HALLUX TALON™

OIL SERVICES

MuddAse Product Line

Overview of Newest Patent Pending Enzymes

- Mission Statement
- Enzyme Properties & Benefits
- Why Use MuddAse
- MuddAse Difference
- Competitive Clean-Up Methods
- The MuddAse Economic Advantage
- Field Applications of MuddAse

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Hallux Talon Oil Services

Mission Statement

To provide our customers with high quality oilfield services and novel enzyme products where we can be proud of the integrity and craftsmanship of our offerings, superior customer service and support

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Enzyme Properties & Benefits

- Almost all metabolic processes in a cell require enzymes in order to function at rates fast enough to support life
- Enzymes are large globular proteins with active sites that contain a binding site and a catalytic site
- Very specific linkages are broken unlike other “breakers” that oxidize the entire system

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Enzyme Properties & Benefits

- Large, highly specialized proteins produced by living cells
- Enzymes are biological catalysts that speed-up chemical reactions
- Highly specific towards their substrate
- Reaction rate controlled by pH, temperature, pressure
- Environmentally friendly and 100% biodegradable
- Not-DOT, IATA or UN regulated

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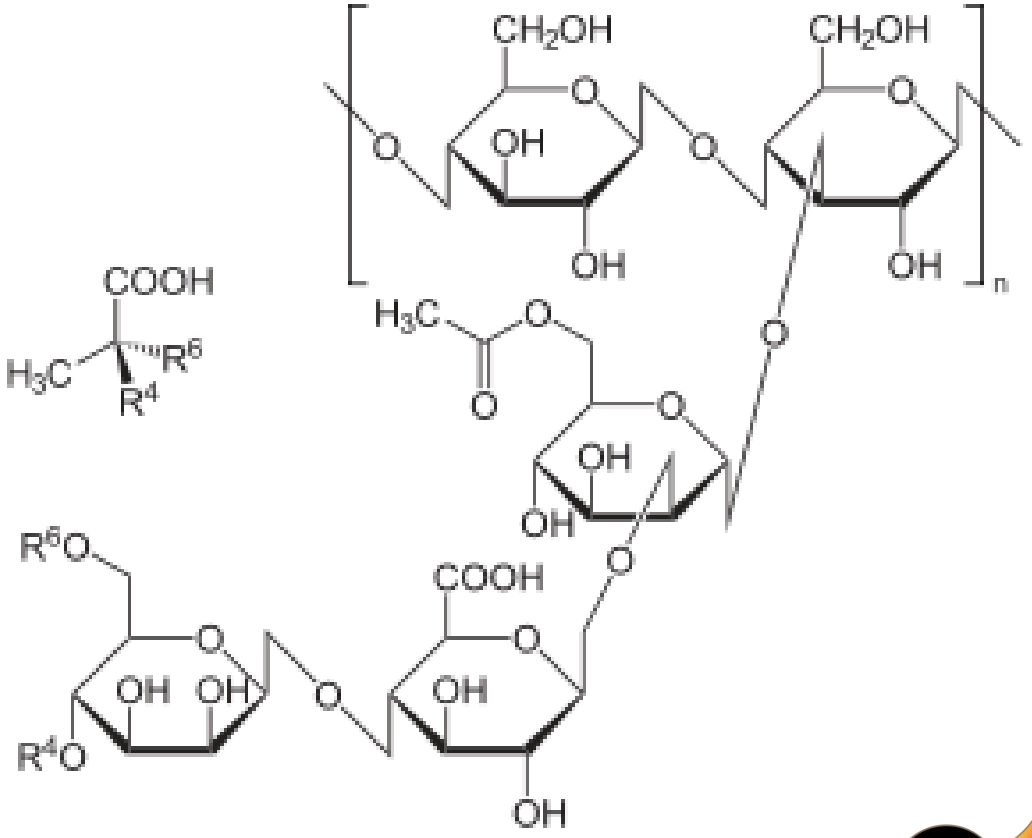
Enzyme Cleavage Sites

Xanthan Gum is a heteropolysaccharide with a very high molecular weight (3,000,000-5,000,000), consisting of repeating units. The sugars present in xanthan are d-glucose, d-mannose, and d-glucuronic acid. The glucoses are linked to form a -1,4-d-glucan cellulosic backbone, and alternate glucoses have a short branch consisting of a glucuronic acid sandwiched between two mannose units. The side chain consists therefore of -dmannose-(1,4)--d-glucuronic acid-(1,2)-- d-mannose



