



## Sealing the future of well integrity

Cecilie Torvund | Director Sales & Marketing

Svein Norman | VP Operations





# Case Story – Water shut off Gas Well Indonesia

## The Challenge

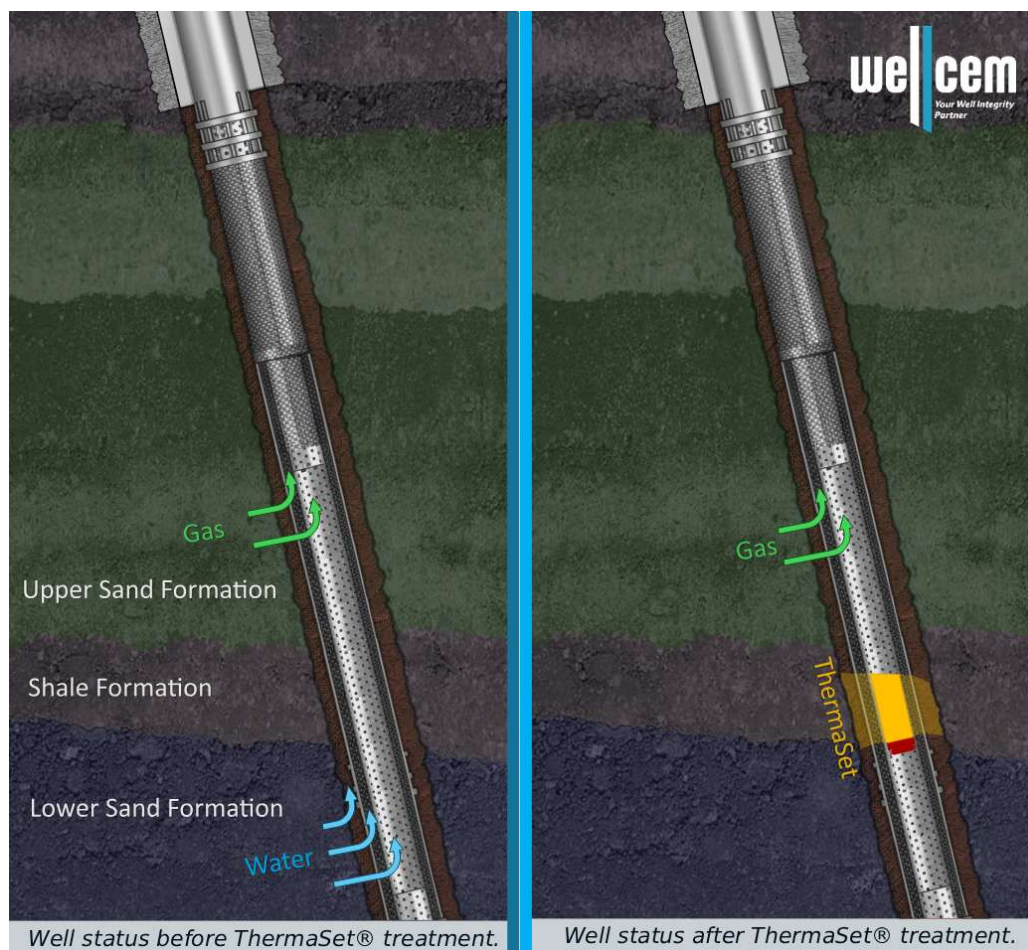
- The well experienced an increase in water production from the lower sand interval.
- Water shut-off treatment is required to restore gas productivity and extend the well's economic life.
- Lower completion consists of OH screens (200 $\mu$  Mesh) and gravel pack.

## Objective:

- Isolate the water producing zone by placing a 4 to 5 m ThermaSet plug across the impermeable zone on top of a bridge plug.

## Resin Selection:

- Cement will hydrate on the screens
- The low viscosity resin demonstrates its superior properties to effectively fill voids and channels within the screens, gravel pack, and into the formation.
- The low density of the resin helps control the volume of resin injected into the formation.



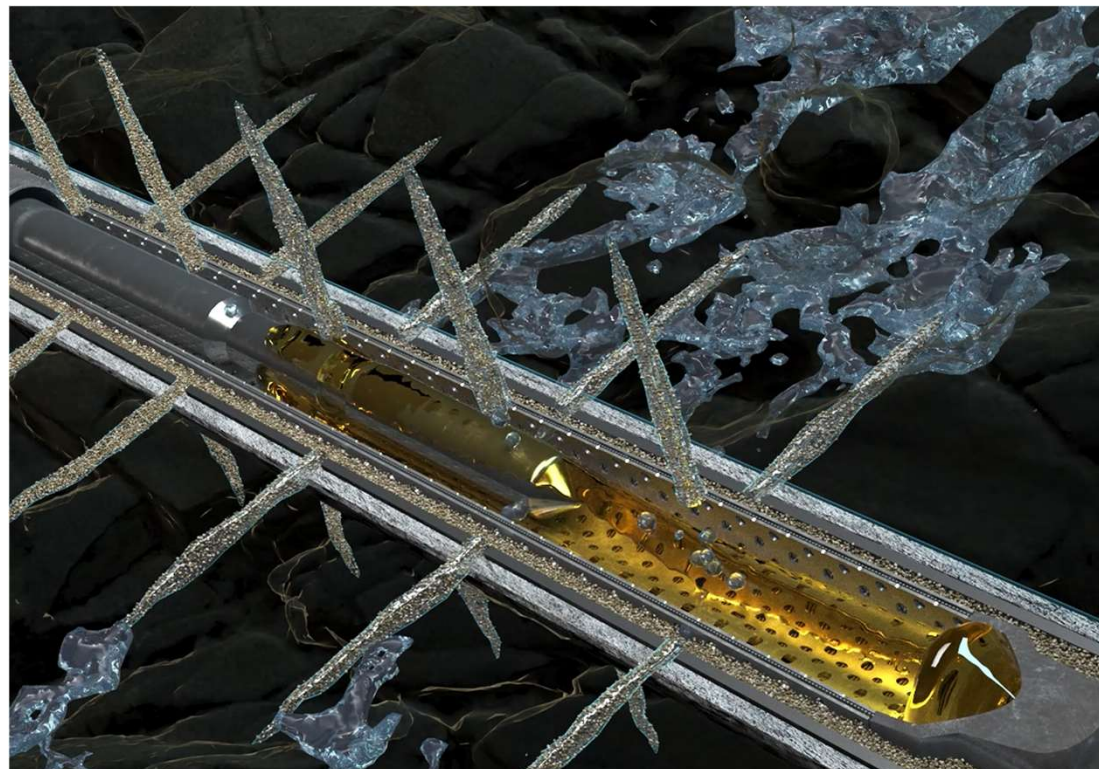
## Case Story – Water shut off Gas Well Indonesia

