



Improving the Up-time of Oil Lifting & Production Facilities in Brown Fields – a RAG Field Case

SPE Workshop - How to maximize the value of mature HC fields?

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Improving the Up-time of Oil Lifting & Production Facilities in Brown Fields – a RAG Field Case

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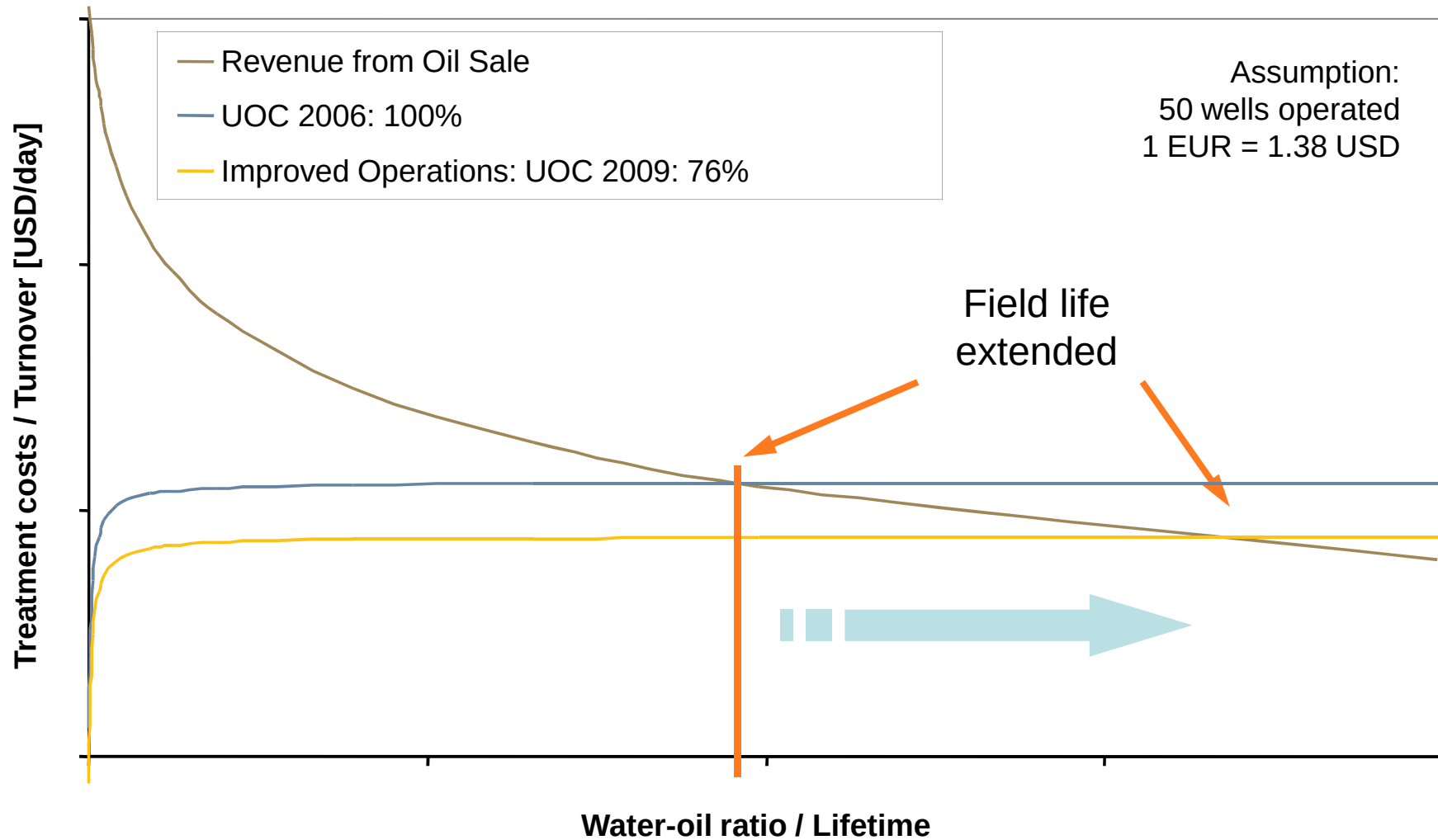
www.rag-austria.at