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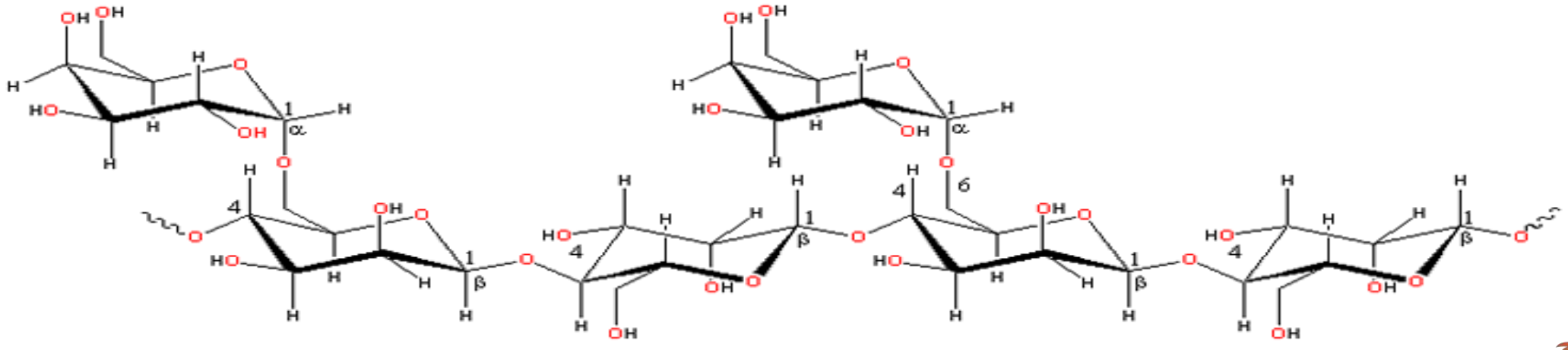
Enzyme Cleavage Sites

Guar gum consistent mainly of the high molecular weight polysaccharides composed of galactomannans which are linear chains of (1→4)-linked β-D-mannopyranosyl units with (1→6)-linked α-D-galactopyranosyl residues as side chains. The mannose: galactose ratio is approximately 2:1. The average molecular weight of guar is 1,200,000.



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Acids & Oxidizers

- Reactivity is not polymer specific
- Rate of reaction is difficult to control
- Potentially not compatible with minerals in formations
- Potential negative side reactions with reservoir fluids
- Corrosion of metal components – tubulars
- Oxidative breakers produce free radicals that react rapidly and oxidize all components within the fluid

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Polymer Degradation

- Typical viscosity is used to determine a “broken” fluid
- Viscosity is a function of polymer concentration and polymer MW
- Misleading to assume reduced viscosity will result in mud cleanup or reduced damage
- Not all fluids with a broken viscosity(<10cps) are truly broken
  - Polymeric intermolecular interactions
  - Shear thinning effect

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Why Use MuddAse

Hallux Talon's MuddAse Series are specific patent pending enzymes, developed to degrade and assist in "removal" of polymers used in Drill-In Fluids. Drill-In Fluids, although significantly cleaner than traditional drilling fluids, still require polymers that impart viscosity to carry and suspend cuttings, as well as polymers to prevent fluid-loss. Typical Drill-In Fluids utilize polymers such as: xanthan, starch and cellulose. Inadequate removal and degradation of these polymers within the wellbore can severely damage formation permeability and reduce productivity. Typical acid treatments utilized to degrade polymers within the wellbore have shown minimal success.

The new patent pending MuddAse enzymes are designed to remove the "skin" throughout the entire openhole zone and thereby optimize productivity.

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MuddAse Difference

- MuddAse has a proven track record for over 15 years throughout North and South America, Europe, Russia, Asia and Middle East (Saudi Arabia, Oman, Qatar, Egypt)
- MuddAse line offers unsurpassed performance in optimizing well productivity
- MuddAse uses the newest patent pending generation of polymer degrading enzymes available anywhere in the world

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MuddAse Difference

- Most economic well enhancement available
- Minimal equipment required for application
- No negative side reactions
- Environmentally friendly and 100% biodegradable
- Not-DOD, IATA, UN regulated
- Independent laboratory testing has shown Regained Permeabilities in excess of 90%

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Competitive Clean Up Methods