### Solution and Implementation:

- Designed resin solution through lab testing and temperature simulation. Setting temperature designed for 8 hours at 50 deg C.
- A total amount of up to 80 liters of ThermaSet was expected to be spotted downhole with 5-6 bailer runs.

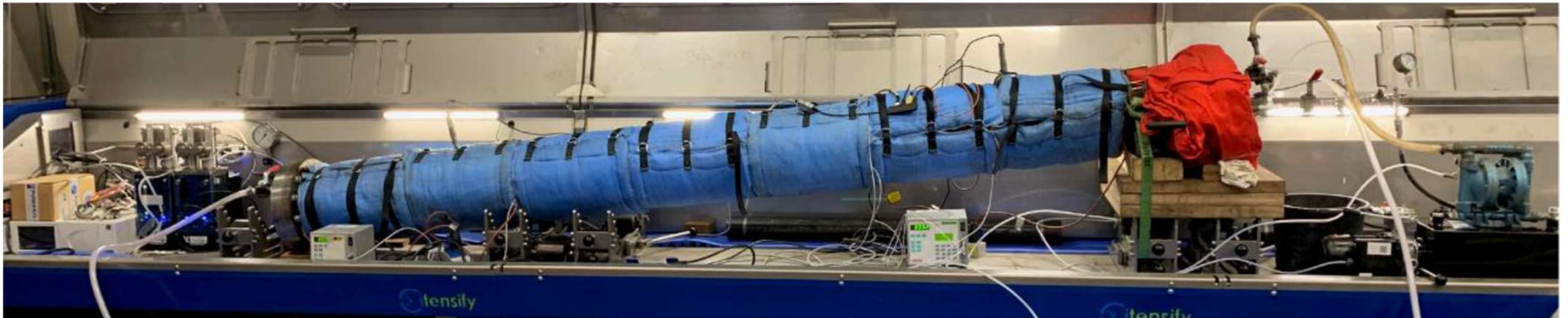
### Results:

- Successfully isolated the water zone in two runs with 30 L ThermaSet resin
- Water production was reduced by 98%
- Operation executed ahead of time and cost



# ThermaSet Resin Evaluation for Isolation in OHGP Wells with APS Sand Screens

- 4" sand screen (150-micron mesh) mounted outside a perforated base pipe
- 8.86" x 4" annulus packed with 20/40 gravel to simulate OHGP conditions
- ThermaSet Resin injection through CT and then squeezed through the screen into the gravel pack.
- Simulated wellbore inclination of 83–86°
- Monitored resin flow, placement, and pressure response through ports and sensors along the test section.
- Measured permeability before and after Resin placement.



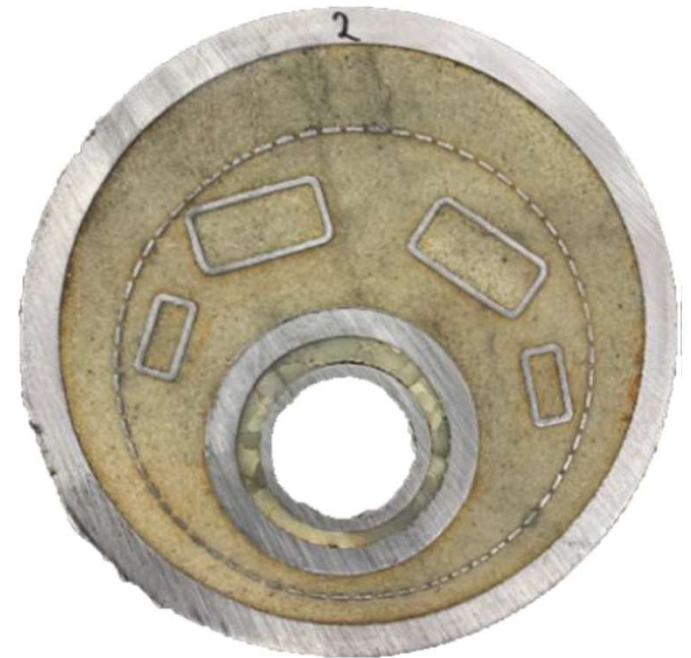
# ThermaSet Resin Evaluation for Isolation in OHGP Wells with APS Sand Screens

## - Results

ThermaSet achieved 99.9% permeability reduction across 3 meters of gravel pack.

### Conclusion

ThermaSet resin demonstrated excellent compatibility with sand screens and the surrounding gravel pack. It enabled clean injections, complete seal formation, and high-efficiency water shut-off under representative downhole conditions.



# Case Story – Sealing a Leaking Cement Plug

## The Challenge:

- Sustained Casing Pressure in A-annulus (9 5/8" CSG x 5 1/2" tubing) due to a leaking cement plug. Preventing the client to effectively abandoning the well.
- 2000 psi shut-in pressure
- TBG Perforation depth @ 2047 mMD.
- Temperature 76-78 °C
- TOC 2347 mMD + Fish in tubing

## Objective:

- Seal up the leaking cement with ThermaSet resin.

