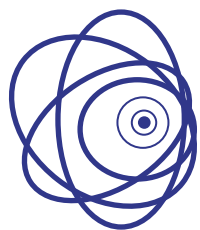


ACTIVATED ENVIRONMENT FOR THE RECOVERY OF OIL



MVG ENERGY
SOLUTIONS

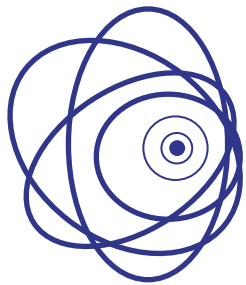
www.mvgesolutions.com

THE BIG SHIFT

The race to be the low-cost king is often overplayed and can be as fruitless as it is uninspiring.

CONVERSELY:

Oil prices are currently too low to justify high cost/high risk pursuits of new oil.



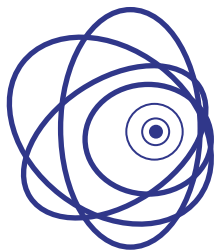
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THRIVING IN TODAY'S MARKET

Survivors will strike the delicate balance between:

- Pursuing new oil
- Reducing operating costs
- Maximizing creative efficiencies

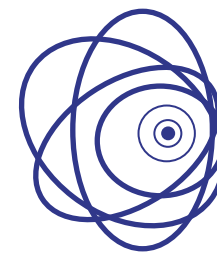


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AERO™

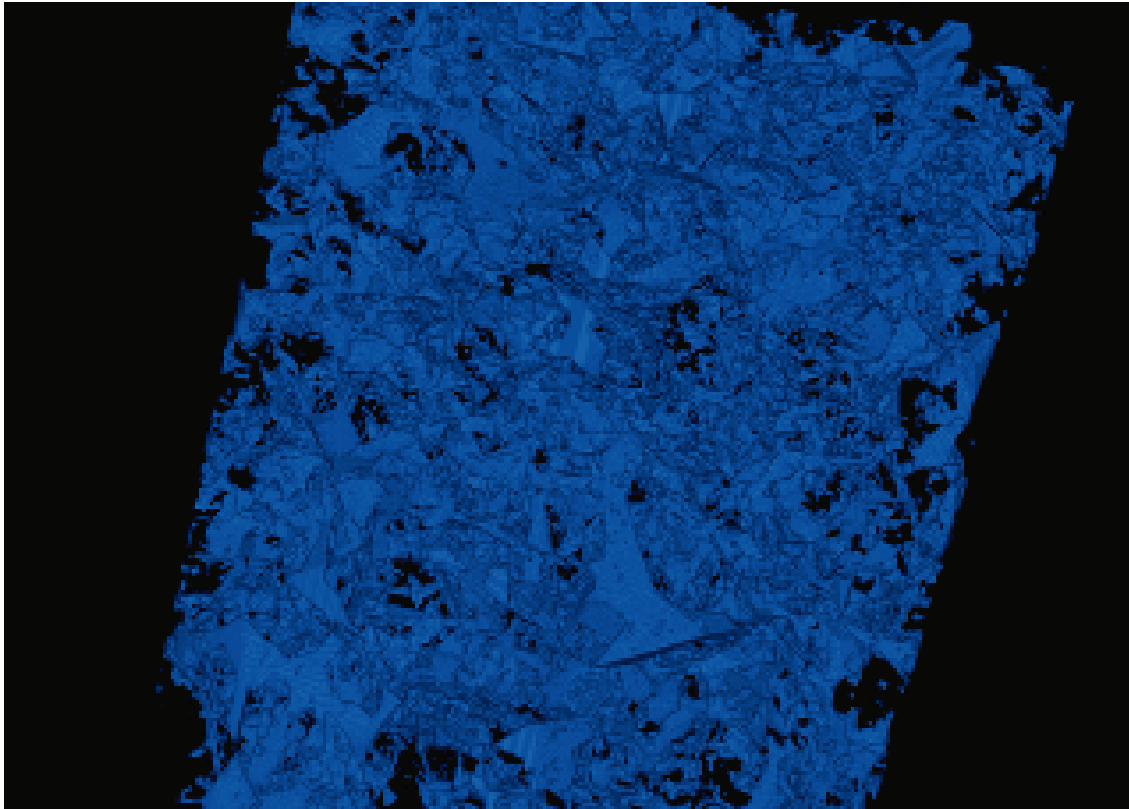
- Pursues new oil ✓
 - Reduces operating costs ✓
 - Maximizes creative efficiencies ✓
-
- **Has reduced LOE by 20-50%**
 - **Incremental oil <\$10/BBI**



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SOLUTIONS

THRIVING IN TODAY'S MARKET

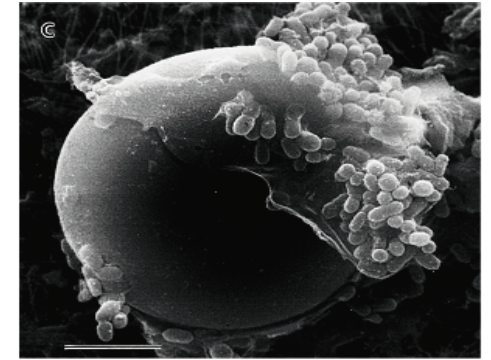
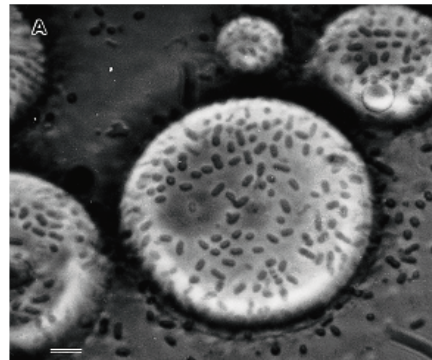
THE PROBLEM – POOR SECONDARY RECOVERY



Complex reservoir matrix
leads to poor recovery
from waterflood:



THE AERO™ SYSTEM



HOW?