Mud Removal Regained Permeability Test Parameters

Disc Type: 1” Ohio Sandstone Core

Disc Diameter: 1 inch

Fluid Density: 8.35ppg

Temperature: 150 degrees Fahrenheit

Differential Pressure: 500psi

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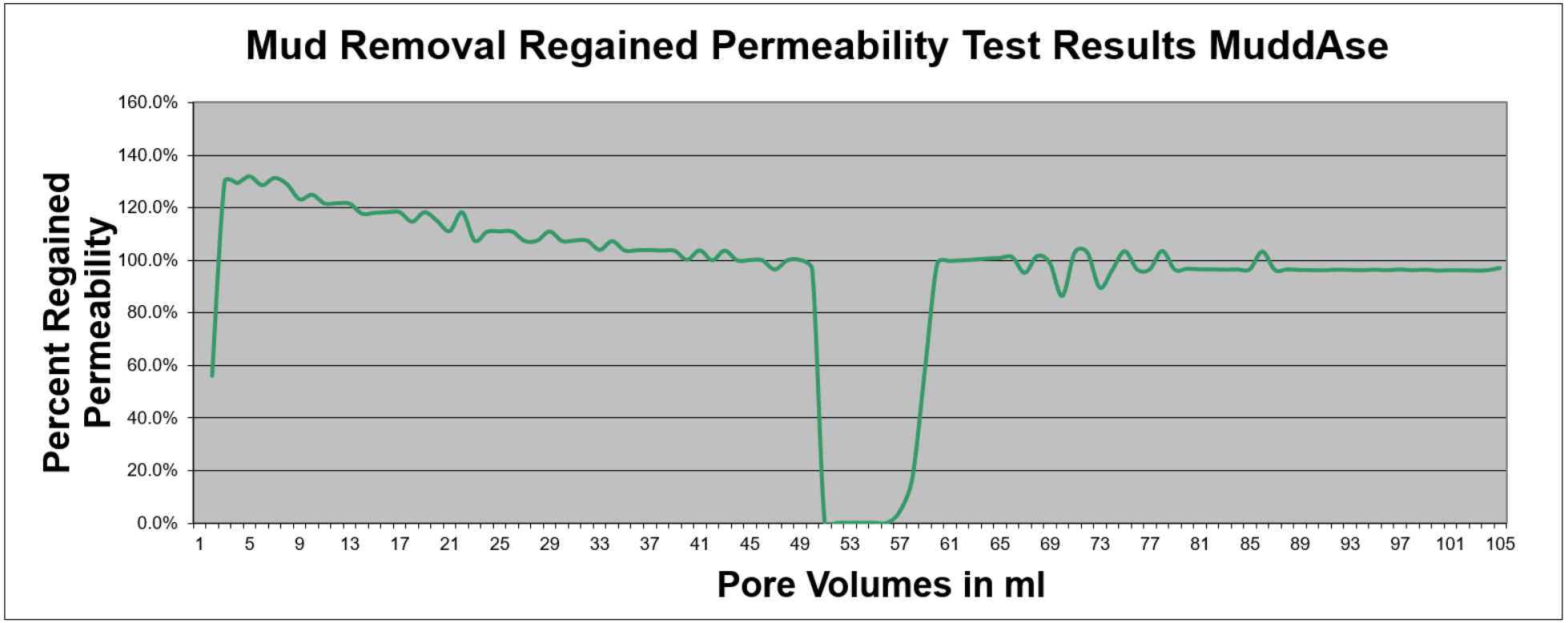
Hallux Talon Clean Up Methods MuddAse



Final Flow Production Direction After Baseline Shut-in for 16 hrs and 22 min

Clean-up Fluid:

MuddAse

Return Fluid: RO Water, 1gpt Choline Chloride 70%

Final Regain Permeability 96.5%

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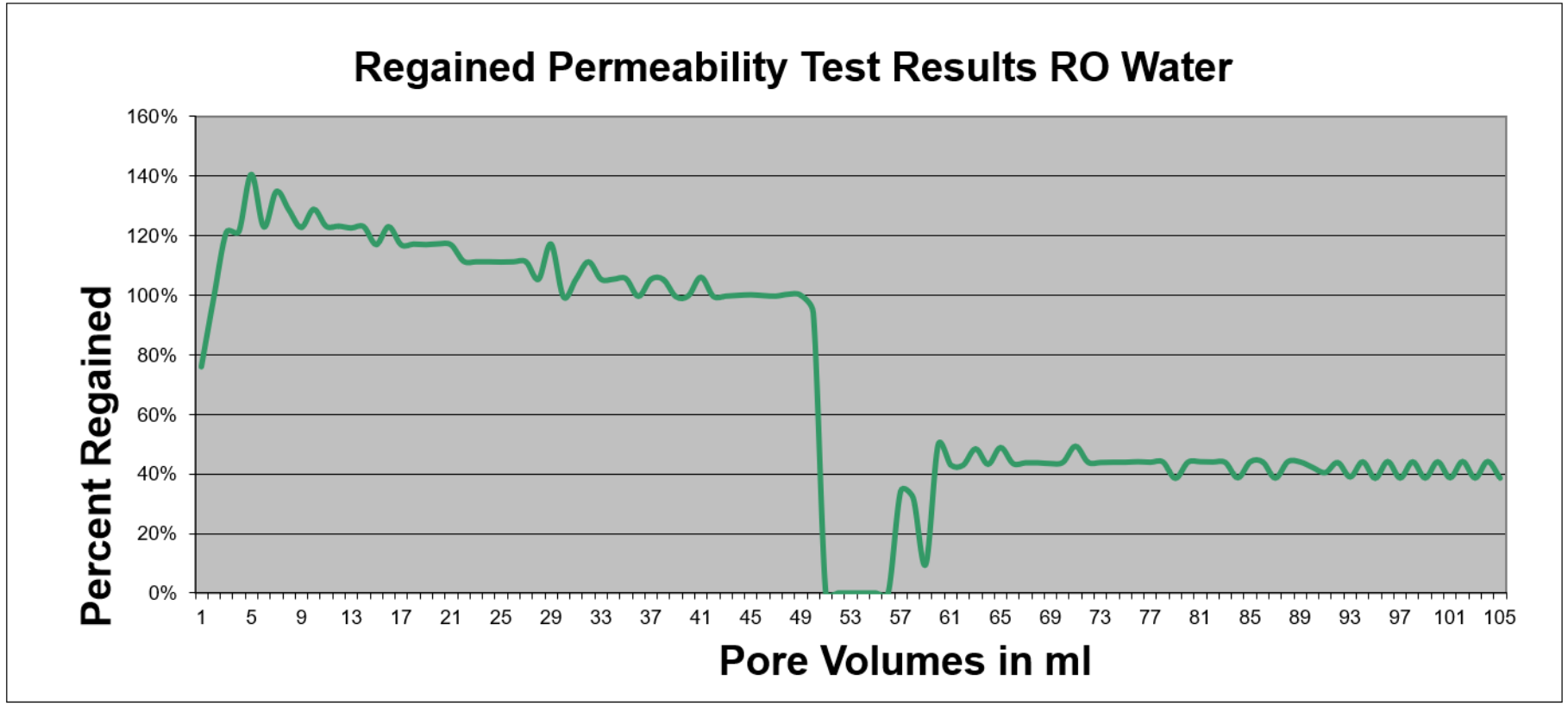
Competitive Clean Up Methods Baseline With Water



