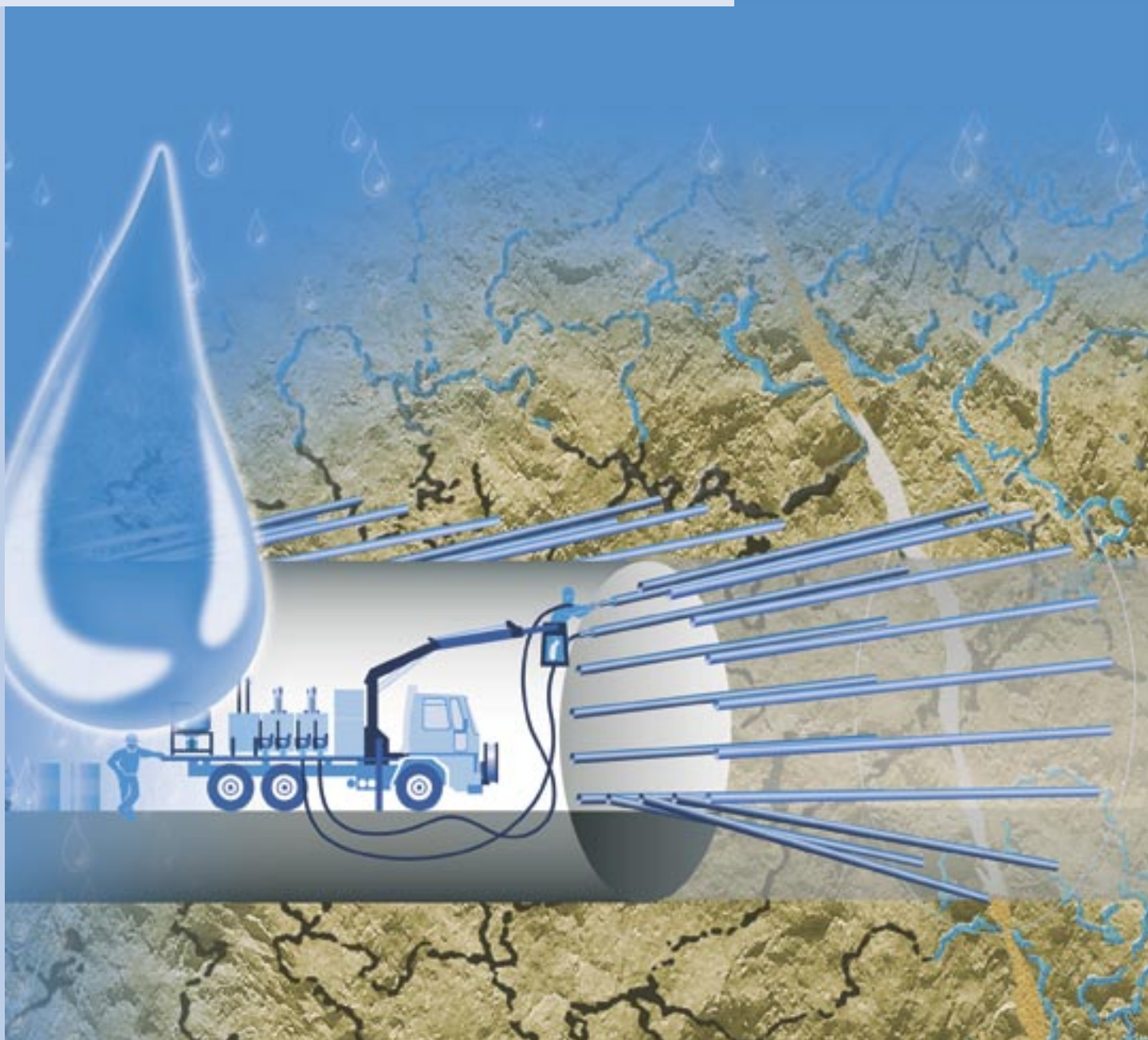


Injection – à la carte

 **BASF**

The Chemical Company



New standards in pre- and post-injection



■ Pre-injection with Rheocem® 800 at Arlandabanen

Avoid the unexpected

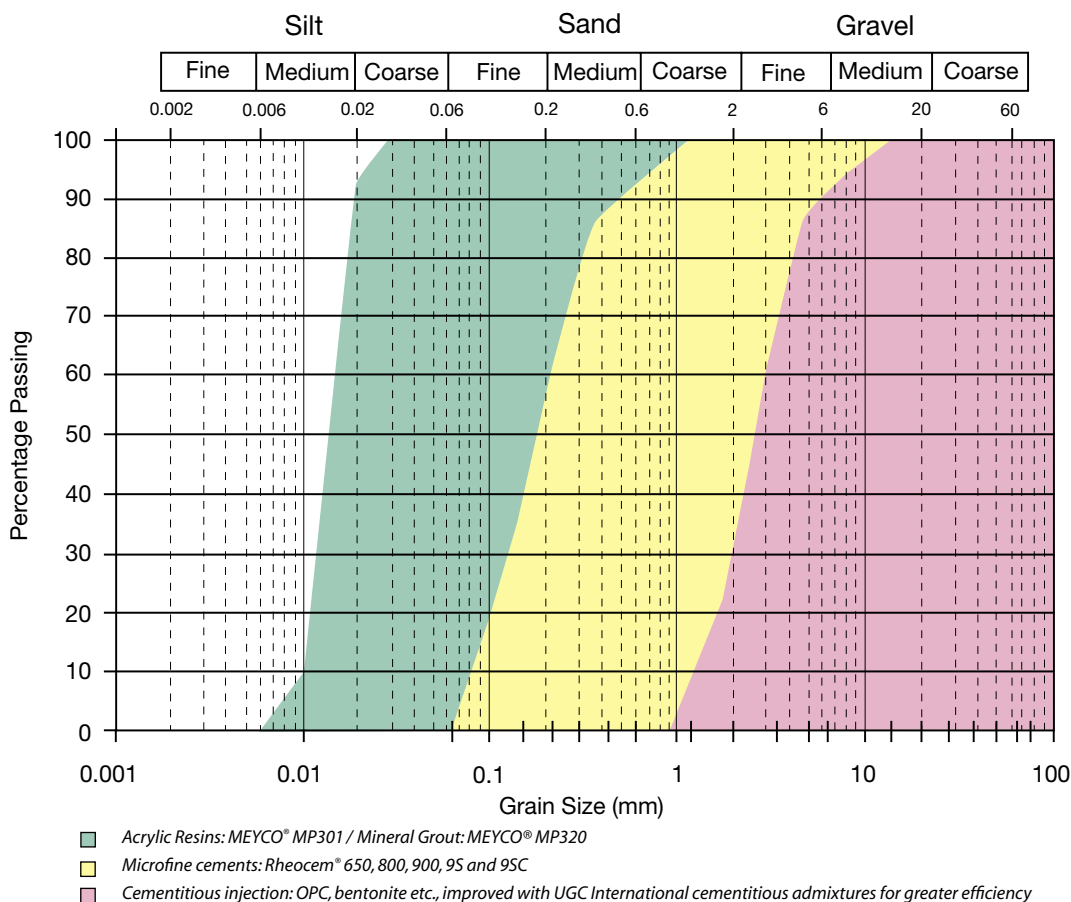
Unexpected water ingress during tunnelling usually escalate project costs, and significant delays are then inevitable.

To counteract these risks, UGC International offers a range of injection systems to suit whatever conditions maybe encountered.

The choice of system is dependant on many factors, such as water quantity and pressure, the characteristics of the rock or soil, the sequence of construction, and the final watertightness requirement.

Choice of reliable solutions

Traditional tunnelling methods are now being replaced with systematic pre-injection technology that optimises tunnel efficiency. UGC International offers two pre-injection systems based on micro cement or acrylic resin, to cater for the range of likely geological conditions during a tunnel drive.



■ General guidelines where to use different UGC International systems in soil

Cement injection



■ Rock injection with Rheocem®

Different types of Rheocem® micro cements

- Rheocem® 650, 650SR <16.5 micron dmax 95
- Rheocem® 800, 800SR <13.0 micron dmax 95
- Rheocem® 900, 900SR <9.0 micron dmax 95
- Rheocem® 9S <9.5 micron dmax 95
- Rheocem® 9SC <9.5 micron dmax 95
- SR – Sulfate resistant
- S – Soil injection
- SC – Soil injection including admixture

Application of Rheocem® micro cements

- Soil injection: stabilisation, reduction of permeability and reduction of ground water lowering
- Rock injection: tunnels, caverns, etc. as pre-injection; reduction of ground water lowering

Injection with Rheocem® micro cements

Micro cements are a range of superfine cements for special applications, such as injection of rock and soil. Because of their fineness they have extremely good penetration into micro cracks in soil, rock and concrete and give efficient tightness and durability.

