TBM drive in blocky ground

Problem: fractured rock + water

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Microcement-Injection (pre-injection) in Sochi

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Problem: blocky rock + water

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PU Injection (post-injection) in Sochi

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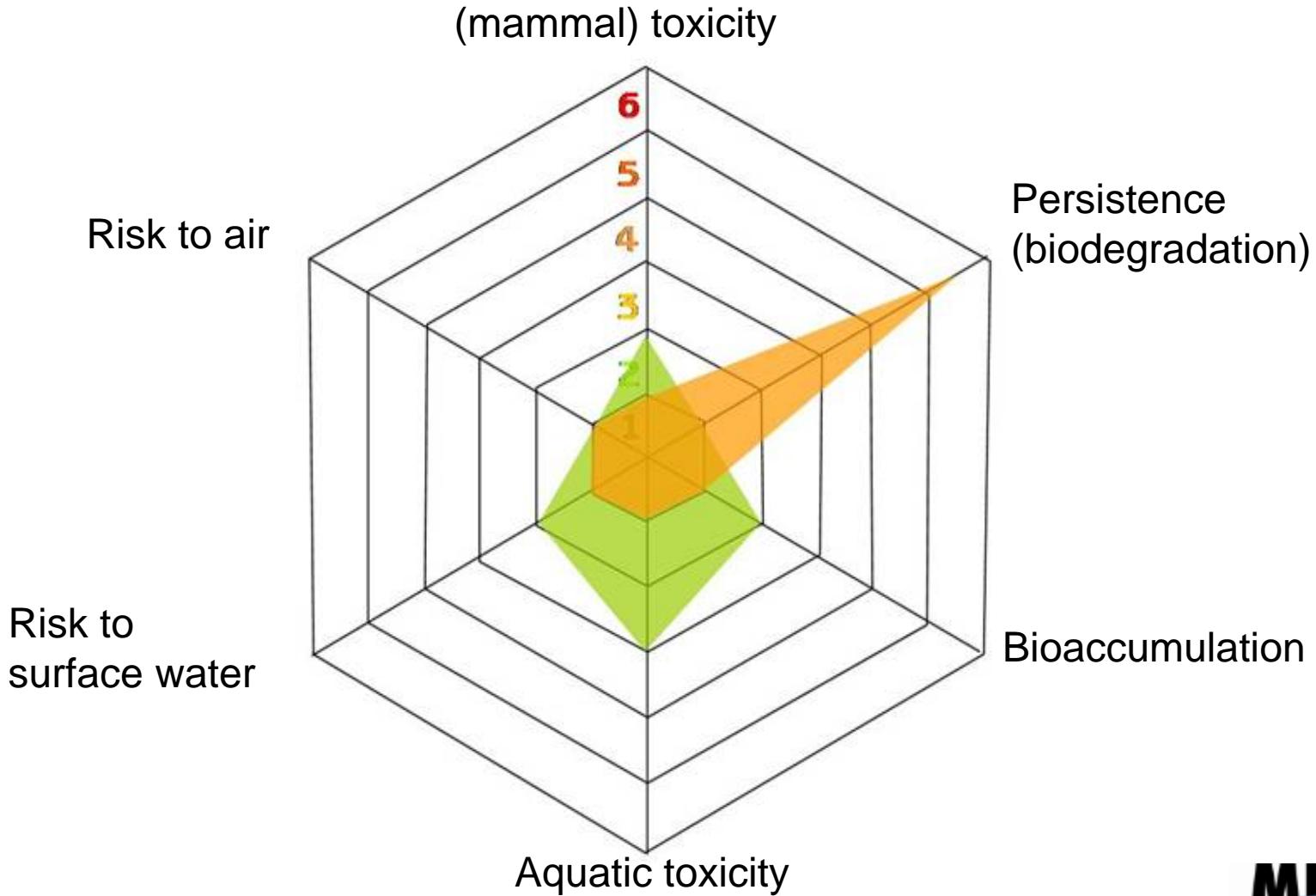
Environmental Studies