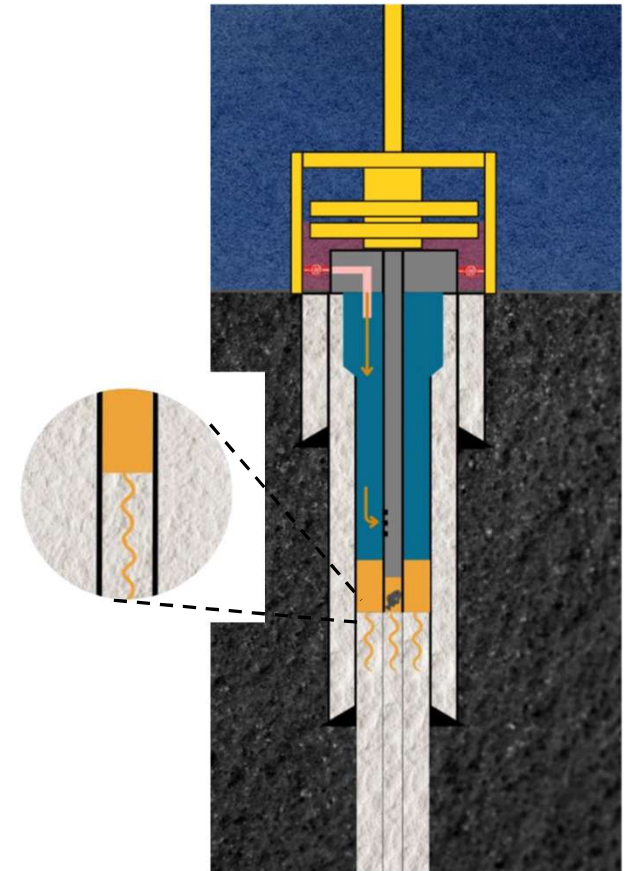
## Execution:

- Circulated ThermaSet pill into the A-annulus through tubing punches chased by ISW
- Allowed the ThermaSet to drop by gravity to TOC
- Applied pressure to squeeze resin into the leak paths in the cement
- Closed in well until ThermaSet was fully cured.
- Bled off pressure and performed inflow test that confirmed a successful operation

Remediation of Sustained Casing Pressure in the well with subsea wellhead by sealing microchannels in cement plug with ThermaSet® sealant prior to P&A

## Results:

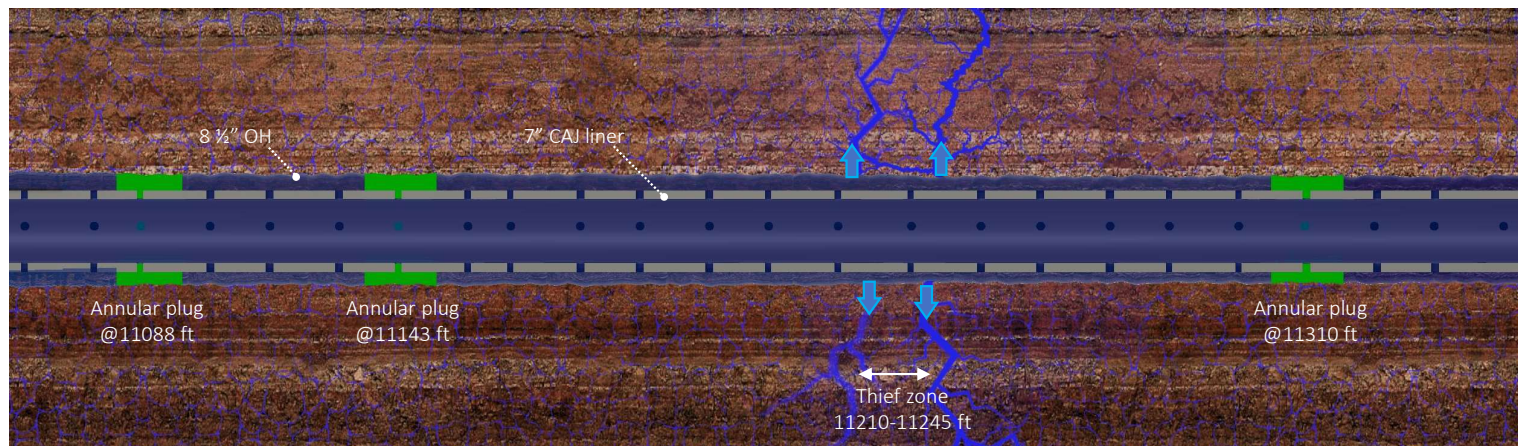
- 8 hours inflow test with no pressure build up



# Zonal Isolation, Case History

## Well Status and Challenges:

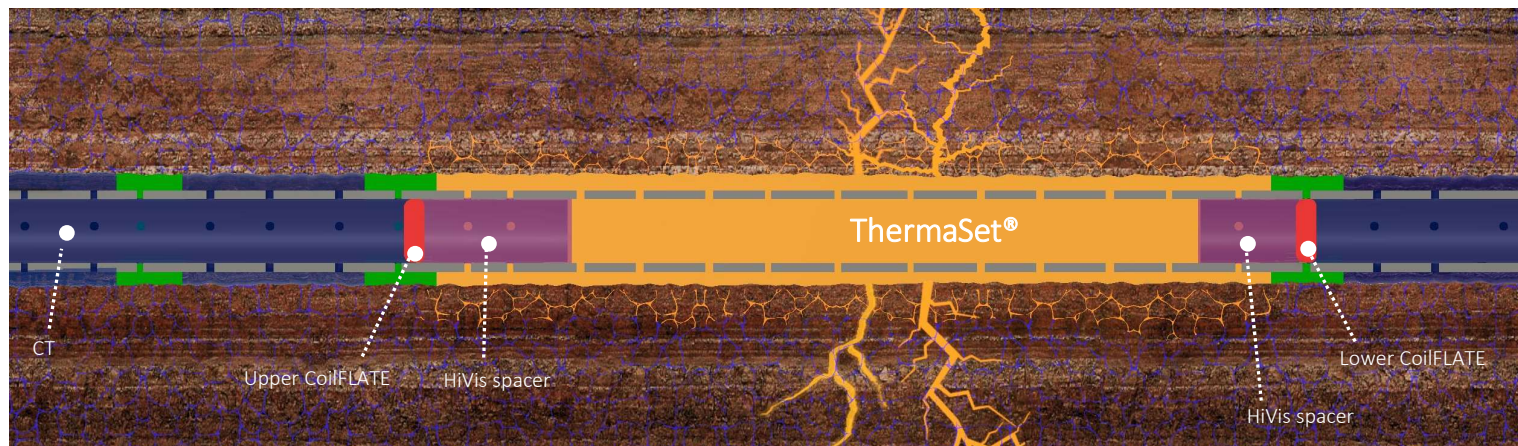
- The well is used for water injection to support the reservoir pressure.
- A dense fracture network (thief zone) located in the horizontal section of the well was connecting it to the neighboring producer.
- The well is completed with a 7" CAJ (Controlled Acid Jetting) liner.
- The condition of the CAJ liner was very poor and in certain sections completely deteriorated.
- 3 Annular plugs placed at 11,088', 11,143', and 11,310' prior to ThermaSet® treatment.