- An EOR system that is continuously added to waterflood injectors
- Causes dormant natural biology in the reservoir to grow
- Growth occurs at trapped oil
- Trapped oil is mobilized by Bio-Diversion™ in nearby water thief zones
- Strong biosurfactants are produced at trapped oil reducing IFT



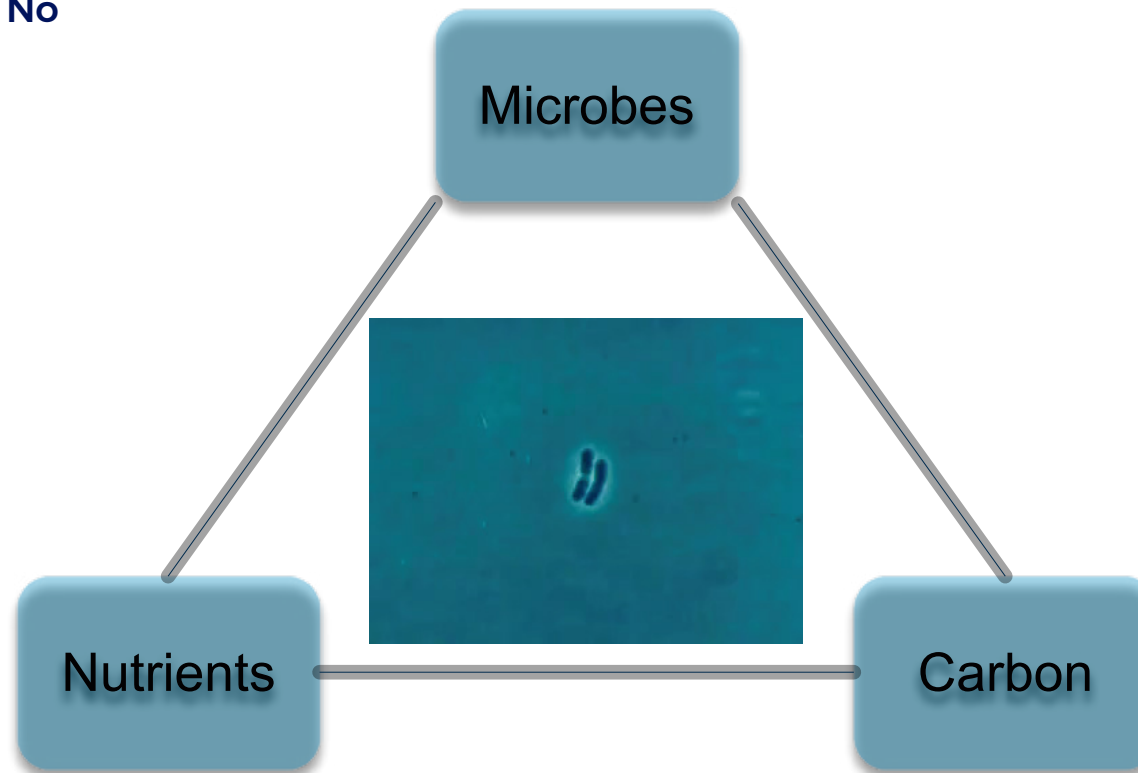
THE AERO™ SOLUTION - RESERVOIR BIOLOGY GROWTH TRIANGLE



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SOLUTIONS

- When all 3 present = **Growth**
- Remove any of the 3 = **No Growth**

- Present but dormant
- Exist only in water phase



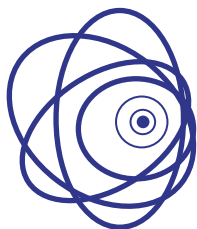
- Mostly **gone** from reservoir
- Proprietary AERO™ Additives

- Oil
- **Food** source

THE AERO™ SOLUTION

Basic Candidate Selection Criteria

- Existing and effective waterflood
- >20 md perm
- >18' API gravity crude
- <190' F BHST
- <10% Salinity water



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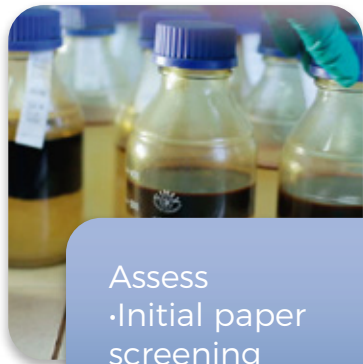


THE NEWAERO APPROACH



ADD OIL PROCESS™

ASSESS

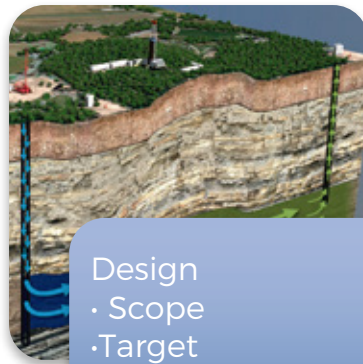


Assess

- Initial paper screening
- Oil/water Lab analysis
- Initial geological assessment



DESIGN



Design

- Scope
- Target injectors/producers
- Go/No-Go
- Detailed geological assessment



DEPLOY



Deploy

- Mobilization
- Injection
- Monitoring
- Evaluation



1-3 months



6-12 months

- Statoil
 - 30 Million incremental Bbls in Norne Field
 - Website testimonial
- Merit Energy Result
 - 9-12% Incremental recovery on OOIP
 - SPE 144205 authored by Merit and Statoil
- California Result
 - JPT Publication February, 2016
 - 66 BOPD increase over 4 producers ranging from 1.5-3.5 fold increase
- Canadian Result
 - JPT Publication March, 2015, Co-authored with Statoil
 - 400% increase in full-field oil production above baseline





30 MILLION INCREMENTAL BBLs OIL IN NORNE FIELD

**FROM STATOIL WEBSITE REGARDING
AEROTM BEING DEPLOYED AT THEIR FIELDS:**

“These efforts have demonstrated what happens in the reservoir when the bacteria are provided with nutrients, and what effect the system could have.

“This is encouraging,” says Ole Magnar Drønen, petroleum technology manager for Norne.

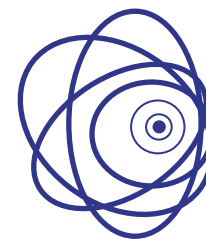
“We’re confident that the method will help to improve recovery from the field, perhaps by almost 30 million barrels over its producing life.”

Statoil has long been a leader in IOR efforts on the Norwegian continental shelf.

Sjur Talstad, vice president for exploration and development technology, emphasizes that AERO™ represents an interesting contribution to reaching the group’s objective in this area. “I’ve noted with gratification that our research programs are yielding results which are being adopted operationally,” he says.



AERO™ RESULTS - KANSAS



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SOLUTIONS

- 9-12% Incremental Recovery on OOIP
- No increase in produced water
- Oil at \$10-15/BBL



MERIT ENERGY COMPANY



Statoil



SPE 144205-PP

Field Experience from a Biotechnology Approach to Water Flood Improvement

B.G. Bauer, R.J. O'Dell, Merit Energy Company, S.A. Marinello, J. Babcock, T. Ishoey, Glori Oil Limited, E. Sunde, Statoil S.A.

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This paper was prepared for presentation at the SPE Enhanced Oil Recovery Conference held in Kuala Lumpur, Malaysia, 19-21 July 2011.