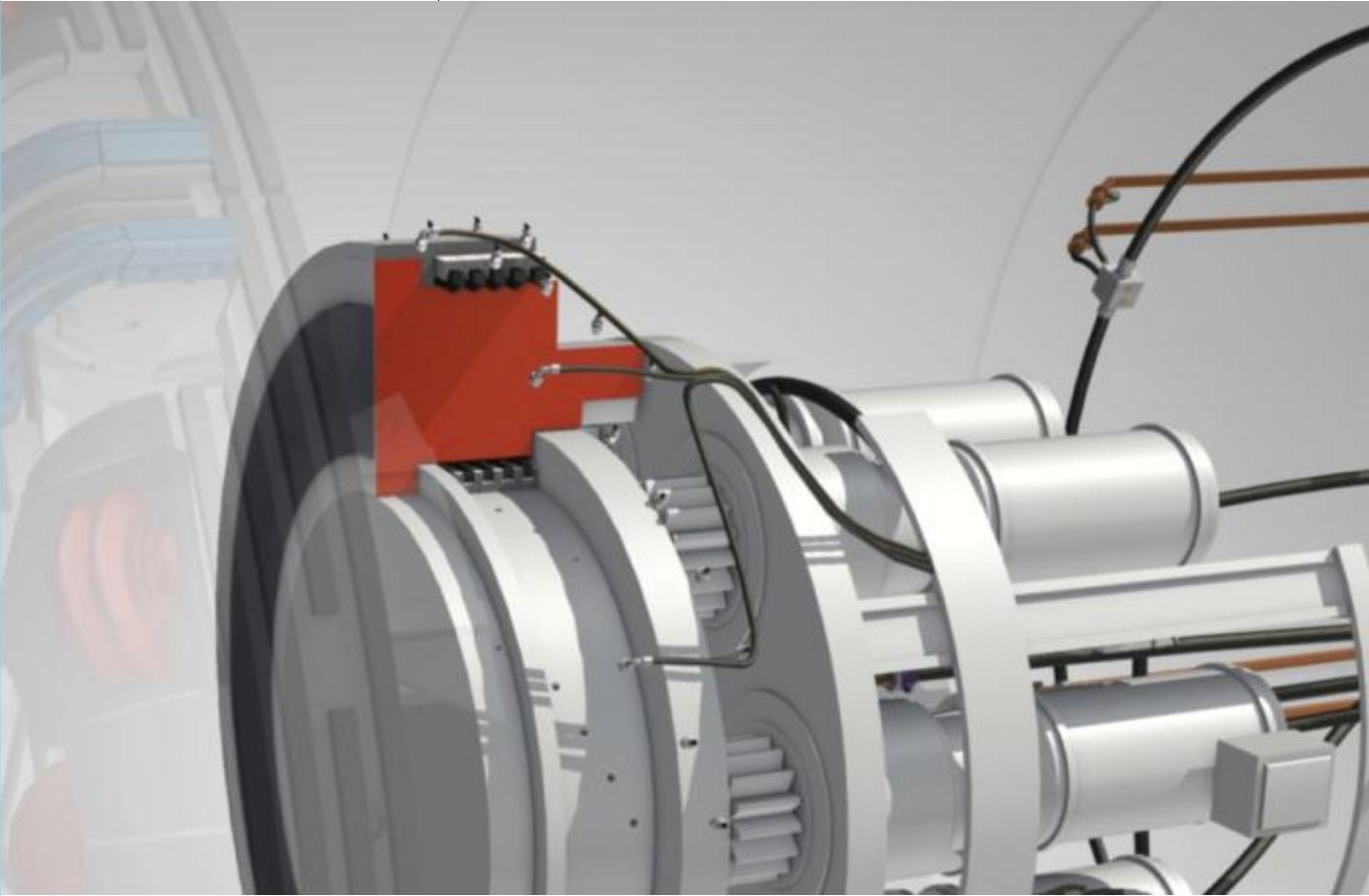


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General Risk Characteristics

