• Challenges by Application of Polyurea in Arctic Areas.
• Solutions Through Experience and Innovation.

By Elisabet Norderup Michelson
Believe it or not
We love snow and low temperature
Challenges by Application of Polyurea in Arctic Areas

• High delta T during application
• Dew point problems. Temperature differences between day and night
• Freeze thaw cycles
• Big movements in existing cracks and crack development due to low temperature.
Strength, elasticity in combination with low temperature properties, makes Polyurea unmatched as a material for protection of constructions.

But, we have to take care, this is not a fairytale!

Even polyurea has its limitation and to obtain the best results, we need to learn from our experience and mistakes.
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We need to think twice before we make the design of the application.

- New constructions
- Repair work
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Right equipment at site and everything well prepared is always expected, but for application in colder areas, it is necessary with preheating even in summertime.
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This was too tough even for polyurea. A layer of app 6-8 mm was applied on a surface which later was used as a training area for big military vehicles with steel spikes of several mm in the studded tires and no ABS brake system.
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Weight cell for ballast. 4 mm Micorea S3 applied in 2006
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No damage 2014
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Tension cracks due to movements in the substrate during nighttime in first day of curing.
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Ensure all the cracks or damages in the surface is repaired and sealed before application of polyurea.
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Prepare a well grinded, dry, dust free surface with a primer and install an anchor slot to make a god membrane finish. Ensure that the primer always ends outside the finish area of polyurea. Normally we recommend sand scattering of an epoxy primer.
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…to avoid adhesion problem….
Try to find out where the lowest point will be and secure that this point isn't along the finish line of polyurea. If water will be able to find the way between the primer layer and polyurea, you have a problem. If the water freeze, you have a even bigger problem.
Water pressure due to hydrostatic pressure from ground water
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Find out as much as possible about the ground conditions. It may be dry enough during application, but if there is a constant water pressure, adhesion failure is difficult to avoid.

Try to avoid overlap areas where there is turning zones, and always keep control of the dew point and use the primer your supplier suggest.
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Tele mast
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Crack repair material…..

Not Polyurea
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Arrange round corners with and try to finish the polyurea lining a bit up on the wall
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Under ground tunnel repair designed with polyurea as lining after concrete surface pre preparation.
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Is this watertight?
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When the failure is a fact- is it the fault of polyurea?
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Crack due to tension during green time and temperatures below 0
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No excuse- such work gives polyurea bad reputation
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Delta T
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This is the reason to promote spray course. The work was done by a contractor without any course.
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Keep the working site clean!!!
• I don't understand why I have done this wrong all this years.....
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Water protection of frost areas in tunnel openings
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Solutions Through Experience and Innovation
Concrete lining of a water vapor tight membrane applied on fresh (green) concrete.
Old technology used offshore since more than 30 years.

This technology will be used in some weeks time, for application of an abrasive membrane based on polyurea on top of a concrete deck directly after casting.
• Time = money
• Criteria's for success
  – 100% control of the concrete formulation
  – Tests has to be performed based on the local cement type
  – W/C ratio close to 0.38, never above 0.4
– Best application time is directly after the concrete reaches its peak heat hydration temperature (app 24 hours after casting)
– No pretreatment of concrete
– 100% control of primer formulation, to avoid problems with osmotic blisters.
Entrapped humidity could course formation of blisters in the coating

Humidity witch condensate beneath the coating and course adhesion failure, and humidity witch cause blisters due to temperature change cause big problems with frost expansion.
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Water vapor diffusion tight coating directly on ground without diffusion barrier.

Pressure of water or water vapor

- If there is humidity in the concrete surface during curing time of primer – the adhesion will be weekend.
- Water is transported by capillary forces
- The application has to be performed on falling temperature gradient
- The temperature shall always be min 3 degrees above the due point during application
Osmotic blisters:

- Occur after several months after application of coating, and may continue to develop in several years.
- The blisters are always water filled with high pressure
Elastic membrane on humid substrate.

• The elastic properties of polyurea also makes it easier to create blisters by expansion in the material in case of pressure from below.

• It could be wise to choose a material with lower elongation properties, if it is possible.

• The primer and the quality of the workmanship of the priming, is critical for a good result.
Thanks for your attention

Elisabet Norderup Michelson
Elmico AS
Elmico is an innovative system house in high-performance thermoset polymer technology, developing functional solutions to meet customer needs.

Elmico’s production plant is situated in Norway, app 1 hour by car from Oslo airport.

Elisabet Norderup Michelson
General manager
+4792484646
elisabet@elmico.no