They are easier to handle, cost less than resins and can cope with most injection situations. Resin products provide a good alternative when cement systems are ineffective.

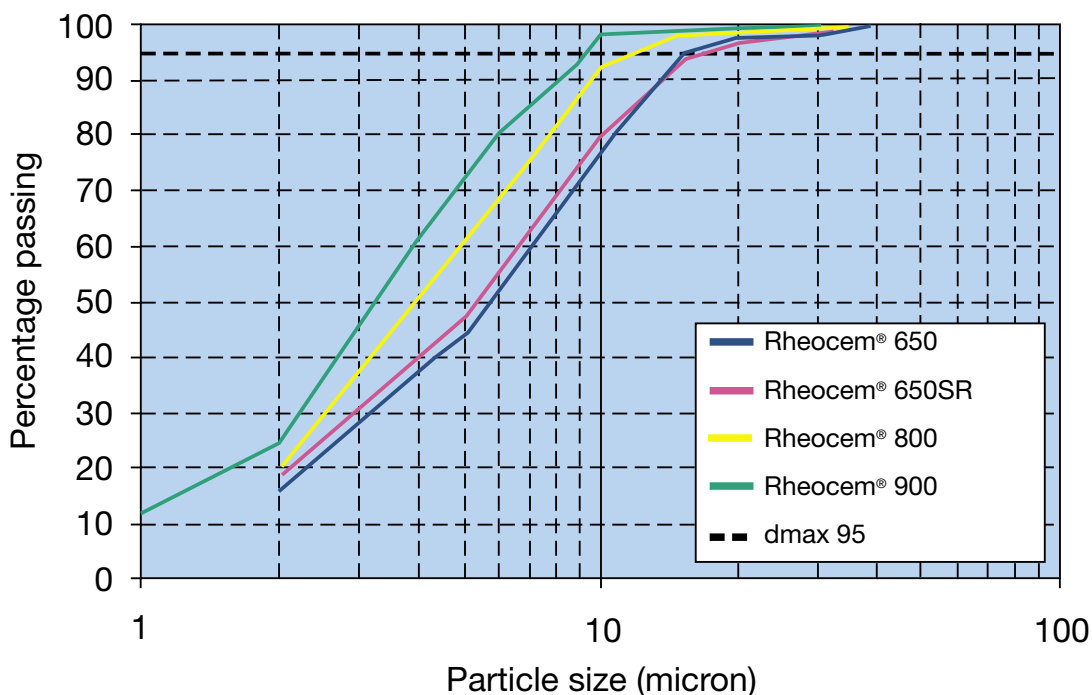
Rheocem® micro cements are produced in different grades relating to the maximum particle size.

Features and benefits of Rheocem®

Rheocem® opens up new possibilities into the injection world. The main properties are:

- fast setting times
- good stability
- good penetration
- reduced waiting times which result in cost savings
- standard cement injection equipment can be used

Rheobuild® 2000PF should always be used together with Rheocem® micro cements to increase the penetration of the mix



■ Rheocem® Particle Size

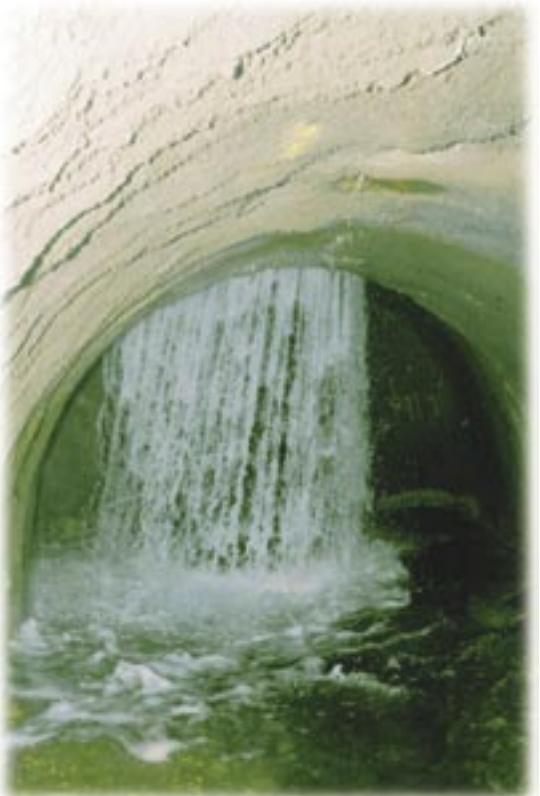
Chemical and Mineral grouts for injection