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Abstract

This paper is based on a field implementation in the United States of a biological process for improving waterflood performance. The Activated Environment for Recovery Optimization ("AERO™") System is being developed by Glori in collaboration with Statoil and derives its roots from a microbial enhanced oil recovery technology developed and successfully implemented by Statoil offshore Norway. Unique among IOR technologies, AERO implementation requires virtually no capital investment and achieves high performance efficiencies at low operational cost. The simplicity of setup allows pilot project implementation creating a very low risk entry point for the operator.

A pilot project was selected for a controlled investigation of the performance and impact. Robust testing was done in both water and oil phases prior to treatment, confirming the potential for improved sweep and conformance from the project. Subsequent implementation resulted in decreased water cut and increased oil recovery observable both at the wellhead and allocated pilot levels.

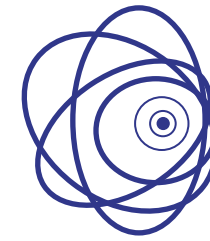
This paper summarizes a rigorous analysis of the pilot project's performance to date, concluding that the production improvement should be credited to the implementation of the AERO™ System.

Introduction

An AERO™ (Activated Environment for Recovery Optimization) System field pilot was initiated at the Stimup Field in southwest Kansas (Figure 1) to evaluate the potential improvement in recovery from a waterflooded reservoir. The field is at a relatively mature stage of waterflood and following robust testing of the water and oil phases, it was believed that the AERO™ System could enhance performance through improved sweep and conformance.

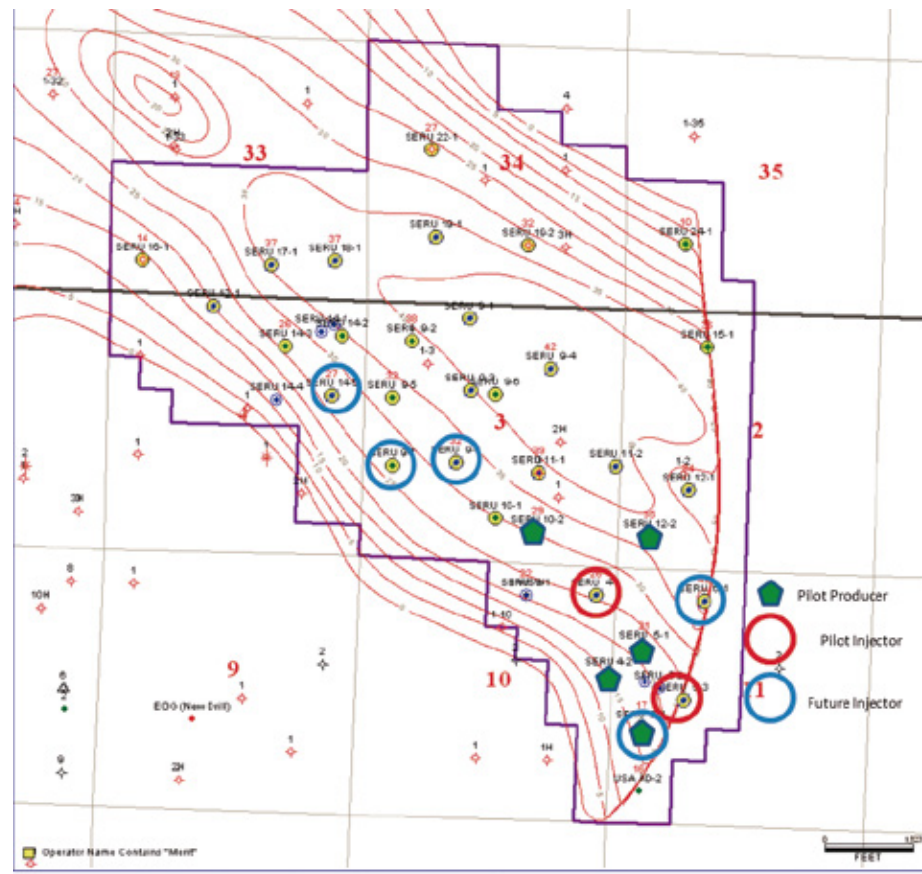


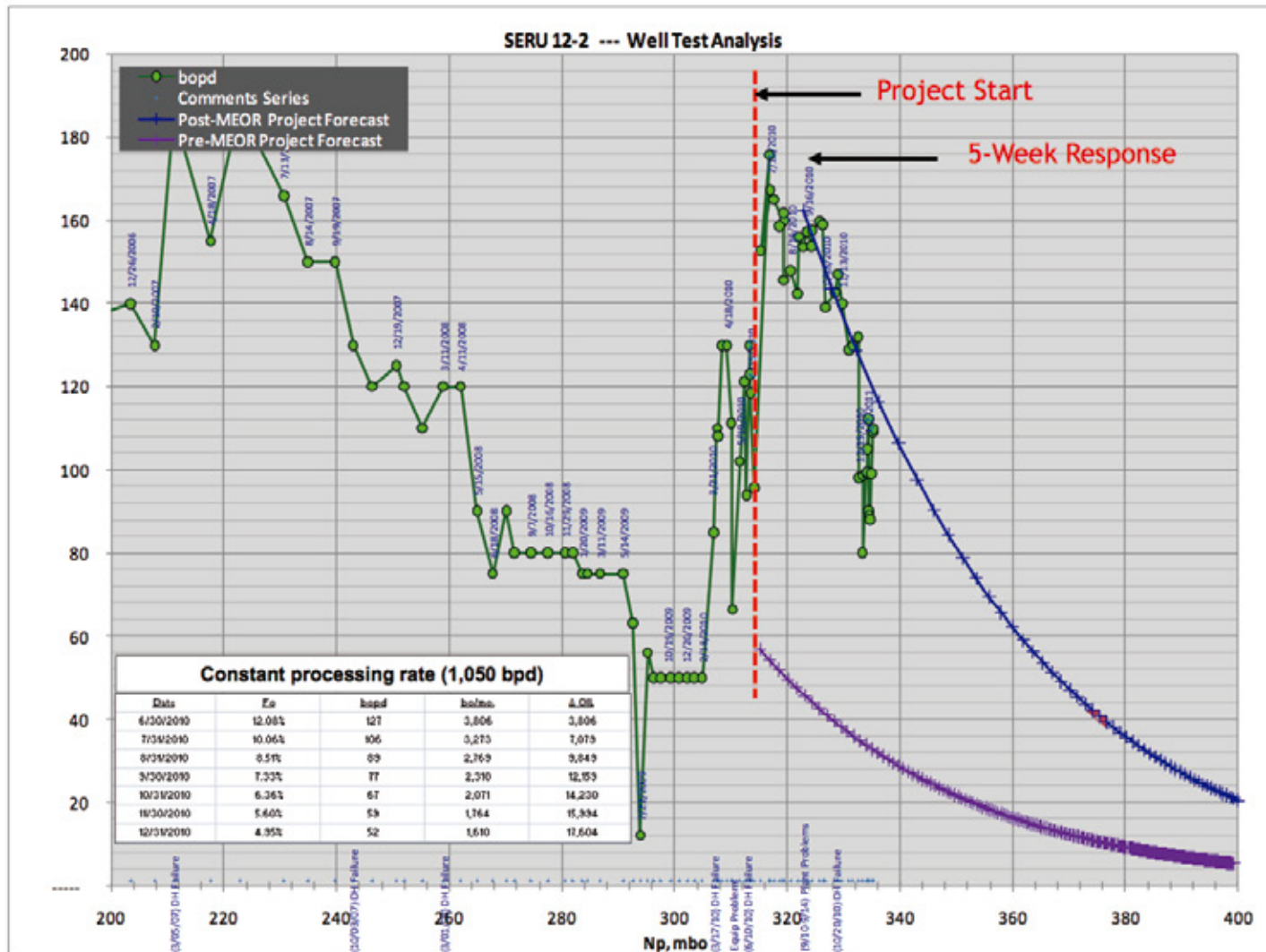
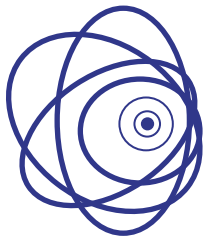
AERO™ RESULTS - KANSAS