# Zonal Isolation, Case History

## Solution:

- Set Lower CoilFLATE @ 11,310 ft
- Placed a HiVis spacer on top of CoilFLATE to protect it from ThermaSet®.
- Set Upper CoilFLATE @ 11,143 ft.
- Pumped 30 Bbl of ThermaSet® pill through CT followed by a HiVis spacer and dart.
- Pumped calculated volume of sea water as displacement fluid.
- Disconnected CT from CF
- With the stinger 1 ft above the CF, pump ThermaSet® Cleaner and washed top of CF
- POOH while circulating water.



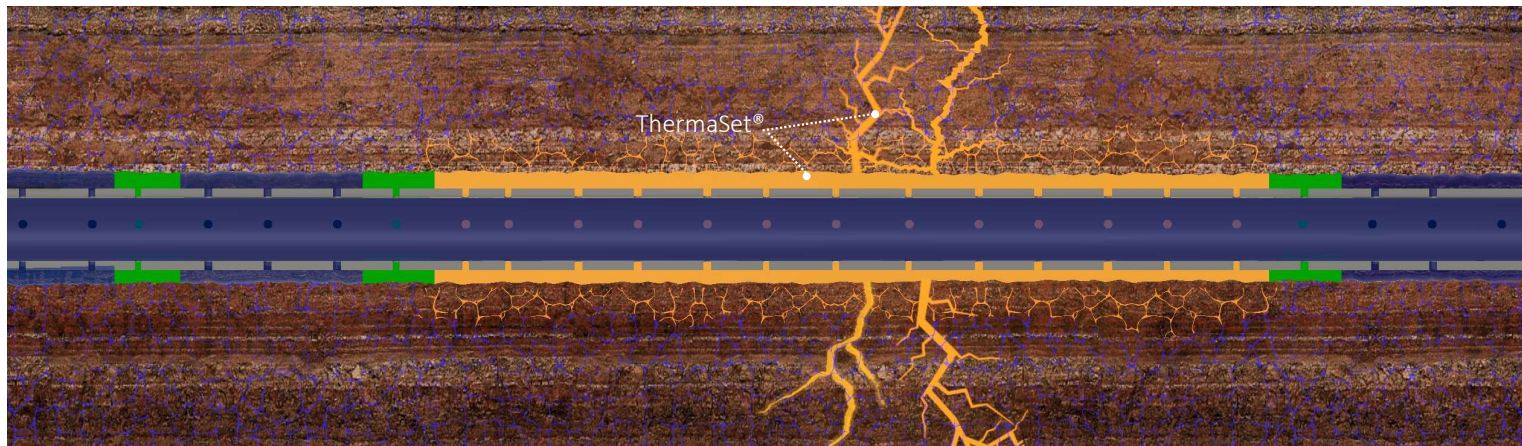
# Zonal Isolation, Case History

## Solution:

- After waiting on ThermaSet® to cure, RIH and retrieved the upper CF
- Milled ThermaSet® plug down to 11,298' MD.

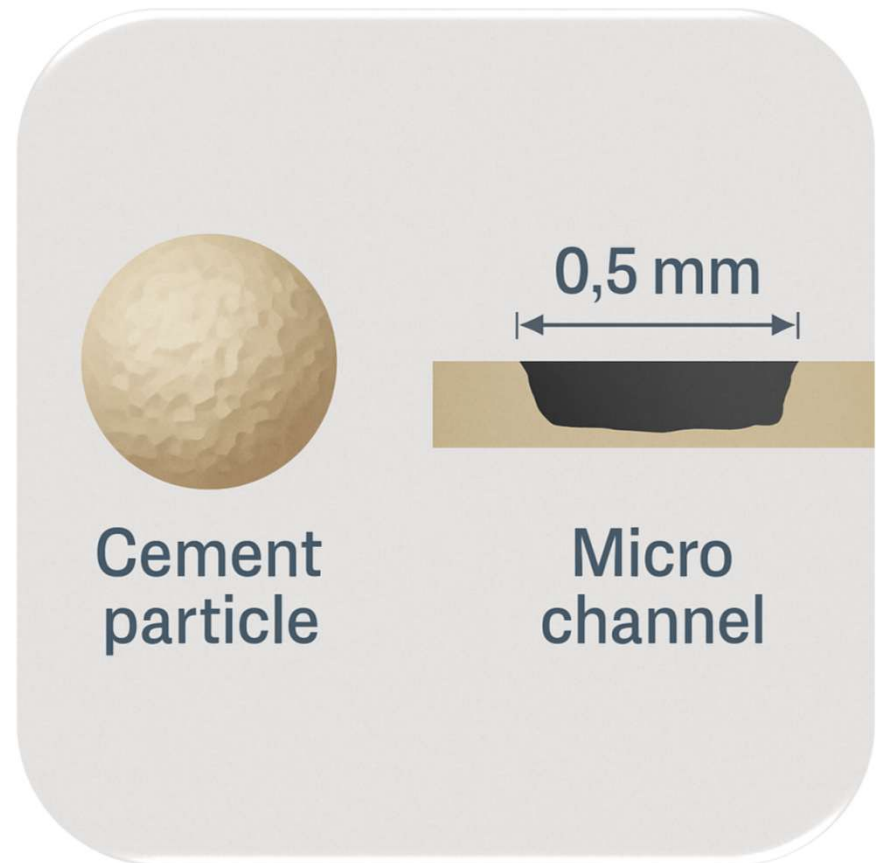
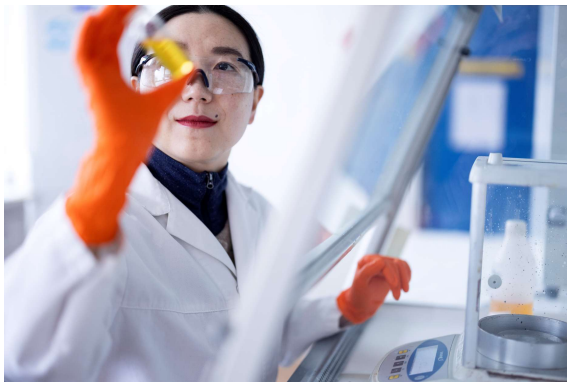
## Results

