

RePlug[®] - P&A the eternal and affordable way

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ReStone as

RePlug[®] - same procedure, better results, environmentally friendly

- 1: The problem
- 2: P&A - the Eternal perspective
- 3: Introducing **RePlug®**
- 4: P&A - the Affordable way
- 5: P&A - the Verification perspective
- 6: Summary

1: The problem

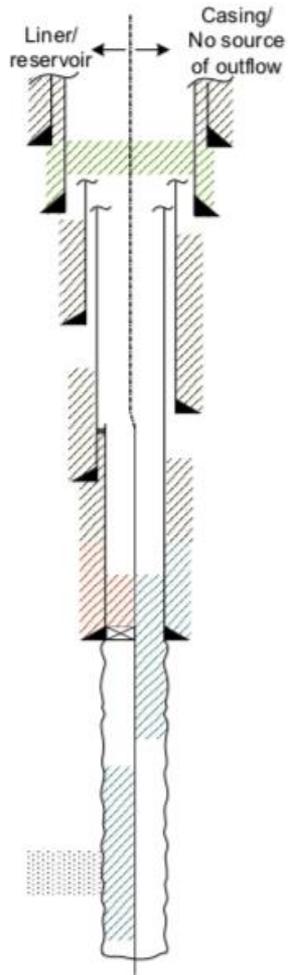
2: P&A - the Eternal perspective

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NORSOK D010

A permanent well barrier should “Provide long term integrity (eternal perspective)”

(9.5.1.1)

“The properties of the set cement shall provide lasting zonal isolation, and structural support”

(table 22)

How can the industry become even more confident that plugs have structural integrity not just today but for 500-10 000 years?



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“Eternal”: 100’s to 1000’s of years

- The oldest cemented well is from 1920
- Portland Cement is 250 years old

How can we be confident that our materials last for 500 - 10 000 years?

- Let nature lead the way
- We are using a naturally occurring additive material that develops and heals cement on these time scales



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RePlug® is an oil-well cement-mixture with an additive material that improves the results of:

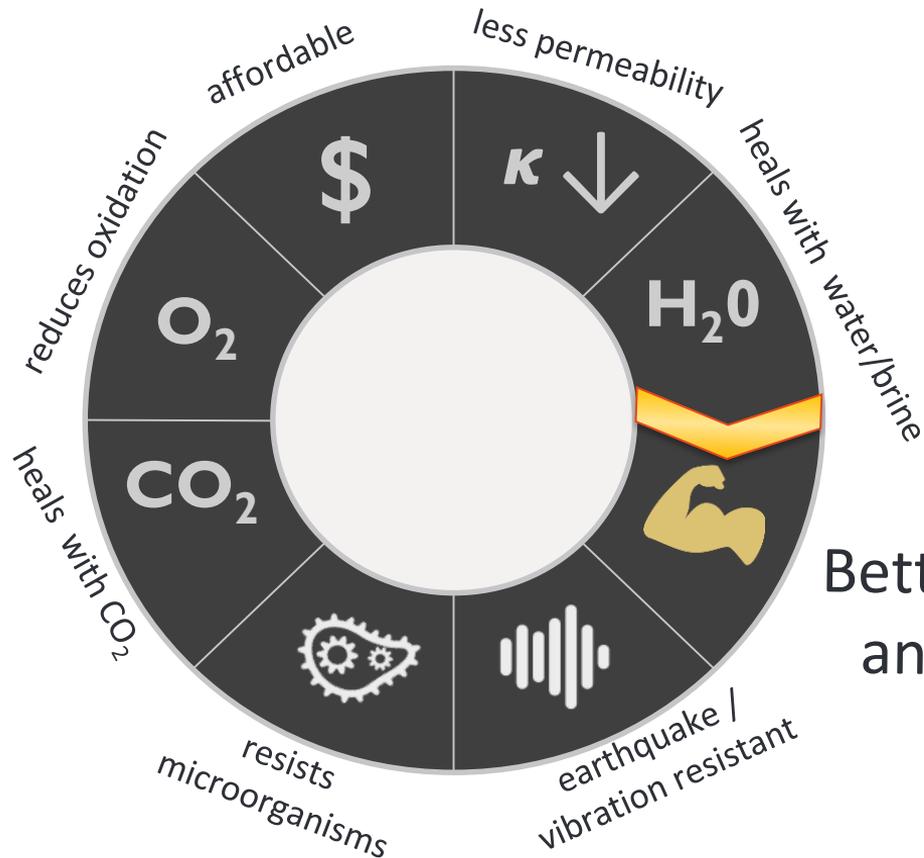
- Well cementing
- Plug and abandonment

RePlug®

- Uses the same procedures for cementing
- Gives better results
- Is environmentally friendly
- Is patent pending