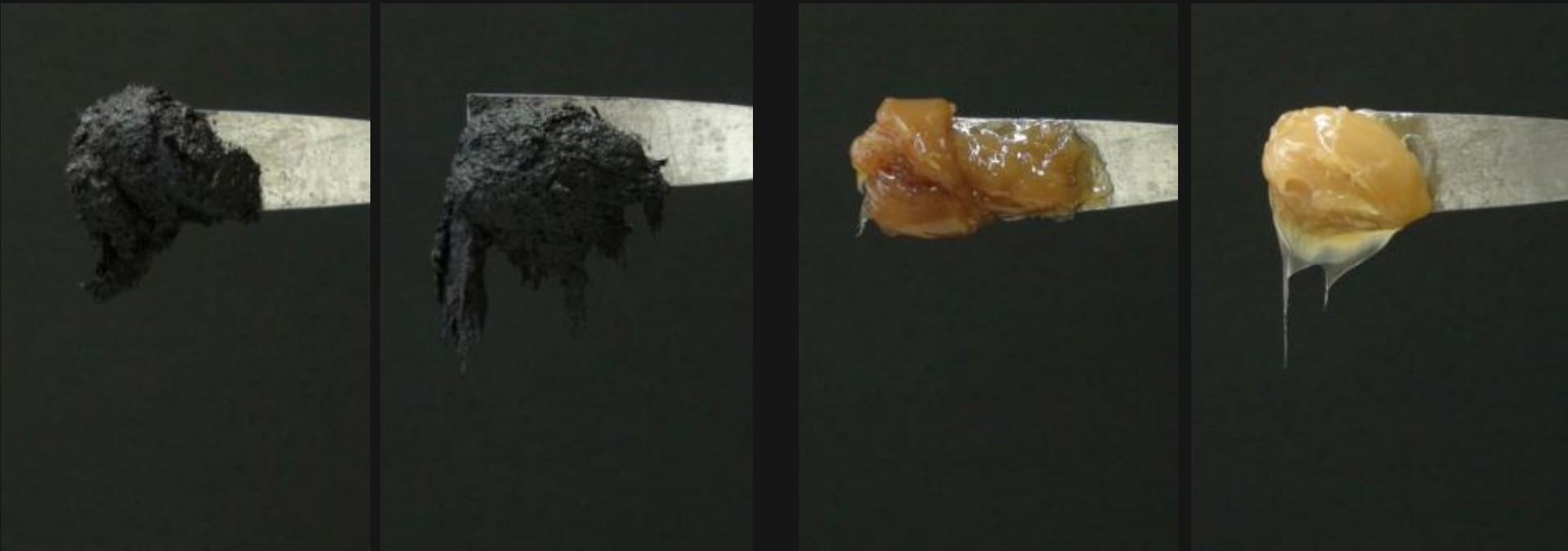
important factors of eco-compatibility





Main Bearing Greases

Main bearing greases with Merkel agreement

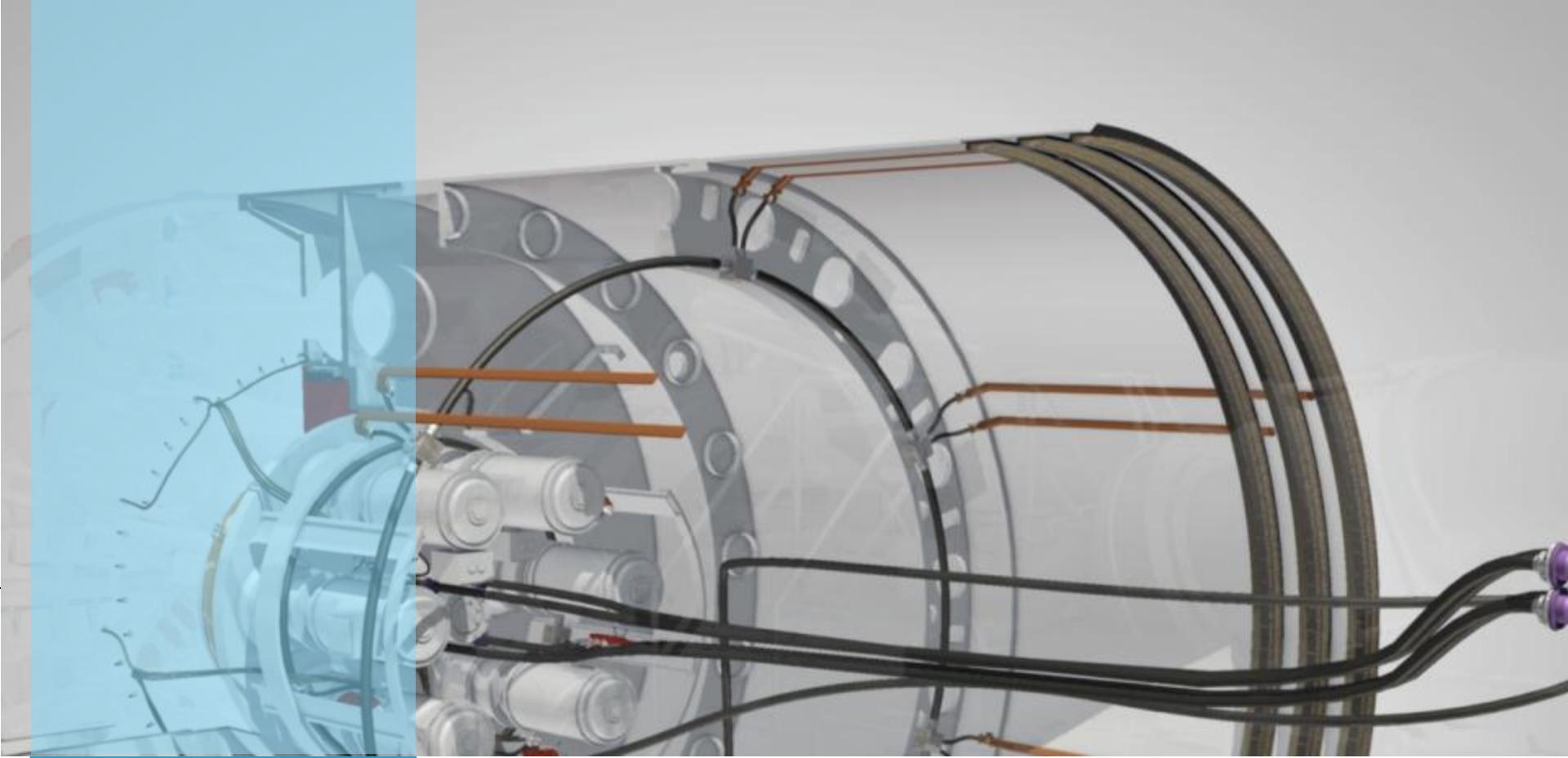


MEYCO BSG 1
Main bearing sealing
Biodegradable
Plant oil based

MEYCO BSG 11
Main bearing sealing
synthetic oil based

MEYCO EPB 1
Main bearing lubrication
Biodegradable
Plant oil based

MEYCO EPB 11
Main bearing lub
synthetic oil based



Tail Sealants

Tail sealants



MEYCO TSG 7

- 1st fill grease
- stiff but pumpable
- not mixable with annulus grout



MEYCO TSG 6

- driving grade
- highly resistant against water
- allrounder



MEYCO TSG 16

- driving grade
- highly resistant against water
- different rheology

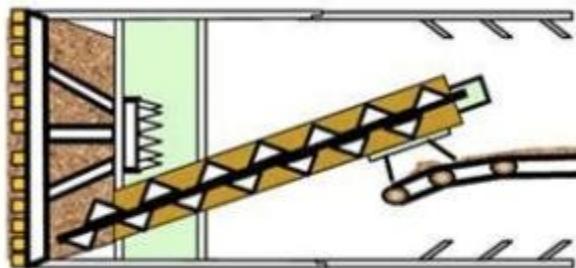


MEYCO TSG 26

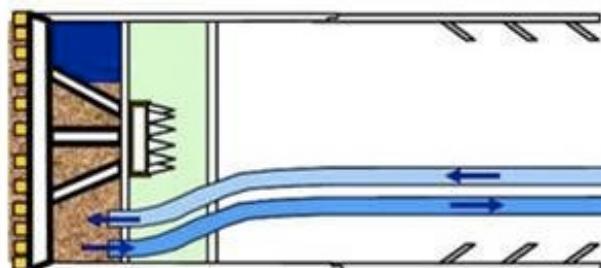