- Perform injection test for 24 hours by injecting water in the well:
  - Observed no change in pressure/temperature responses at the neighboring producer well
- Successful treatment to shut off water break through.



# SCP - Reason for using ThermaSet

- Fluid migration through micro annuli in cement cap or leak in casing or completion system
- Reservoir gas migrate through micro fractures in the cement itself, along pore bonding cement-steel interface as well as through cement-formation interface.



# Case Story– Production Packer Leak

## The Challenge:

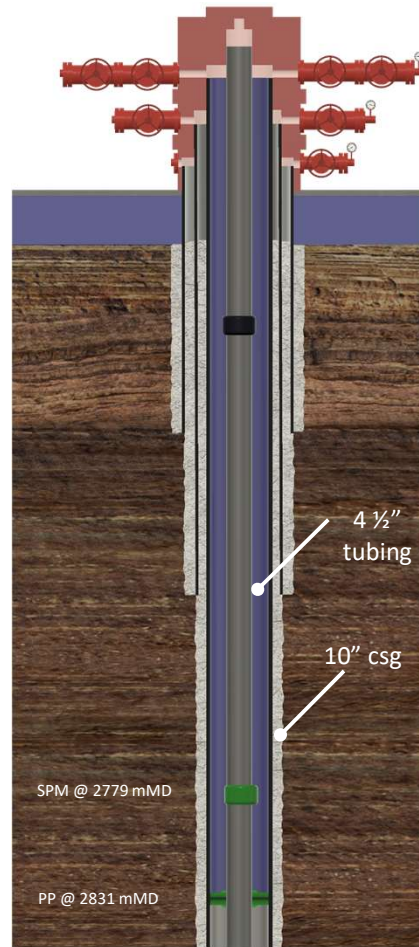
- Sustained Casing Pressure in A-annulus (10" CSG x 4 ½" tubing) due to a leak in the production packer.
- Estimated leak rate: 1 SCF/hour
- Differential pressure across the packer: 2100 Psi (when annulus is full of brine)
- The annulus was filled with oil.

## Objective:

- Seal the packer leak and stop the fluid migration through the packer.

## Plan:

- Remove the valve/dummy from the SPM and displace the base oil from the annulus with brine.
- Pump N<sub>2</sub> (equivalent to +4 m<sup>3</sup> space in the annulus) to push the brine level down to minimum 150 m below the wellhead.
- Bleed off N<sub>2</sub> from the annulus and pump 21.5 bbls of 1.5 SG resin pill into the annulus and allow it to drop by gravity to the top of packer.
- Apply 2500 psi pressure to overbalance the annulus by around 300-400 psi and so squeeze some resin into the leak.
- After the curing time, inflow test & pressure test the resin plug.



## Execution:

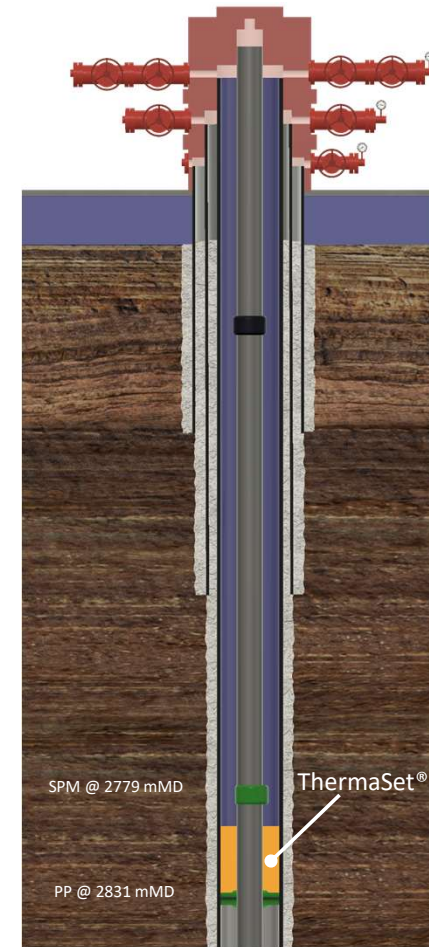
- Displaced the annulus to brine,
- Pumped N<sub>2</sub> to push liquid level in the annulus 150 m below the wellhead
- Pumped resin pill into the annulus. While pumping resin into the annulus, pressure build-up was observed indicating that annulus became full of liquid and indicating that insufficient liquid-free space was created by N<sub>2</sub> to dump resin into the annulus.
- Rest of resin pill was pumped into the annulus using lube and bleed method

*Pumped +/-13 bbls of resin pill. Pumping the full 21.5 bbls resin pill was not possible without jeopardizing the job overall.*

- 2500 psi squeeze pressure was then kept on the annulus to inject some resin into the leak path.
- Final pressure was closed in on the A-annulus until full curing of the resin.