RePlug® gives better outcomes for cement jobs



Better durability
and longevity

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Ordinary well cement

Well barrier criteria (NORSOK D010)		Ordinary well cement
a) Provide long term (eternal) integrity	X	(unknown)
b) Impermeable	X	(known issues)
c) Non shrinking	X	(shrinks 2-4%)
d) Able to withstand mechanical loads / impact	X	(once fractured it is open)
e) Resistant to H ₂ S, CO ₂ , hydrocarbons	X	(CO ₂)
f) Wetting to ensure bonding to steel	X	(known issues)
g) Not harmful to the steel tubulars integrity	X	(limited buffer capacity)



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RePlug[®]

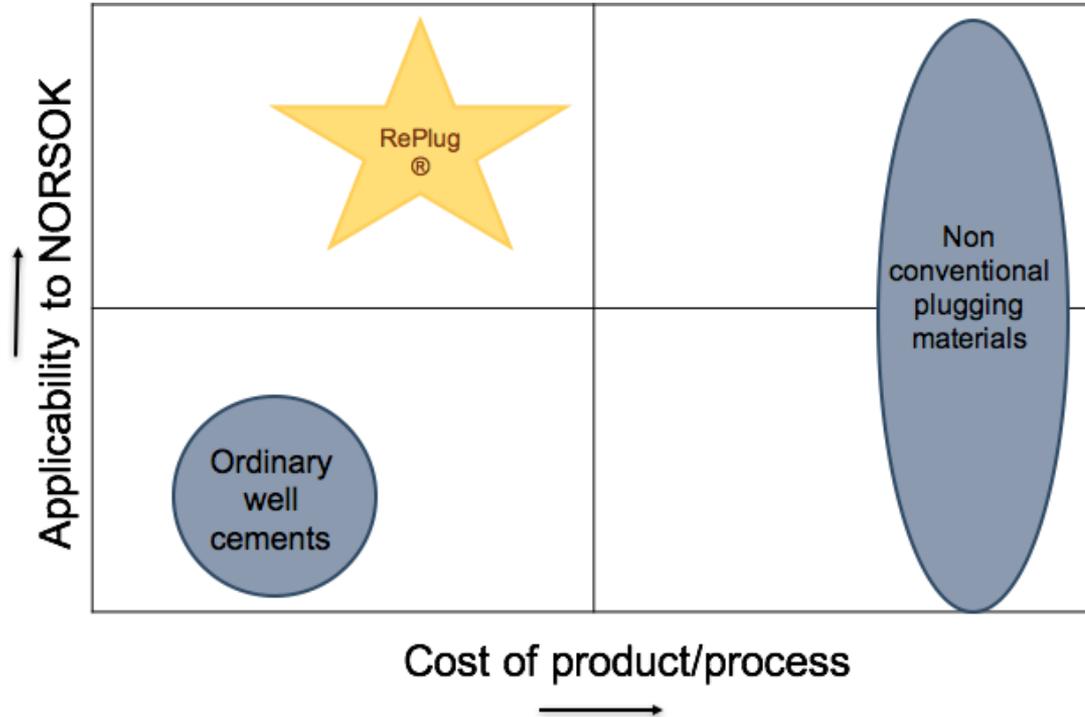
Well barrier criteria (NORSOK D010)	RePlug [®]
a) Provide long term (eternal) integrity	✓ (well known)
b) Impermeable	✓ (self heals)
c) Non shrinking	✓ (expands to fill the available space)
d) Able to withstand mechanical loads / impact	✓ (cataclasis followed by hydrous self healing)
e) Resistant to H ₂ S, CO ₂ , hydrocarbons	✓ (CO ₂)
f) Wetting to ensure bonding to steel	✓ (early tests show excellent wetting)
g) Not harmful to the steel tubulars integrity	✓ (high buffer capacity)