Agenda

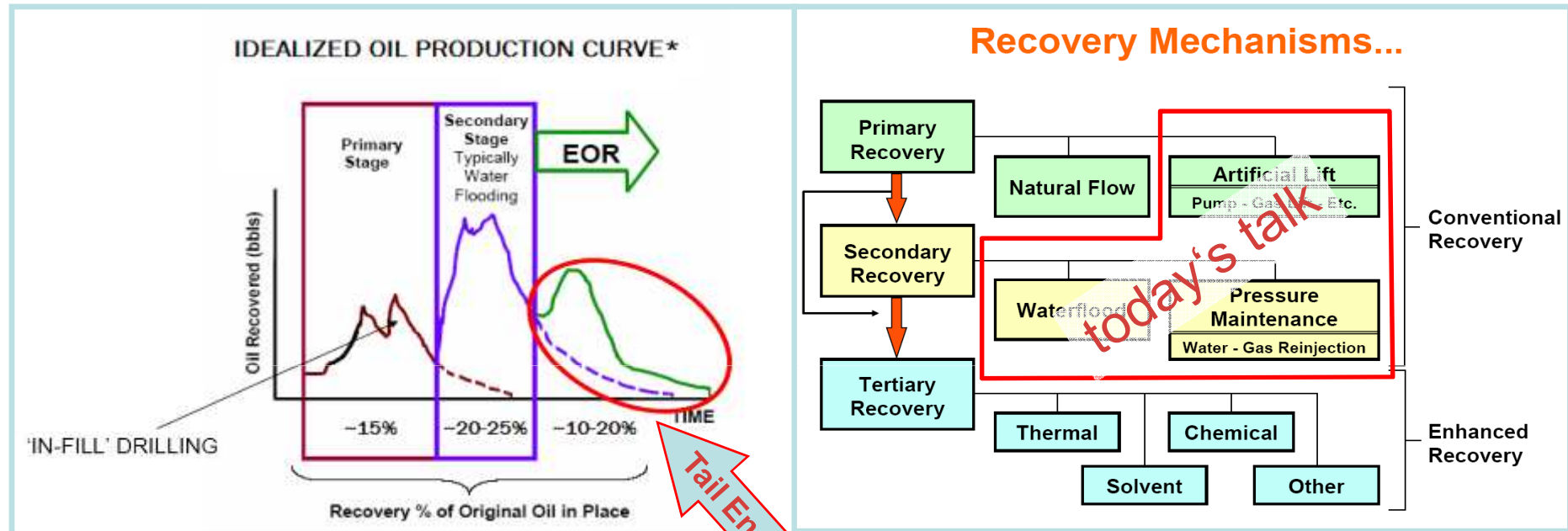
- Introduction
- Initial Situation
- Measures taken
- Results
- Summary



Tail-End Production Challenges

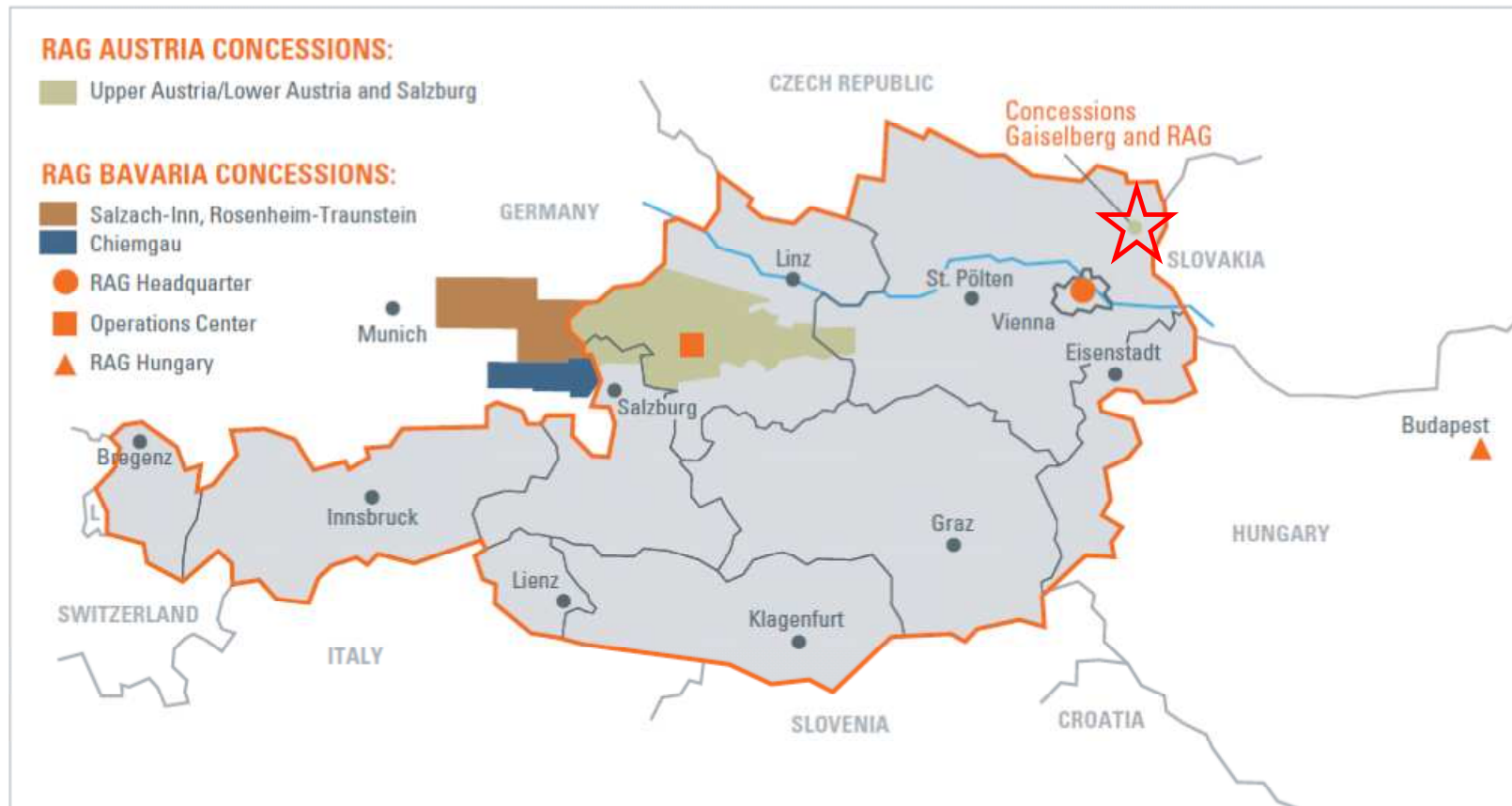


How to maximize the value of mature HC fields?