■ Sand stabilisation with Acrylic resin



■ Rock injection with Acrylic resin



■ Waterstop: Typical PU-Foam injection situation

In certain situations micro cements cannot be totally effective and resin based products have to be used. UGC International has developed products that are designed to have a high performance and yet be economical. Of critical importance is that these products are safe to handle and remain environmentally friendly.

Acrylic resin system

MEYCO® MP 301

- Very good penetration into cracks and fissures
- Adjustable gel time (2–10 minutes)
- Polyacrylamide and formaldehyde free.

Mineral Grout

Colloidal silica MEYCO® MP 320

- Very good penetration due to low viscosity (<5 mPa s) and extremely small particles
- Adjustable gel time (10 min–2.5 hour)
- Environmentally friendly.

Polyurethan – Injection foam

UGC International has developed 2 types of PU foam for injection MEYCO® MP 355 1K and MEYCO® MP 355 A3.

MEYCO® MP 355 1K

Is one-component closed cell polyurethane injection foam for filling voids and jointed rock as well as for cutting off running water.

Application of MEYCO® MP 355 1K

- Crack injection in rock
- Stabilisation of jointed rock
- Sealing of flowing water

Features and benefits of MEYCO® MP 355 1K

- Solvent free
- Adjustable reaction time
- Reaction in moist and wet conditions
- Sealing of running water

MEYCO® MP 355 A3

Is robust two-component closed cell polyurethane injection foam for filling big voids and jointed rock, stabilisation of loose rock, and cutting off running water.

Application of MEYCO® MP 355 A3

- Pre-injection of jointed rock
- Water cut off
- Stabilisation of weak loose rock

Features and benefits of MEYCO® MP 355 A3

- Solvent free
- Reacts also in dry conditions
- Sealing of running water
- Robust rigid foam

Injection packers and lances

Injection procedure using disposable packers

Step 1



The packer is attached to the injection pipes and pushed into the drilled hole.

Step 2



The packer is expanded in the drilled hole using the tightening lever. Cement mixture or chemical substance is injected into the rock's crack system through the rubber valve in the packer.

Step 3

A. Double lock-washer
B. Rubber valve



The pump is stopped when injection is to be ended. The valve in the packer is automatically closed by the return pressure so that the injected substance does not run out. The tightening lever is screwed back and the injection pipe is screwed out of the packer. The pipes are taken out of the drilled hole. The rubber sleeve on the injection packer is held in the expanded position by a double lock-washer.

References

Europe

- Bjørøy, Subsea Road Tunnel, Norway
- Arlandabanen Railway Tunnel, Sweden
- Gardermoen Railway Tunnel, Norway
- Ormen drainage Water Tunnel, Sweden
- Frøya, Subsea Road Tunnel, Norway
- North Cape Subsea Road Tunnel, Norway
- Galmoy Mine, UK
- Sedrun Access Tunnel, Switzerland
- Kilkenny Main Water Drainage Tunnel, Ireland
- Torbay Waste Water Shaft and Tunnels, UK

Near East

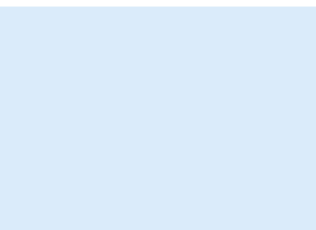
- Khimti Hydropower Project, Nepal
- Strategic Storage Program, TBM Tunnel, Saudi Arabia
- Uri Hydropower Project, India