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RePlug[®] is affordable



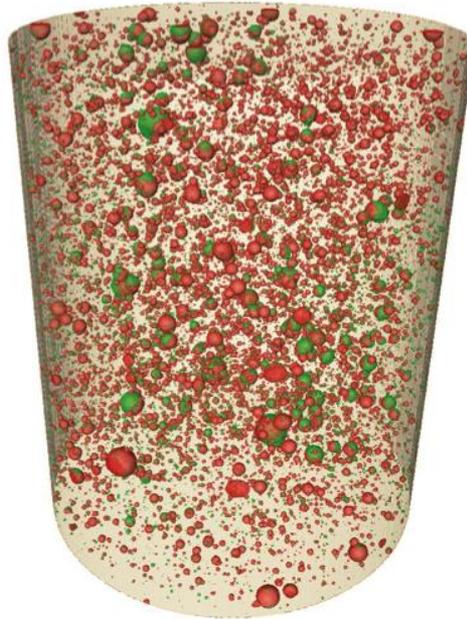
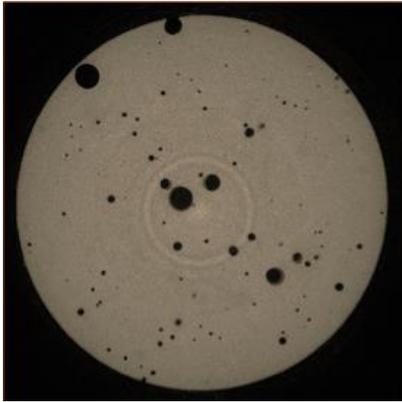
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RePlug[®] permeability

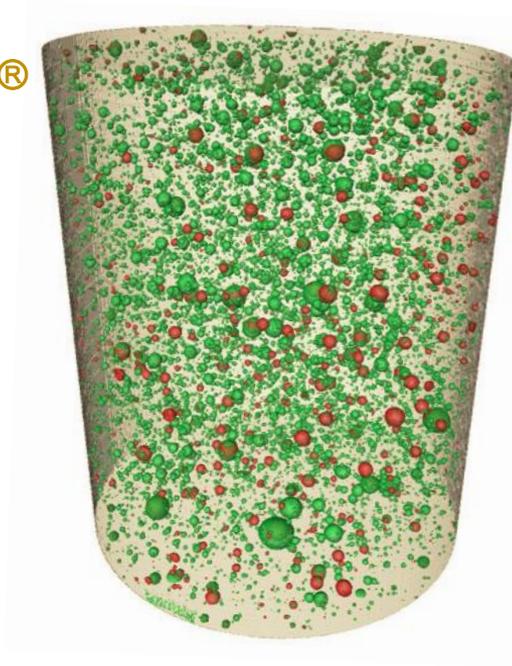
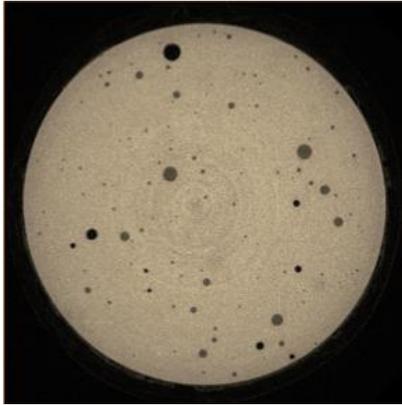
Red = voids, green = RePlug[®]
precipitates in voids



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RePlug[®] permeability

Red = voids, green = RePlug[®]
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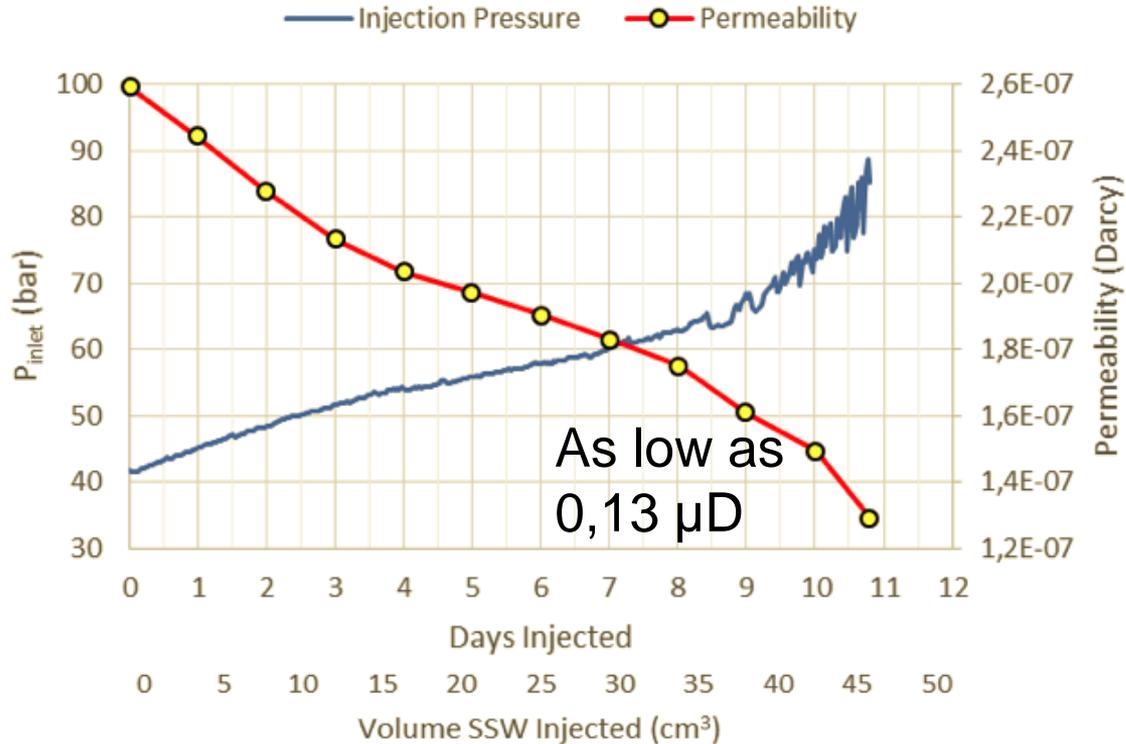