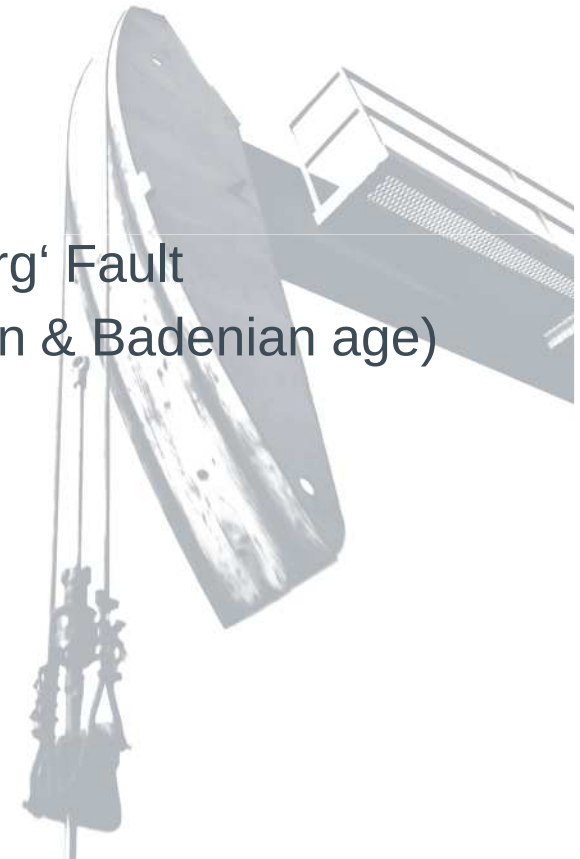
- Extending field life by
 - Cost Reduction
 - Production Increase (IOR/EOR)