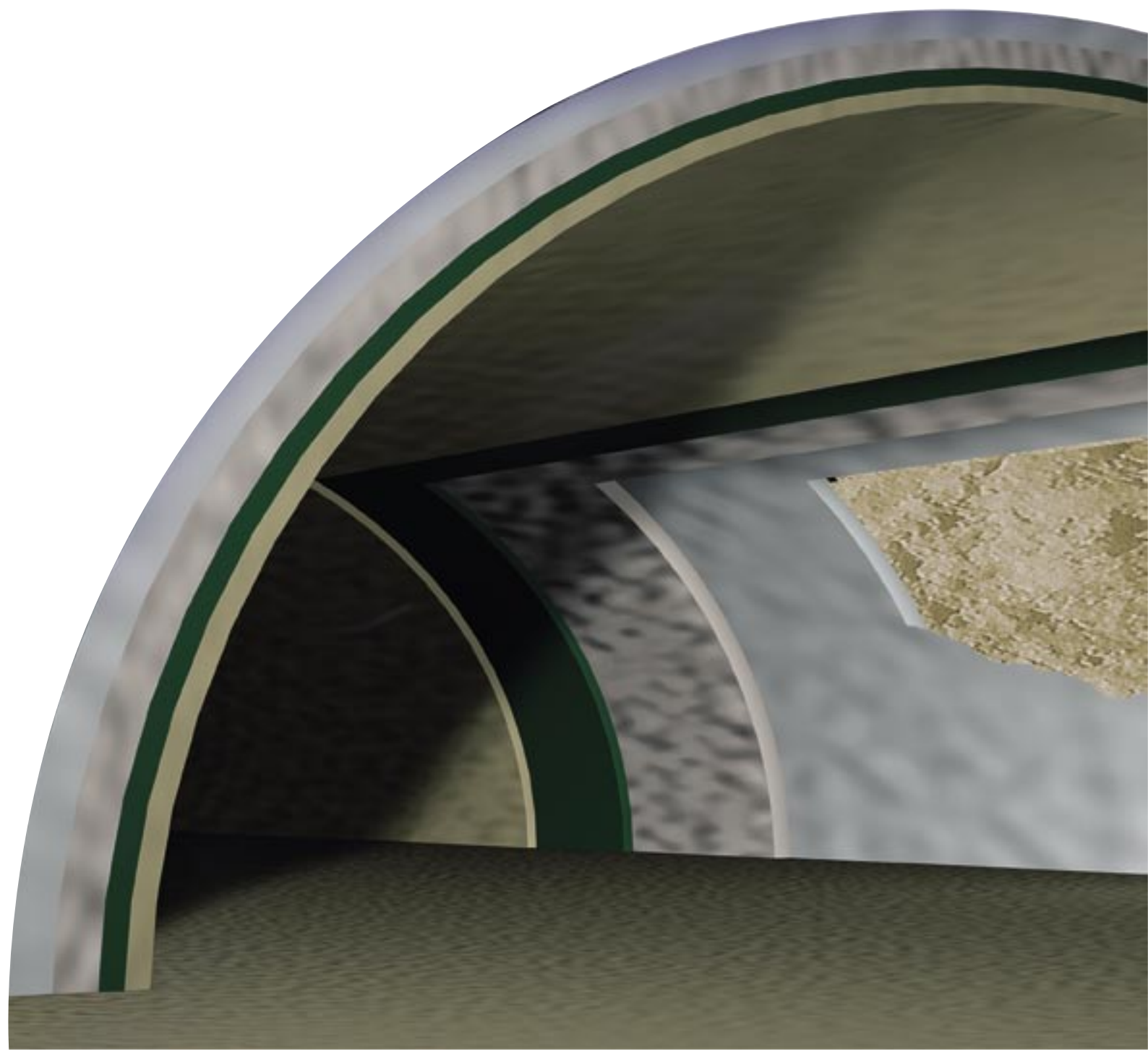
Asia Pacific

- Bukit Timah Caverns, Singapore
- Strategic Sewage Disposal Tunnel, Hong Kong
- Shanto LPG cavern, China
- KCRC Railway Tunnel, Hong Kong
- MTRC Metro Tunnel, Hong Kong
- Eastern Distributor Storm Water Tunnel, Sydney, Australia
- Melbourne City Link Road Tunnel, Australia
- MRT North East Line C709, Railway Tunnel, Singapore

North America

- Stillwater Mine, USA







«Together we do things better.»



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