Porosity
reduced 70%

Permeability
reduced 55%

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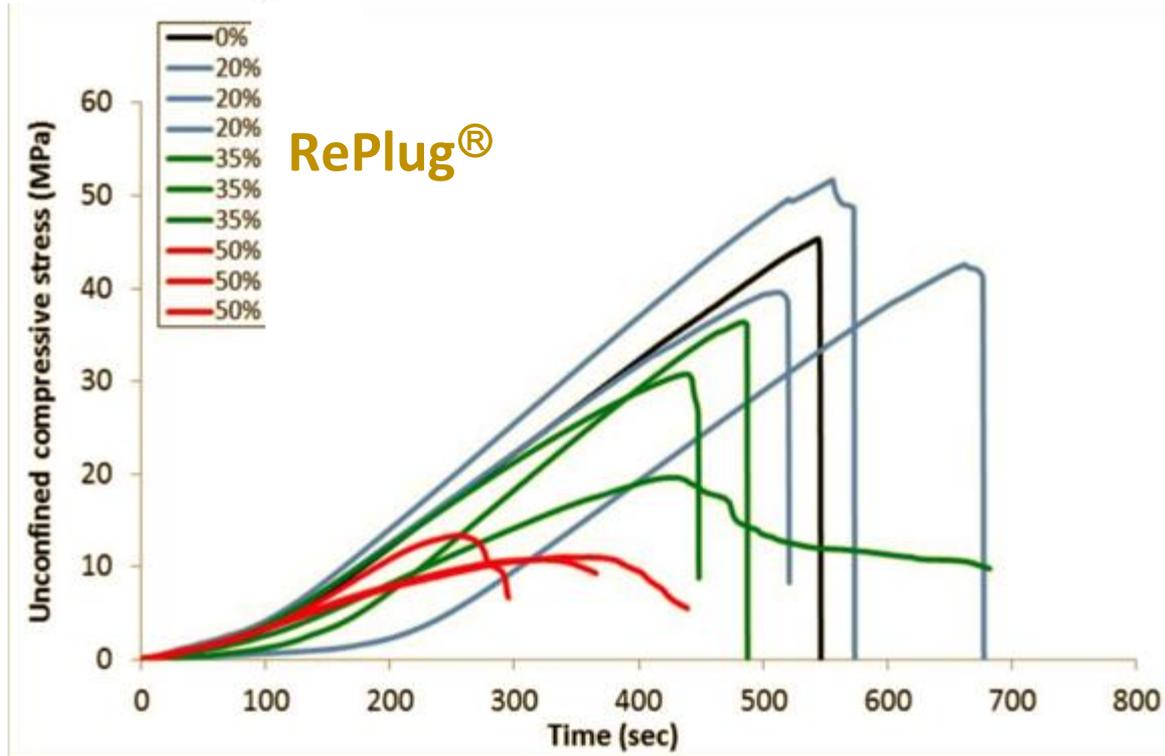
RePlug[®] permeability