## Results:

- After resin was fully cured, the A-annulus was successfully inflow tested (bled off pressure to zero).
- The well was brought back online.



# ThermaSet® Solution Applications



## Isolating gas/water zones

Penetrating through screens and gravel packs, even into formations to effectively seal off zones.

## Curing lost circulation

Instead of plugging the entrance of the loss zone, our solution penetrates and cures inside the loss zone.

## Sealing failed cement

Penetrate and seals small, leaking cracks unreachable by traditional methods.

## Sealing packer leaks

Restore packer integrity in just two days with only two people, minimal equipment, lower costs, and reduced risk.

## Casing leak repair

Restore casing integrity quickly and cost-effectively with precise injection and durable sealing.

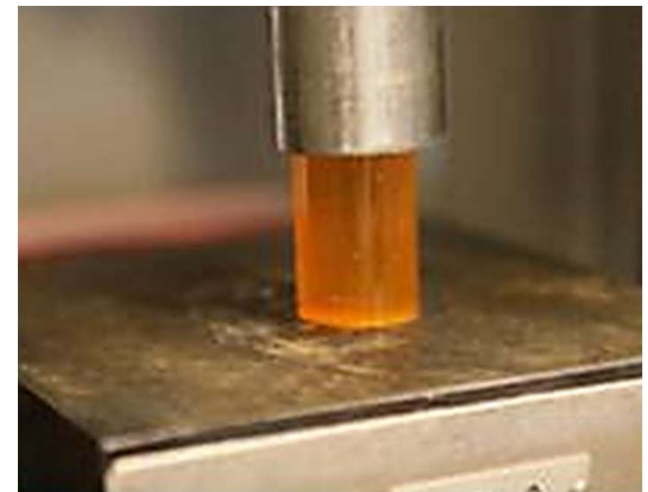
# ThermaSet® Engineered Solution

- ThermaSet® is a polymer-based thermosetting resin
- Tailored designed for challenging wellbore conditions
- Consistency as thin oil, density as sea water
- Immiscible with water
- Curing time, density and viscosity can be accurately tuned and controlled

## The set product is:

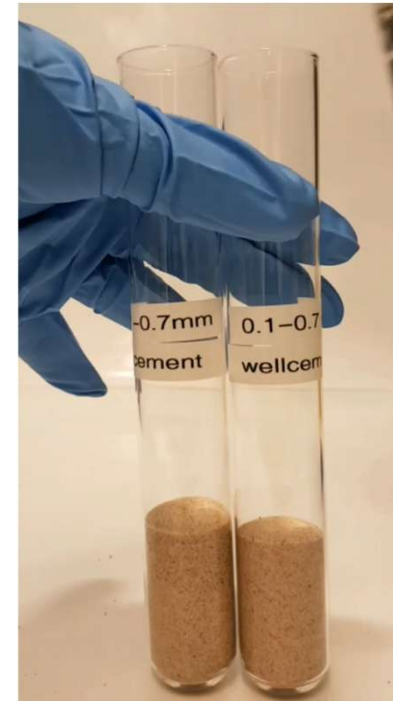
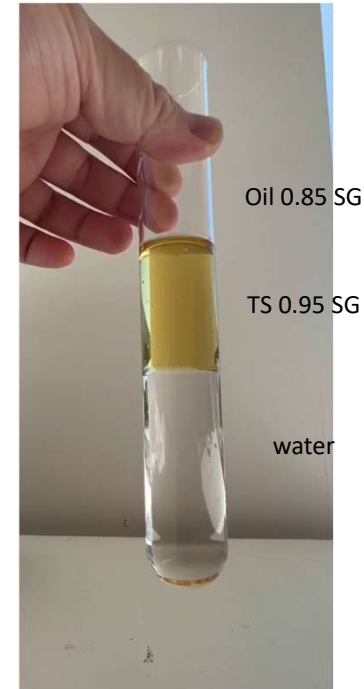
- Strong bond with metal and formation
- Proven to last in typical oil & gas well conditions
- Flexible
- Impermeable
- Can be logged with standard logging tools

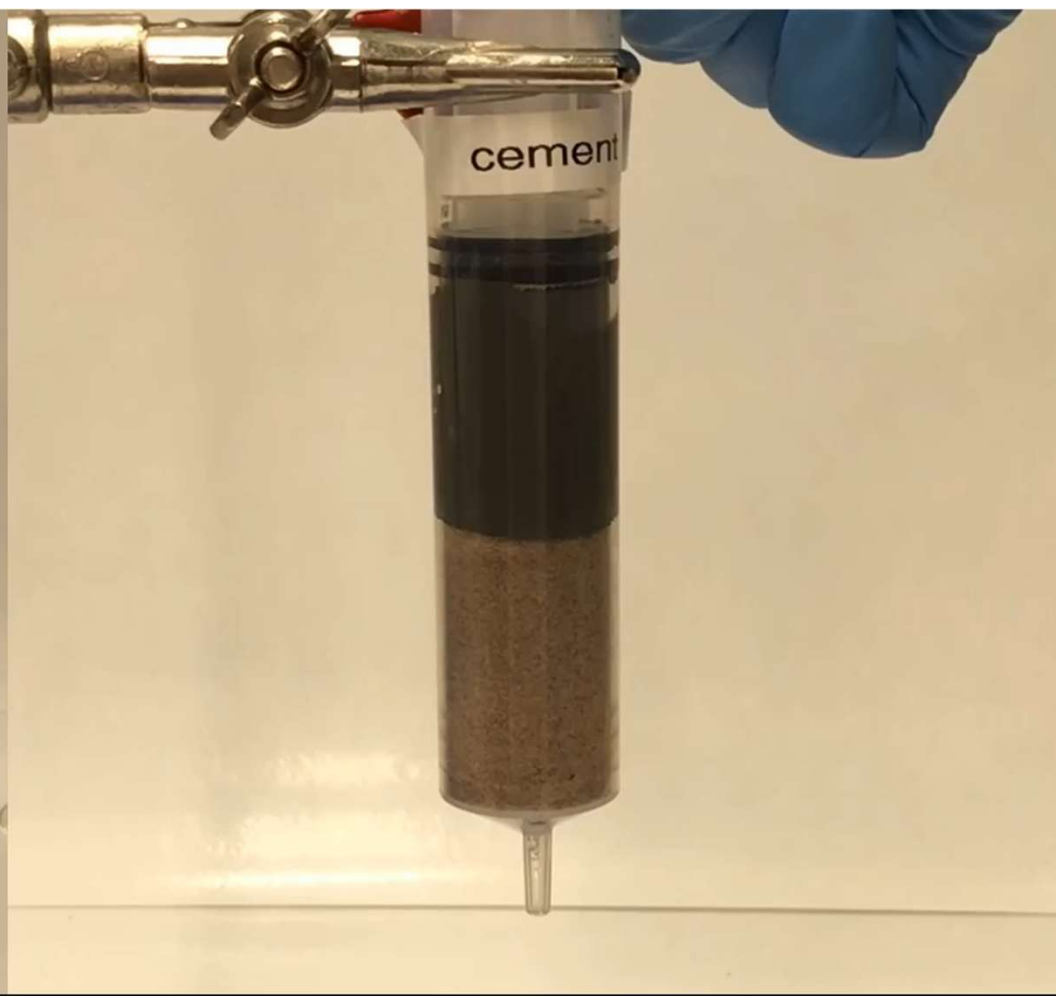
Note: ThermaSet® will not start to cure before it reaches the designed setting temperature.