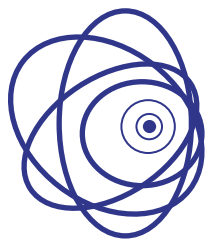
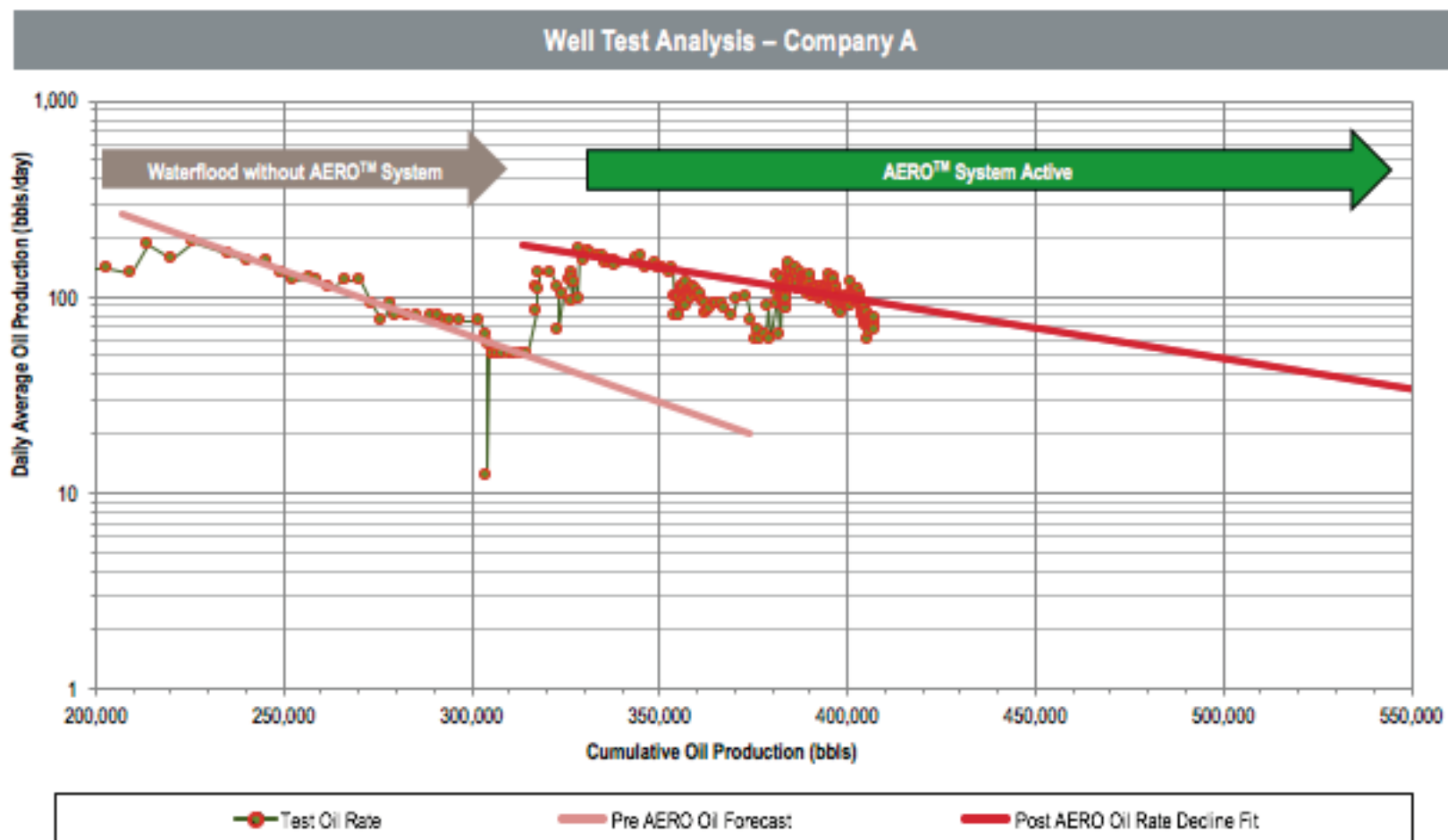
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- 2 Injectors
- Pilot Area Summary
- Oil Production 207 bopd
- Water Production: 2,800 bwpd
- Water injection approximately 1,600 bwpd