- fire resistant
- eco-friendly because 100% oil-free
- passes waterpressure tests

Product families according to TBM types

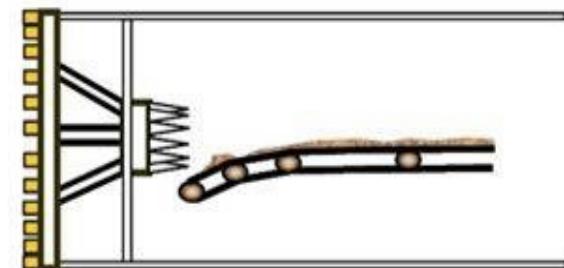
EPB machine



Slurry machine



Hard Rock machine



- Soil conditioners (Foams & Polymers)
- Anti-Clay-Agents
- Anti-Abrasion-Agents
- Main bearing sealing
- Main bearing lubrication
- Tail sealants
- Annulus grout additives
- Segment concrete additives

- Bentonite additives (Improvement & Separation)
- Anti-Clay-Agents
- Main bearing sealing
- Main bearing lubrication
- Tail sealants
- Annulus grout additives
- Segment concrete additives

- Anti-dust & Anti-wear additives
- Anti-Clay-Agents
- Main bearing sealing
- Main bearing lubrication
- Tail sealants
- Annulus grout additives
- Segment concrete additives
- Injection & void filling
- shotcrete