Introduction

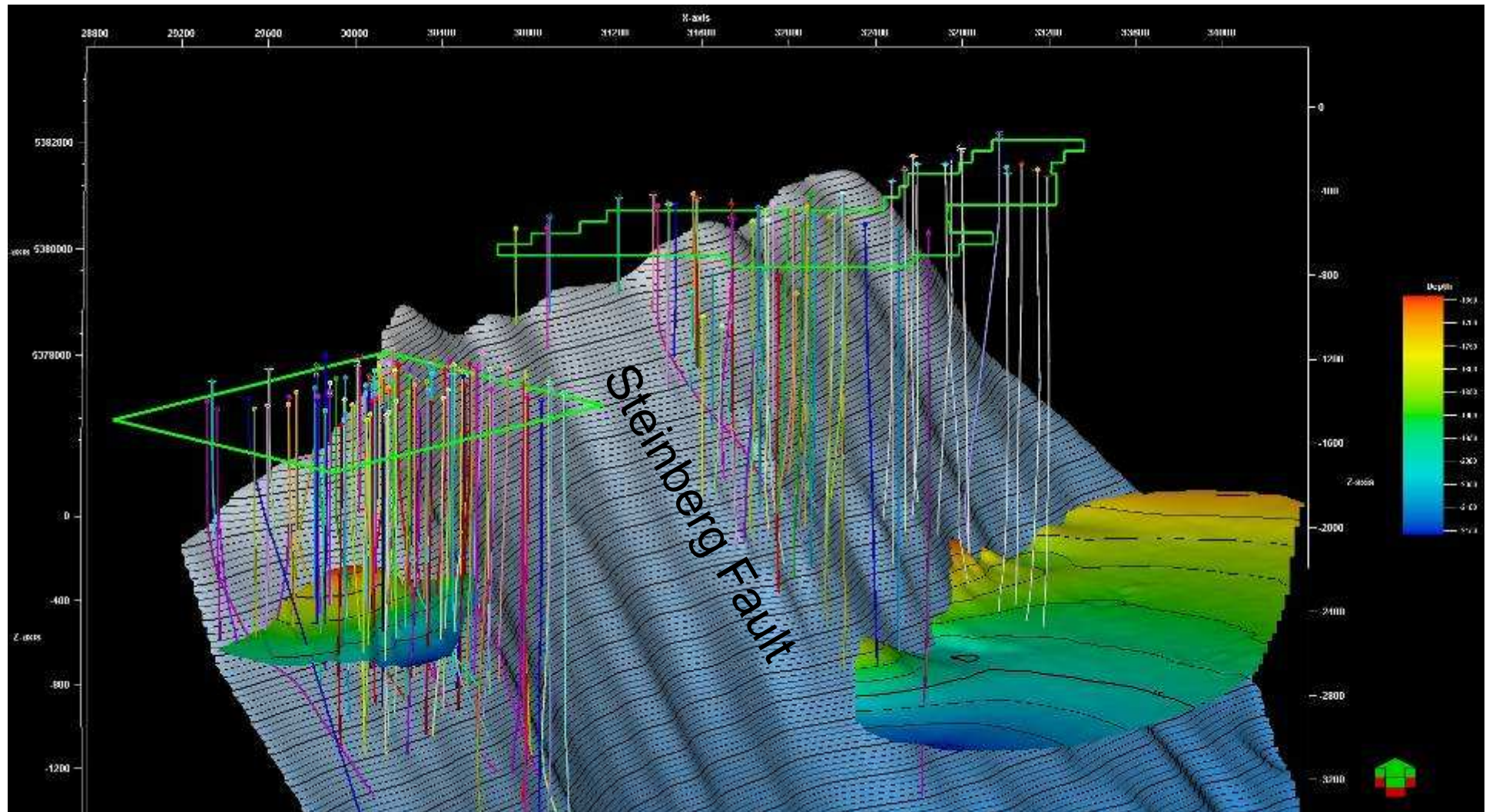


Facts & Figures about the relevant oil field

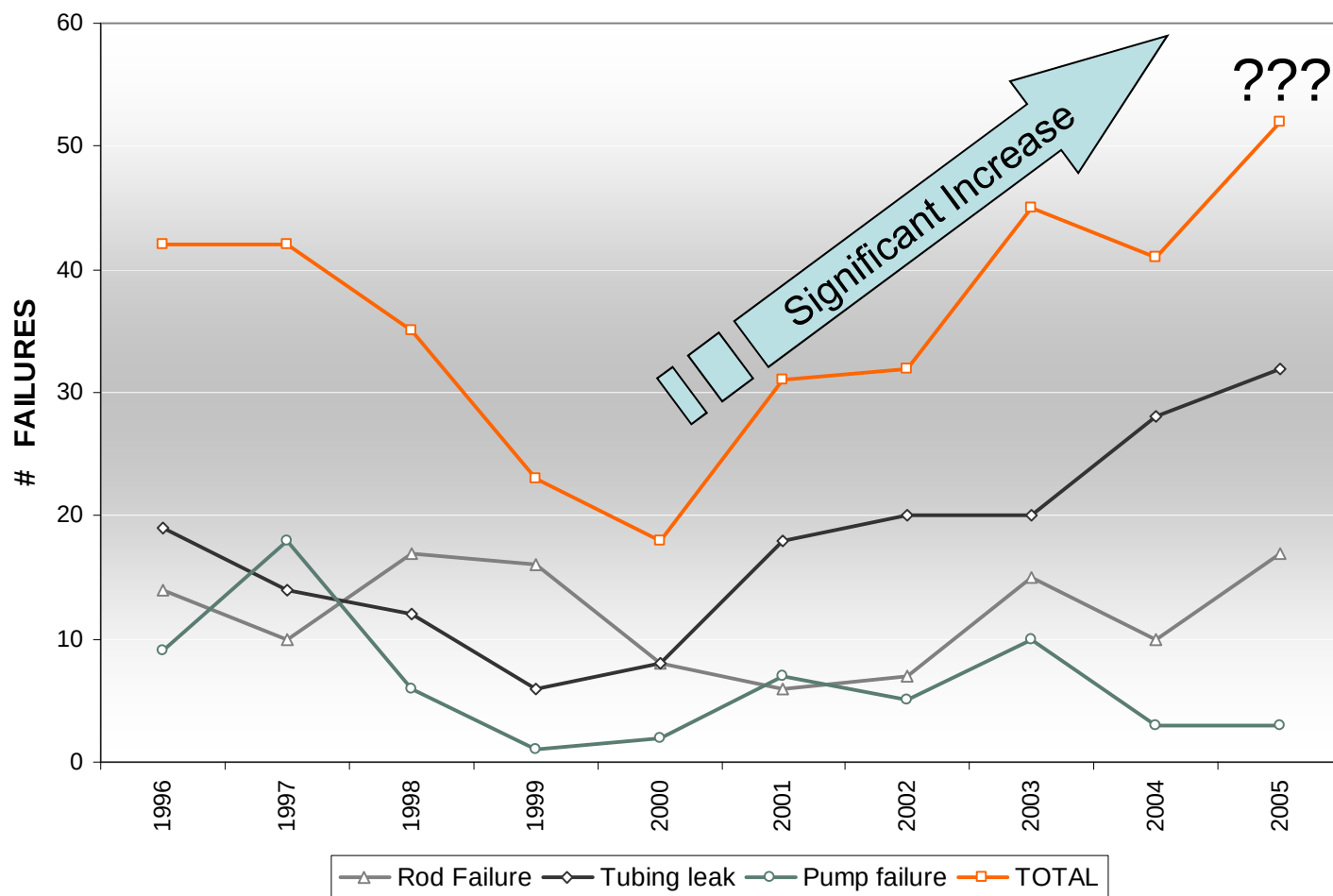
- Gaiselberg, Zistersdorf / Lower Austria
 - First Oil in 1937
 - Gaiselberg-Field (2,5 km²)
 - RAG-Field (2,5 km²)
 - Complex Geology bounded by major 'Steinberg' Fault
 - 40 stratigraphic units oil bearing (Sarmatian & Badenian age)
 - 15 fault blocks -> ~ 600 compartments
 - HC height > 1000m in neogen basin fill
 - 62 wells (33 producer, 18 injector, 11 shut in)
 - field water cut: ~ 92%
 - unconsolidated sandstone formations