Final Flow Production Direction After Baseline Shut-in for 19 hrs and 43 min

Clean-up Fluid: **RO Water, 1 gpt Choline Chloride 70%**

Return Fluid: RO Water, 1gpt Choline Chloride 70%

Final Regain Permeability 44.1%

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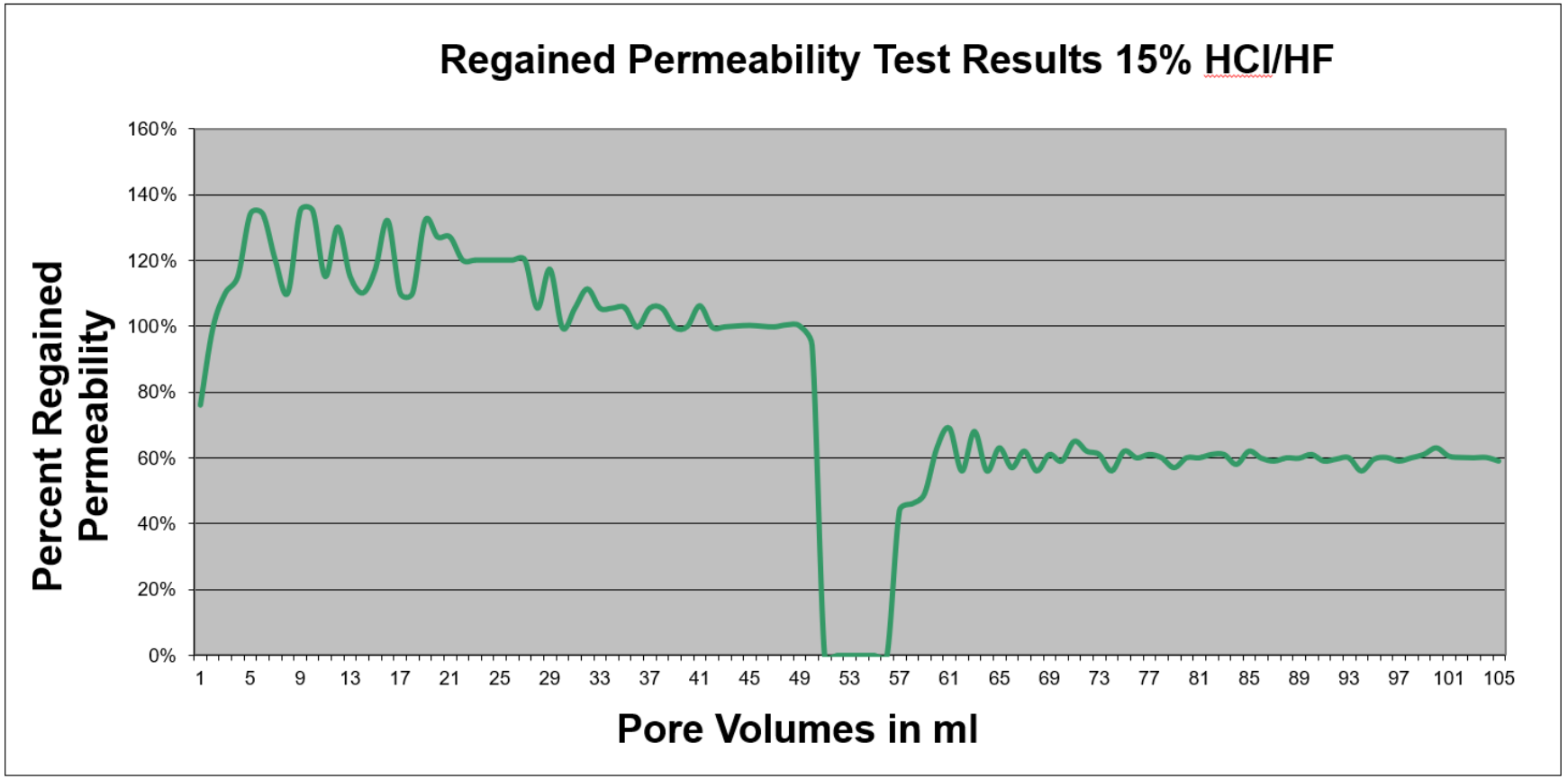
Competitive Clean Up Methods With 15% HCl/HF



Final Flow Production Direction After Baseline Shut-in for 20 hrs and 15 min

Clean-up Fluid:

15% HCl/HF

Return Fluid: RO Water, Choline Chloride 70%

Final Regain Permeability 59.4%

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Competitive Clean Up Methods

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The MuddAse Economic Advantage

"How much will MuddAse increase our production?"

- a very common question asked by Operators

Use of Hallux Talon's enzymes have reported increases as high as **3.5 times** expected production. Case history in the general region may help provide an approximate performance. Field testing is the most accurate indicator of performance.

Hallux Talon Oil Service works closely with customers to perform field testing and help ensure jobs are applied correctly.

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The MuddAse Economic Advantage Enzyme Case History

	# Of Wells	Average Lateral Foot	Expected Average Production (bbl/day)	Actual Average Production (bbl/day)	Average Shut-In Time (hrs)	Average Increased Gross Profit/Day Oil @ $50/bbl
MuddAse-Enzyme Treatment	4	2,870	2,300	5,591	13.1	$164,550.00
Acid Treatment-Offset Wells	7	3,305	2,500	1,986	29	($25,700.00)

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Field Applications of MuddAse
Utilizing Cement Pumps

3-4 bbl/min

Volume of MuddAse – 2X Hole Volume

Soak Time 6-10 hours to overnight

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Field Applications of MuddAse
Utilizing Coil Tubing

Volume of MuddAse – 2X Hole Volume

Soak Time 6-10 hours to overnight

Go to toe and pull out

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Hallux Talon Enzyme Product Line

MuddAse Wellbore Clean-Up: Xanthan, Cellulose, Starch

Hallux Talon Guar Enzyme Super HT
Hallux Talon Guar Enzyme HT
Hallux Talon Guar Enzyme MT
Hallux Talon Guar Enzyme LT
Hallux Talon Enzyme for Hybrid Systems from LT to Super HT

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"Why let residual polymeric damage reduce the profit potential from every well?"