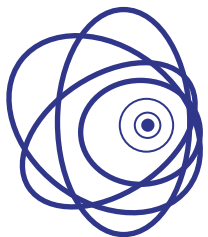
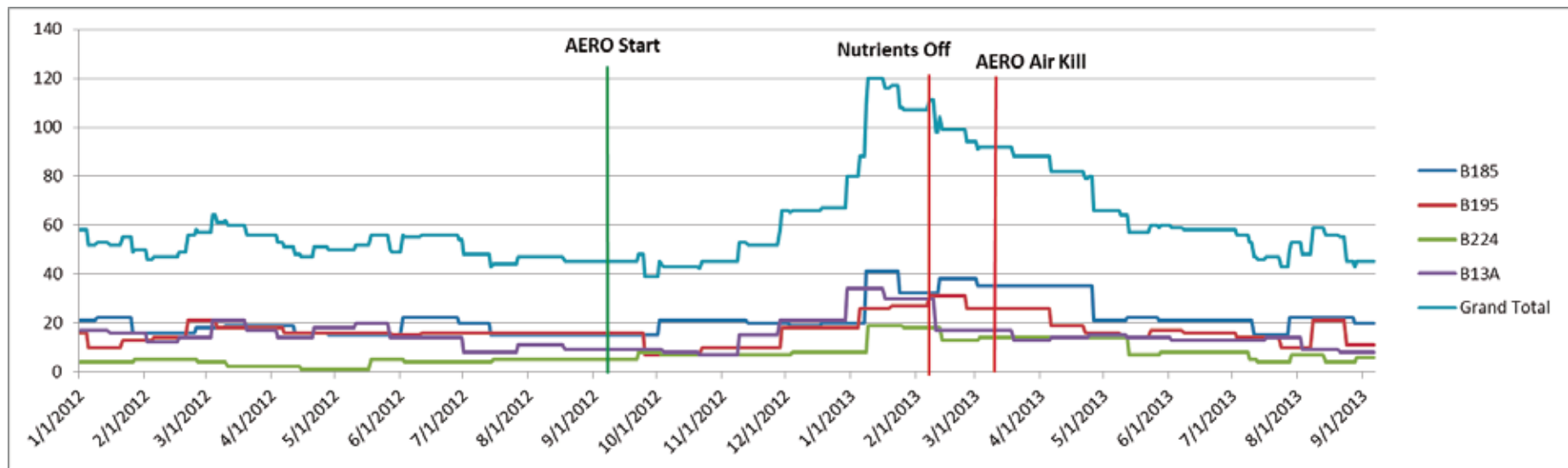
AERO™ RESULTS - KANSAS



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AERO™ RESULTS - CALIFORNIA

- 4 Injectors – 4,000 BWIPD
- 4 responding producers
- 6 month duration



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- JPT Publication, February, 2016
- Deviation from established decline

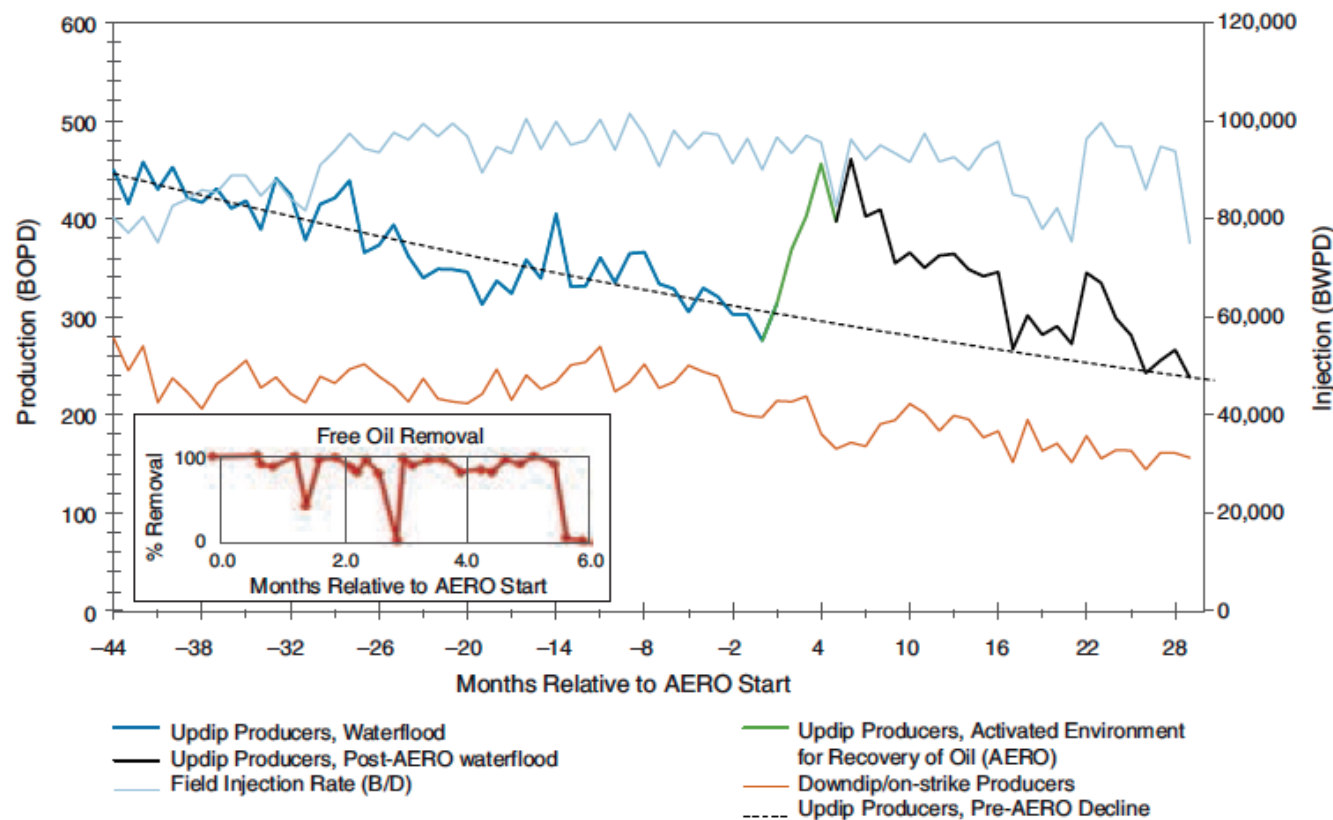


Fig. 1—The average daily oil production, water injection, and calculated pre-project decline trend for the pilot project are shown. The daily oil rate increased significantly following nutrient injection and dropped back to predicted decline rate when the project ended. Inset: The free oil content in the injection water is shown before and after a remediation system was used for meeting water quality specifications. *Graphics courtesy of Glori Energy.*

AEROTM RESULTS - CANADA ALBERTA FULL FIELD PROJECT

- 400% increase oil production off baseline
- Reduced LOE 50%
- Published JPT March, 2015