Overview – Geologic 3D Model

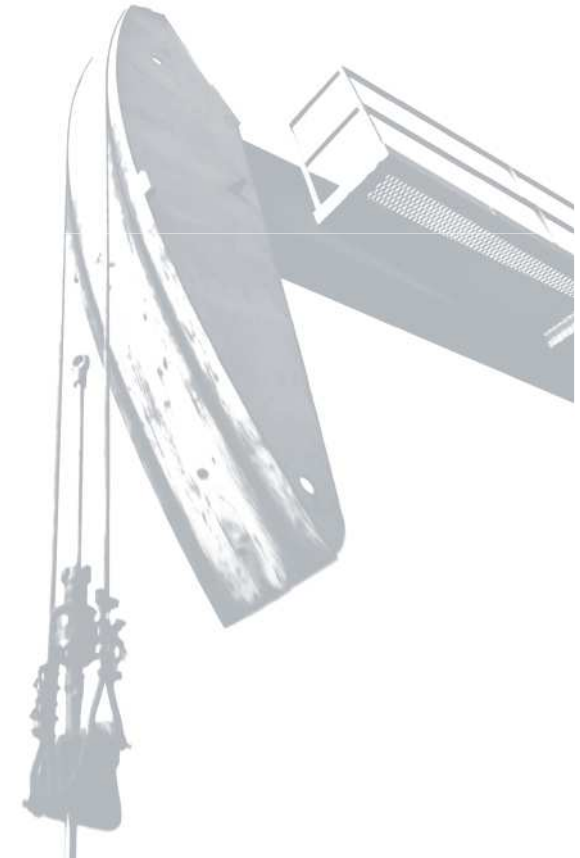


Failure Statistics 1996 - 2005



Results after analysing the Initial Situation

- Main failure categories
 - Tubing leak
 - Rod failure
 - Pump failure
- Deferred Production
- Significant Workover Costs
- No spare capacity for
 - Well Stimulation
 - Re-development of abandoned horizons



Rod Failure – severe wear & corrosion



Paraffinic Tubing



Tubing Leak

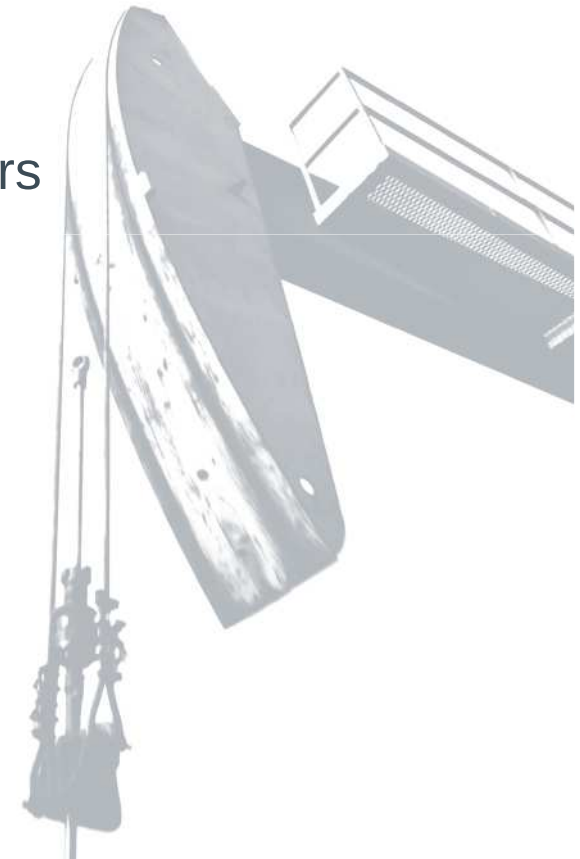


Tremendous Corrosion



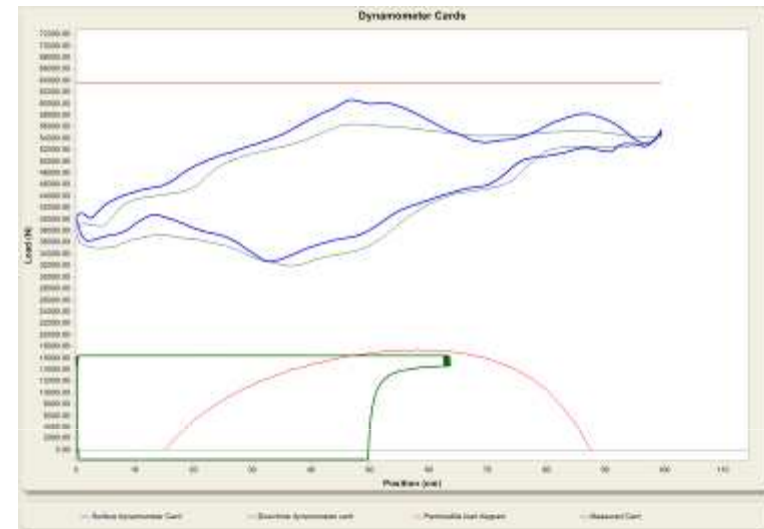
Identified Areas for Improvement

- Improved tubing & rod design + operation parameters
- Improved Materials
 - Rod Pumps
 - Rods with spray-metal couplings and protectors
 - Tubing Specs
 - Line Pipe Specs
- Implementation of Production Chemicals
 - Corrosion inhibitor
 - Paraffin inhibitor