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RePlug[®] - strength



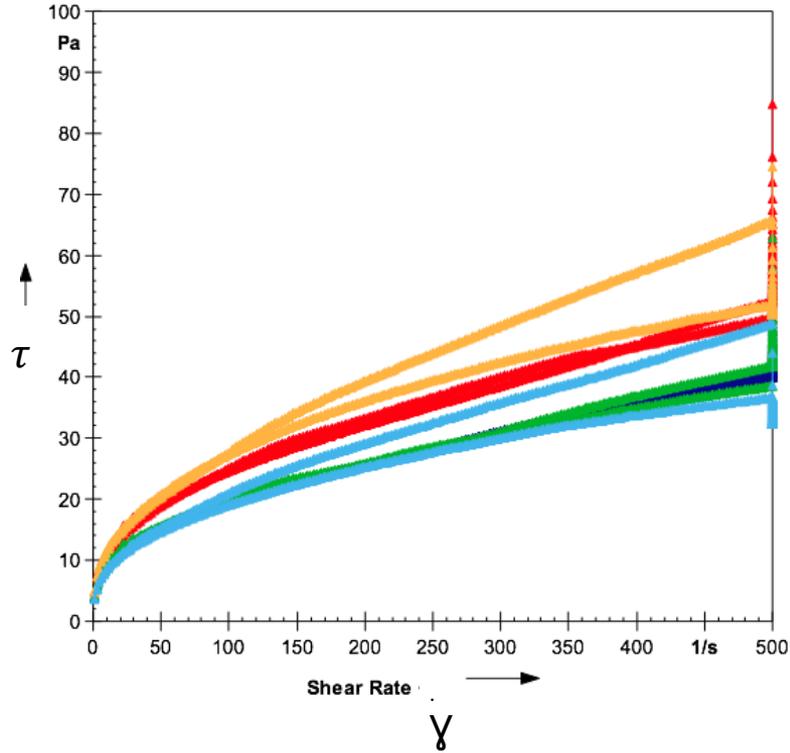
RePlug[®]

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RePlug[®] - Rheology

“Pozzolanic”
properties of
RePlug[®]



← Portland G

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Work in progress

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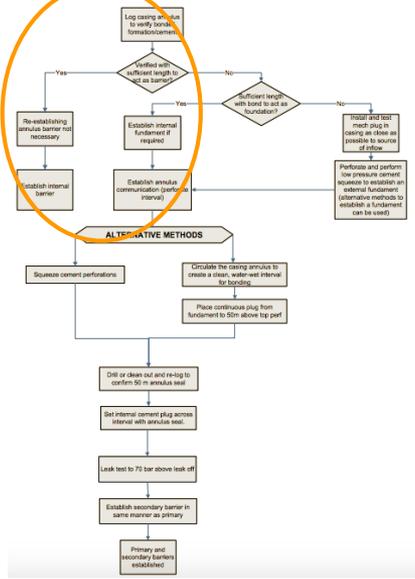
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RePlug[®] makes P&A affordable

The use of alternative methods to establish the barriers shall be verified and documented.



NORSOK-D10

Log casing annulus to verify bonded formation/cement



Re-establishing annulus barrier not necessary

Establish internal barrier

“Re-establishing annulus barrier not necessary”

RePlug[®] saves big \$

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Verification of cement

There is a particular seismic signal contrast between **RePlug®** and the formation rocks if used in all well operations

RePlug® may be easier to verify than other cements made with the same types of minerals as the formation rock

The permeability of **RePlug®** has been measured in μ Darcy



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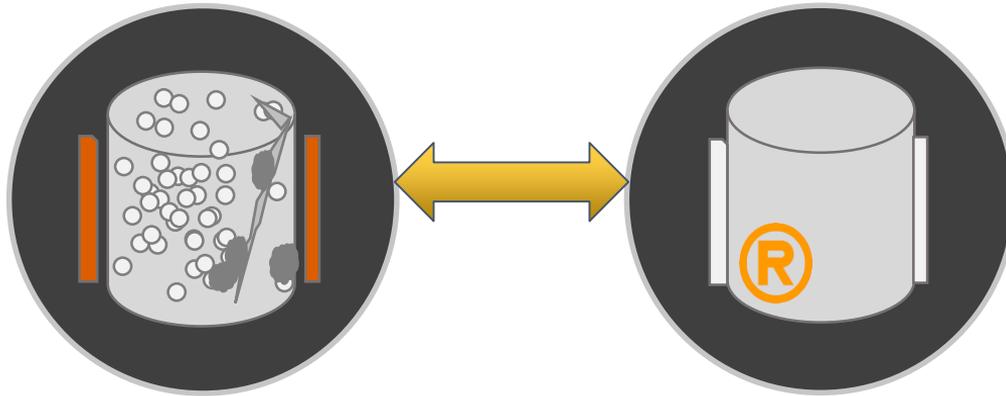
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Thank you for your attention! Questions?

Watch us remix the cement sector! – @RockDoctors

Thanks to:

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Maryland (USA)

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