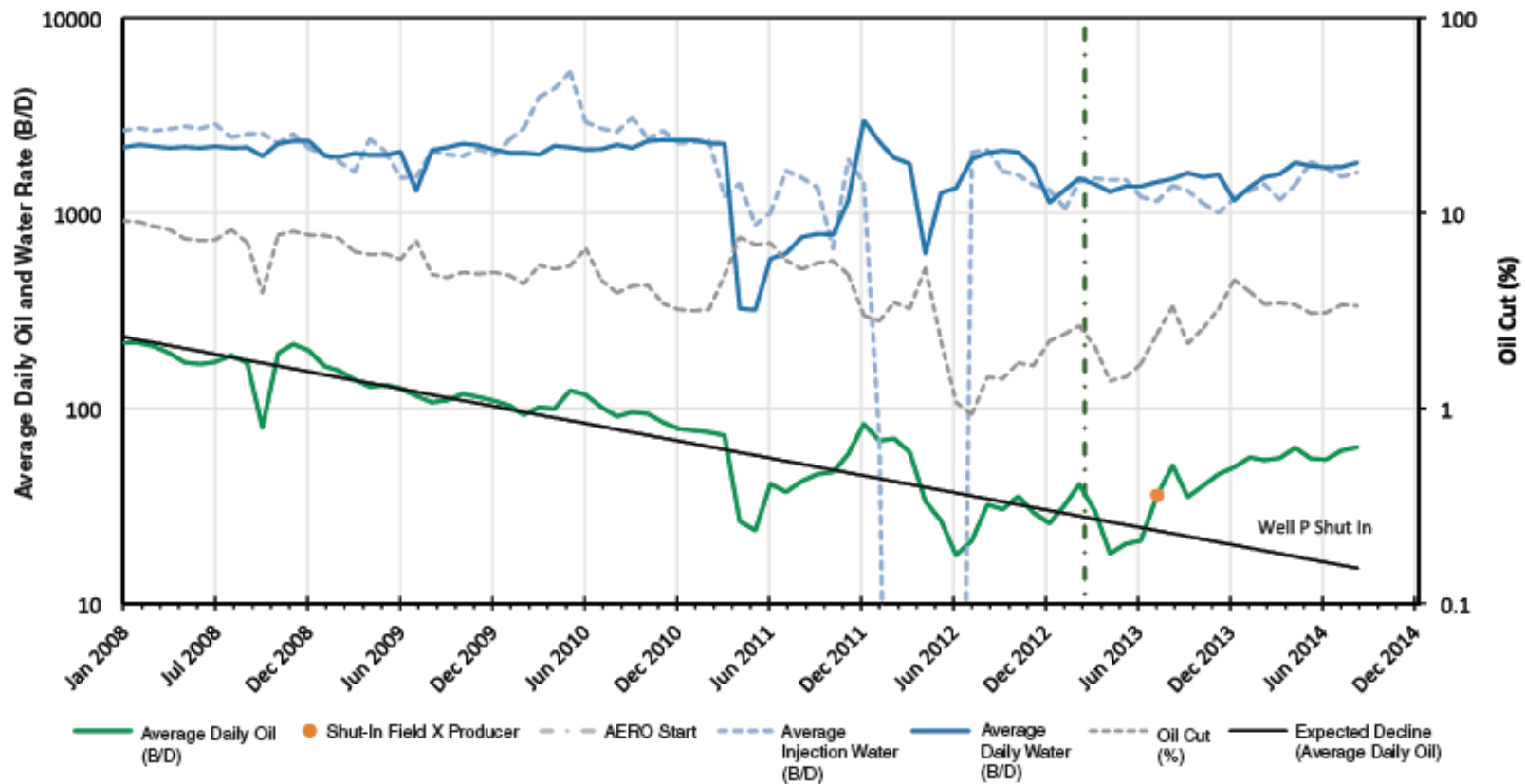
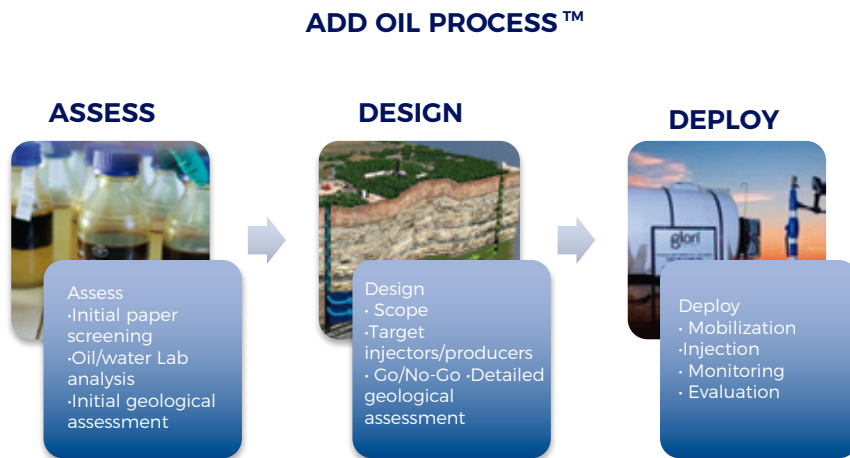


Fig. 2—Average daily oil production rate, water injection rate, and oil cut of Field X from available public data. The data was used for calculating the baseline production trend before the initiation of biological enhanced oil recovery.

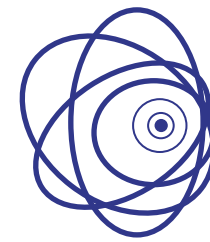


The Offer:

- Initial screening Assess Phase
- Low-cost Design Phase
- Risk-Reward Pricing Deployment Phase for suitable projects

Benefits:

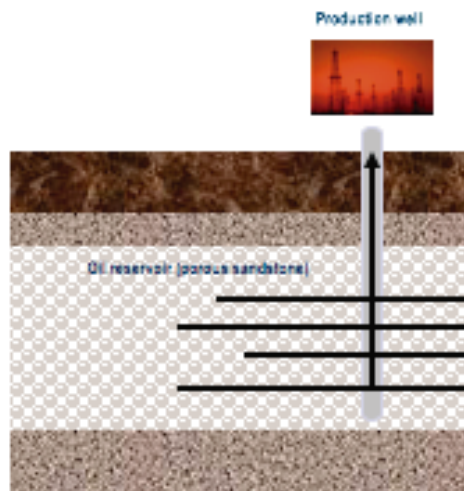
- Minimum 30-50% production uplift in project area within 6-months
- No additional water production
- 9-12% incremental oil recovery on OOIP for long duration projects
- **Incremental oil at \$10/BBI for full-scale projects**
- **Reduction in LOE of 20-50%**