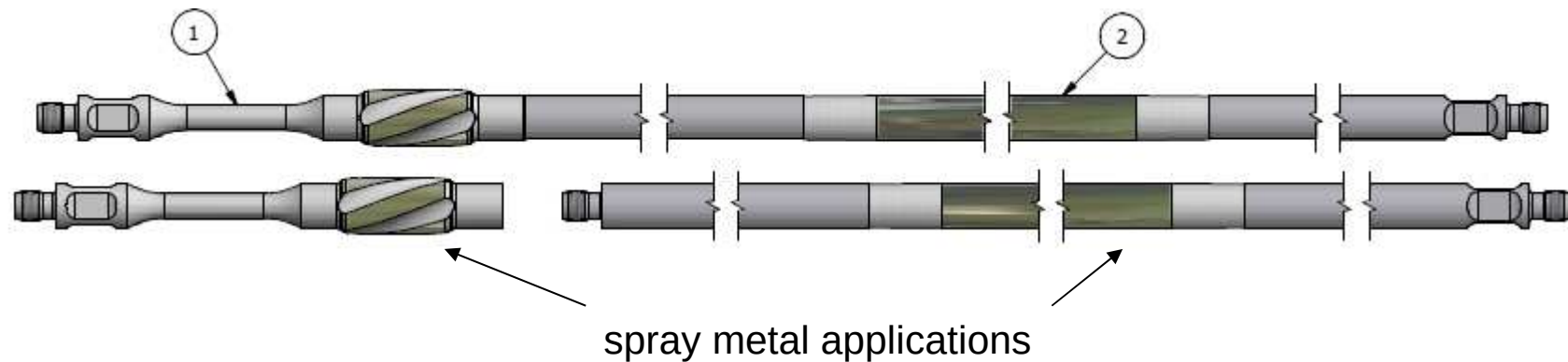
Improved Rod Sting Design and Operation Parameters

- Design & analysis with software tools like
 - Theta's Rodstar, CBalance, XDiag
- Electronic dynamometer
- Target/Actual comparison
- Optimization parameters
 - reduced wear (min. load, min. side wall forces)
 - maximized stroke length
 - minimized rod dynamics



Improved Materials I

- Use superior grade material
 - Rod String Grade D acc. to API
 - Pump parts in special alloy acc. to RAG specification
 - Spray-metal applications for couplings, spiral centralizers and sinker bars
 - Rod protectors with modified Polyamid



Improved Materials II

- Tubing Grade J 55
 - with plastic liner (PE or PP)
 - above pump seat to avoid rod buckling
 - high deviated wells
 - avoid paraffin & wax deposition due to insulation effects
- Line Pipes
 - C-steel with epoxy resin (or PE) coating on the inside



Increased Application of Production Chemistry

- **Corrosion** inhibitor selection
 - laboratory screening
 - 20 products tested
- Pilot test in the field
 - 4 + 5 wells
 - Simple wireline connected beam driven dosing pump
- Gradual field implementation
 - Developed module type dosing units
 - Optimizing dosing and metering of inhibitors
 - High inhibitor volume available for high volume producers
 - Possibility to extend the module with second inhibitor barrel (paraffin/scaling...)