# ThermaSet® Liquid State

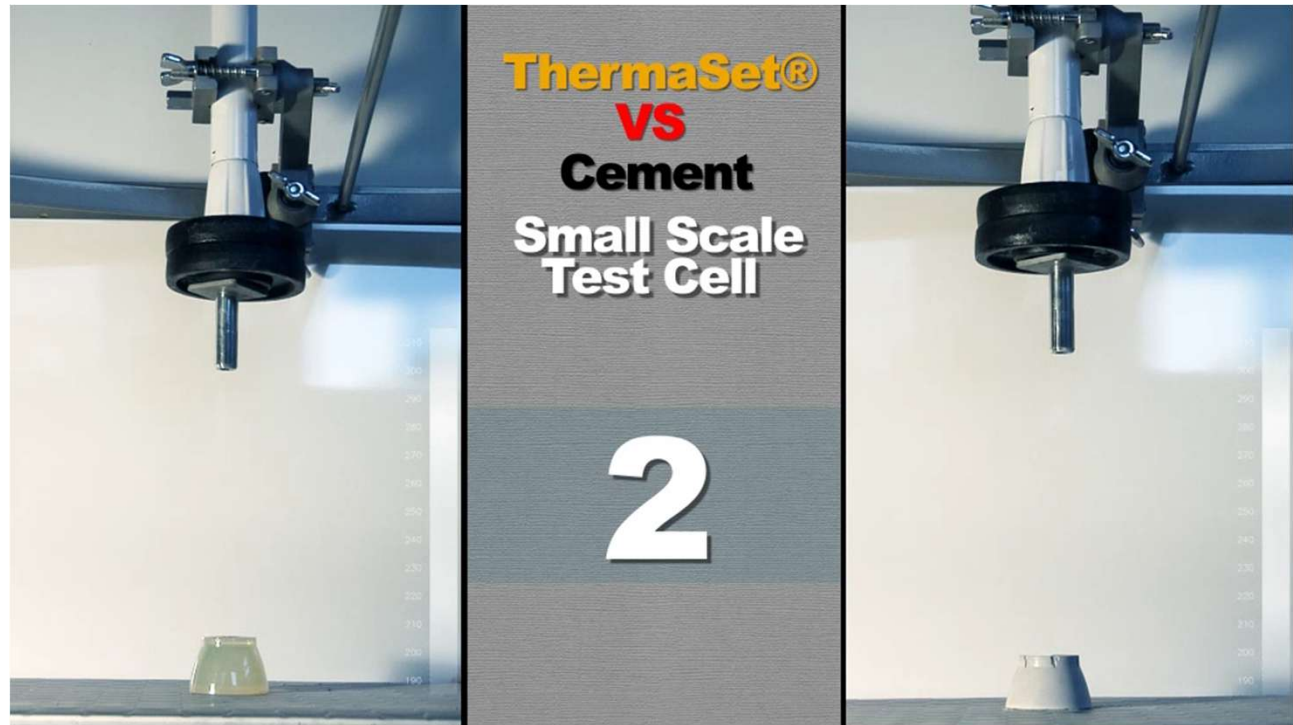
- Is a thermosetting resin
- Is immiscible with water and water-based fluid.
- Has low viscosity; Easily penetrates and seals off microchannels.
- Recipe (density, viscosity & curing time) can be designed as per requirements.
- Micron size particles (1 – 5 microns): Used to adjust resin density to reduce resin “bridging-off”. Density: 0.75 SG to 2.5 SG





# ThermaSet® Set Product

- Strong, it seals and bonds well
- Proven to last in typical oil & gas well conditions
- Flexible
- Impermeable
- Can be logged with standard logging tools