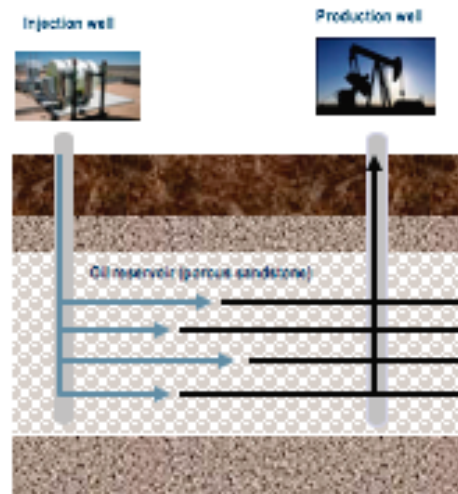
AERO™ Mechanism

1 Initial oilfield production

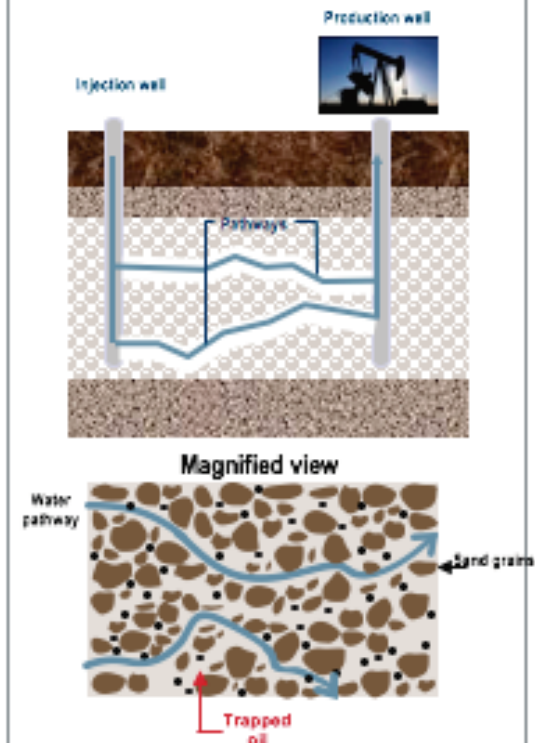
- Internal natural reservoir pressure forces oil toward well bore
 - 10-20% of original oil is recovered

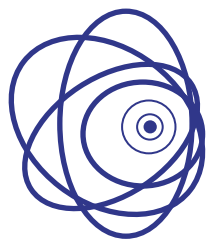
**2** Waterflood recovery – initial

- Natural reservoir pressure reduces and recovery is aided by water forcing oil towards well bore
 - Sandstone is porous and permeable which allows for water/oil flow
 - Another 10-15% of original oil can be recovered

**3** Waterflood recovery – mature

- Eventually water finds paths of least resistance to producer
 - Most injected water follows these paths and recovery greatly decreases



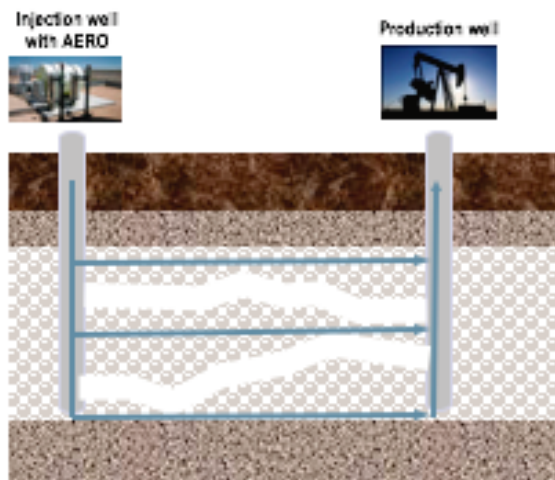


AERO™ Mechanism

4 Activated Environment for Recovery of Oil

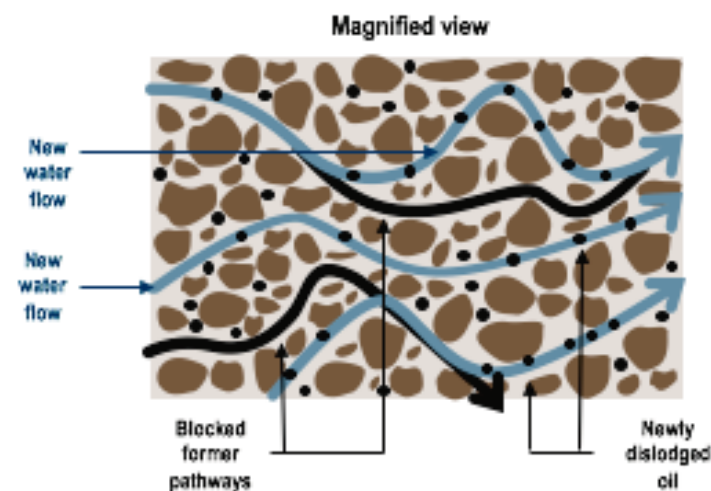
Pathways are blocked

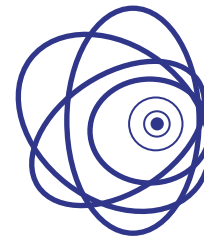
- Some of the oil, water and microbes join to form a microbial biomass which lowers Interfacial tension (IFT) between residual oil and water and alters flow patterns at a reservoir's pore-throat level