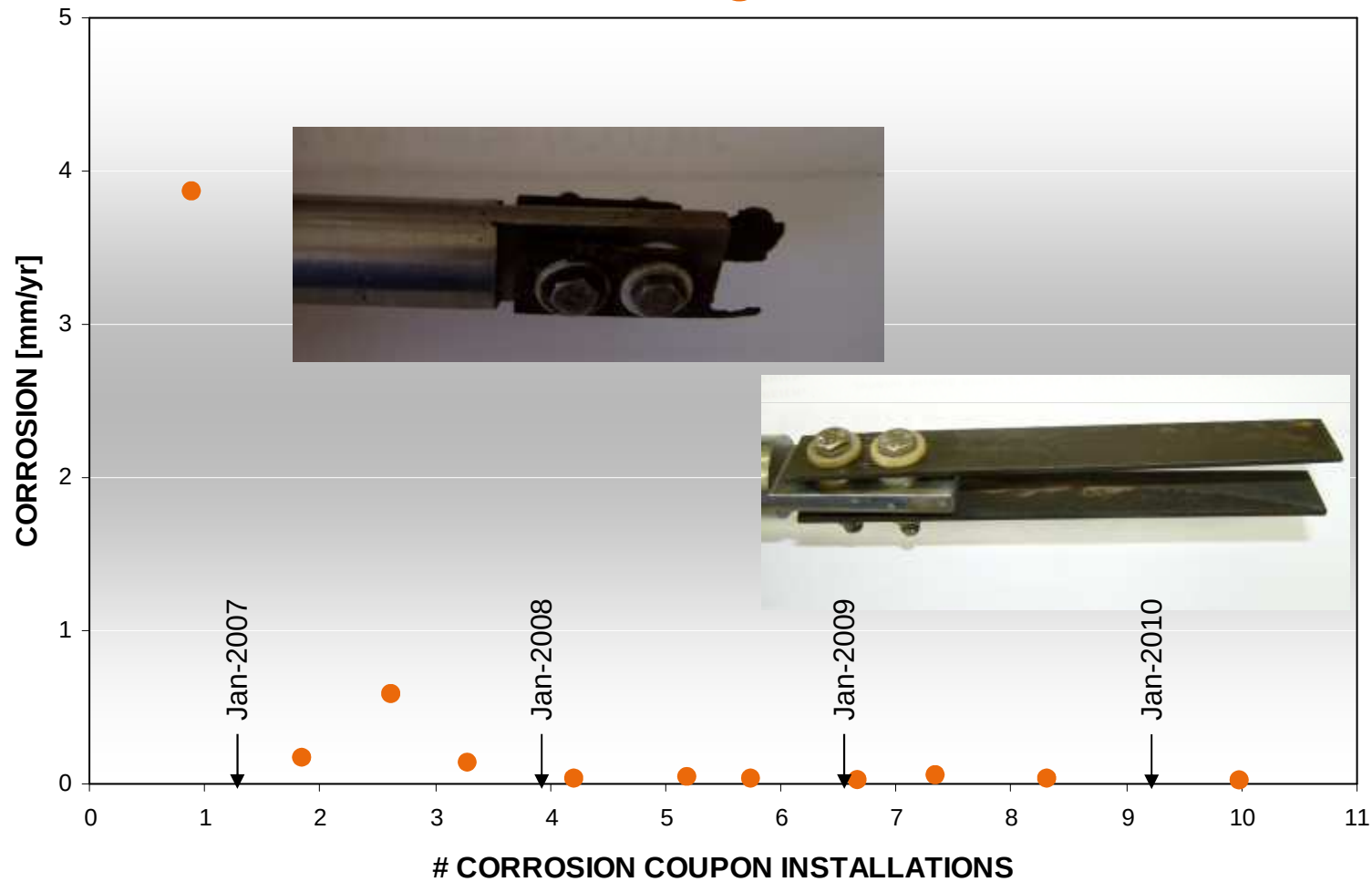


Monitoring – Key Factor in Production Chemistry

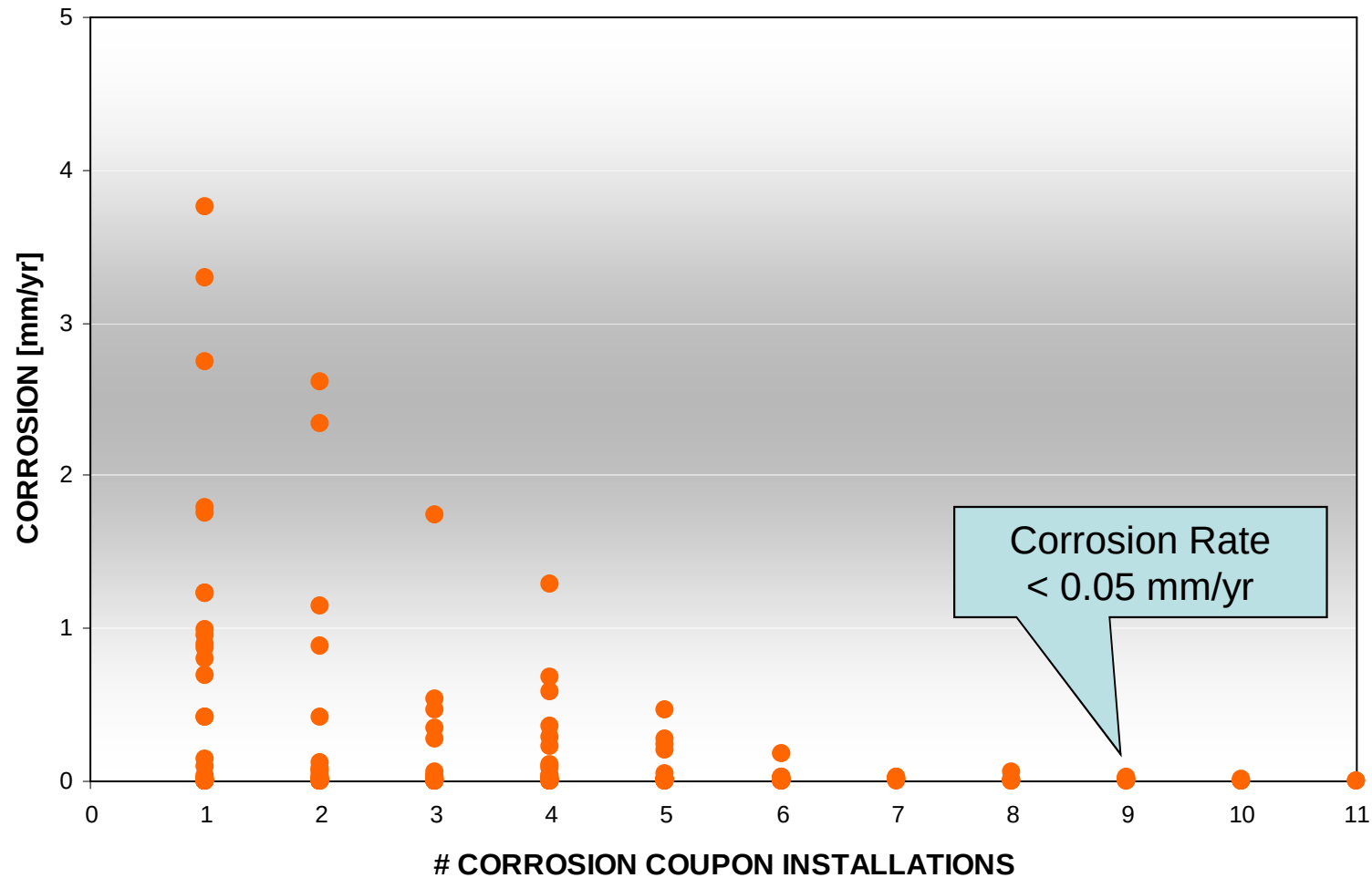
Most critical factor for success!