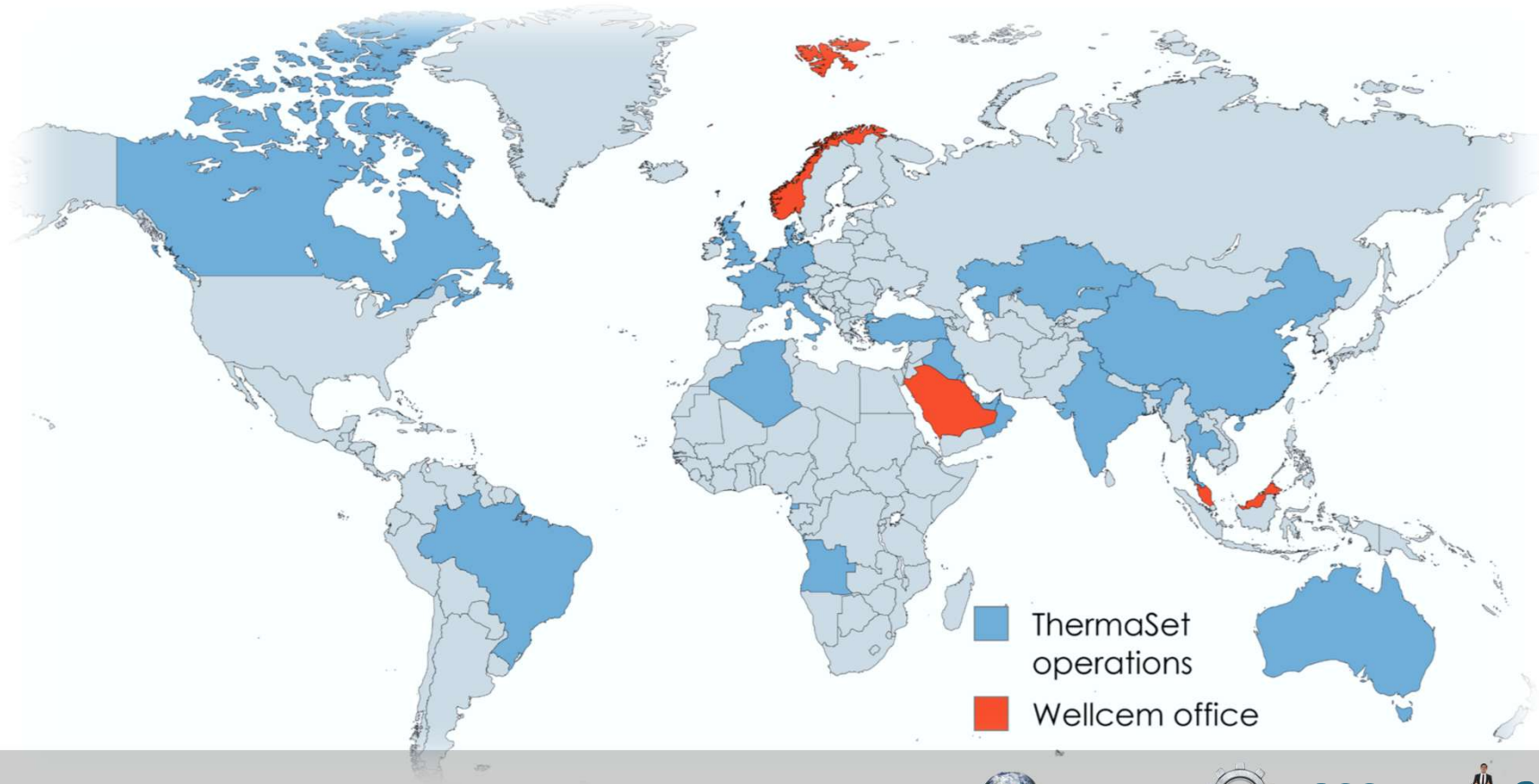


# Key Advantages of Wellcem

- Proven Technology and Methodology
- In-House Expertise in well construction, intervention, reservoir drainage, and P&A
- Software modelling for placement precision and temperature
- ThermaSet® reduces both time and costs compared to conventional methods.
- Can be pumped with conventional cementing pump and mixer
- Lower pumping pressure when pumping through e.g. CT
- Predictability in setting time
- Refined petrochemical product, Repeatability in curing time.
- Can be logged and drilled
- It offers superior mechanical strength over traditional cement.
- The resin can be customized for viscosity and density.
- Will not dilute in water
- Particle free
- ThermaSet® effectively seals leak paths. 25cP Viscosity



# Wellcem worldwide



27+



800+



35

# LWIS (Light Weight Intervention System)

## Applications and advantages

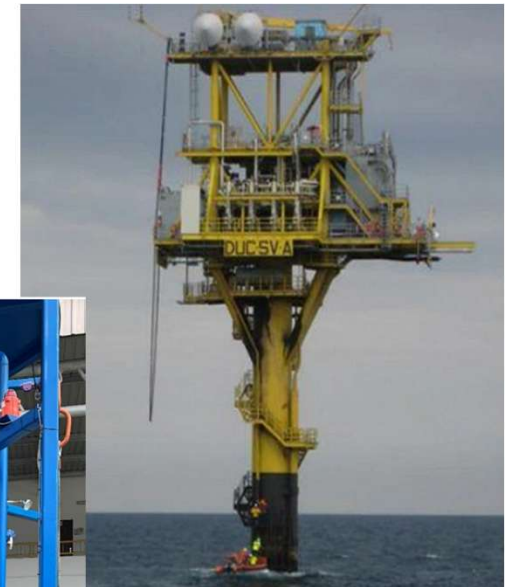
- Custom made for mixing and pumping ThermaSet resin at remote offshore platforms where deck space, deck load and power are limited.
- Light weight equipment with small footprint
- All equipment is air driven and suitable for operation in a zone II environment
- Whole operation can be done and managed by a minimum crew

## Features

- Two mixing tanks
- Two low-pressure circulation and pressurizing pumps
- Two high-pressure positive displacement pumps

## Technical Specifications:

- Maximum rate: 55 LPM (0.35 bpm)
- Maximum pressure: 345 bar (5000 psi)
- Mixing tanks: 2 x 500 L (3.15 bbl)



# References

- [blog.wellcem.com](http://blog.wellcem.com)
- Published SPE papers:
  - SPE-182978-MS [First Application of Thermal Activated Resin as Unconventional LCM in the Middle East](#)
  - SPE-173852-MS: [Resin: An Alternative Barrier Solution Material](#)
  - SPE-175425-MS: [Thermal Activated Resin to Avoid Pressure Build-up in Casing-Casing Annulus \(CCA\)](#)
  - SPE-182978-MS: [Thermal Activated Resin to Repair Casing Leaks in the Middle East](#)

# Q&A