Trapped oil is freed

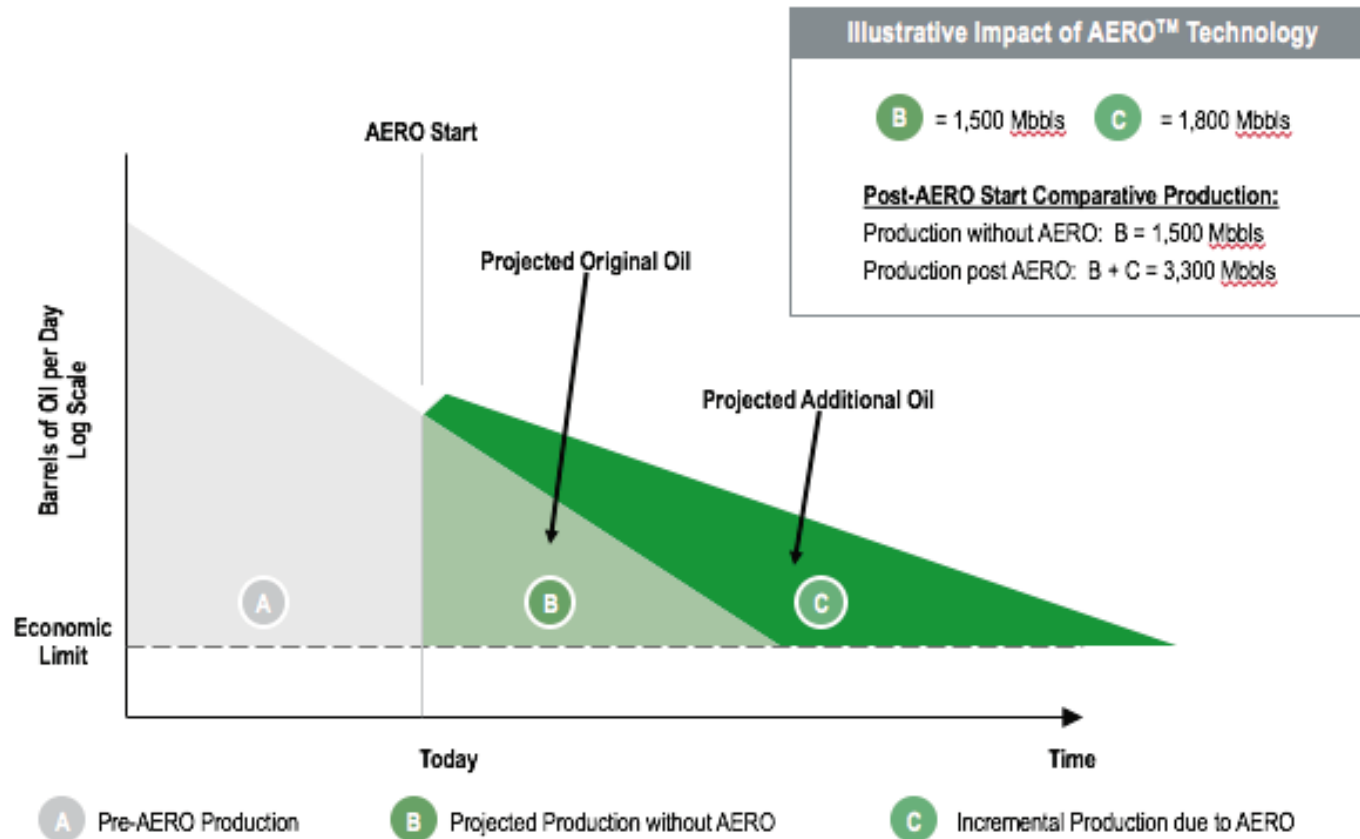
- The interfacial tension of the oil/water interface is greatly reduced which helps free trapped oil

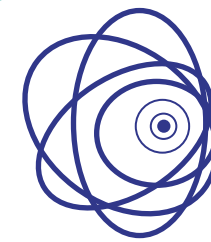




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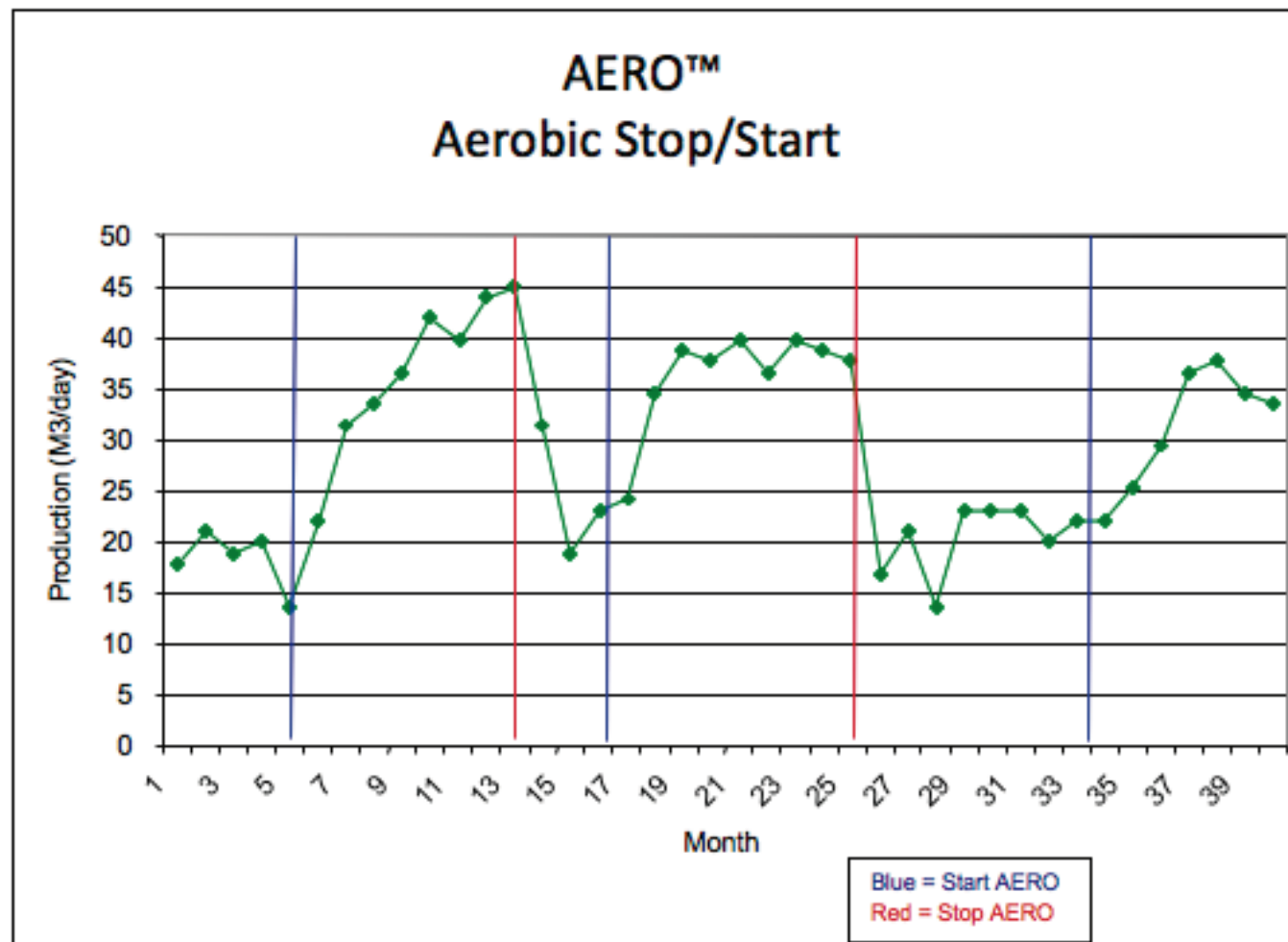
AERO™ Field Model:





AERO™ Results - Statoil

Statoil demonstration of process control:





AERO™ Proven and Proprietary Technology



Donald E. Glover
(c)+ 1 832-316-9005
Donald.Glover@mvgesolutions.com



MVG ENERGY
SOLUTIONS

Vanesa Arteaga
(c) +57 320 744 2549
Vanesa.arteaga@mvgesolutions.com

Manuel Gutiérrez
(c) +57 321 490 1363
Manuel.gutierrez@mvgesolutions.com

www.mvgesolutions.com



CONTACT US