- Use of test coupons (material C 1020)
- Mounted in pipe lines close to the well head
- Period of application about 6 – 12 weeks
- Dismount and directly analyse in lab
- Optimize dosing rate according to lab results

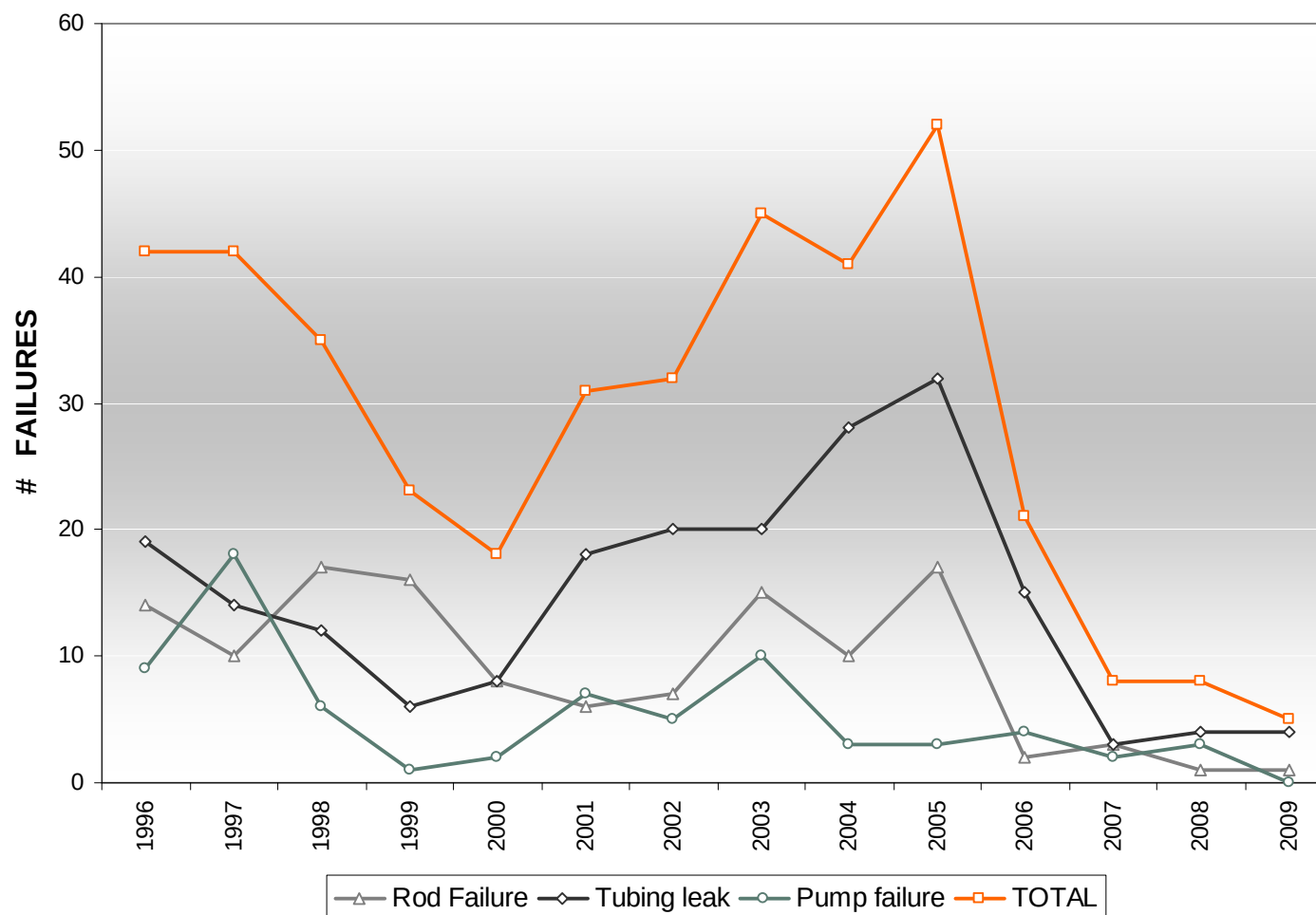
Corrosion Inhibitor – Single Well GA-083



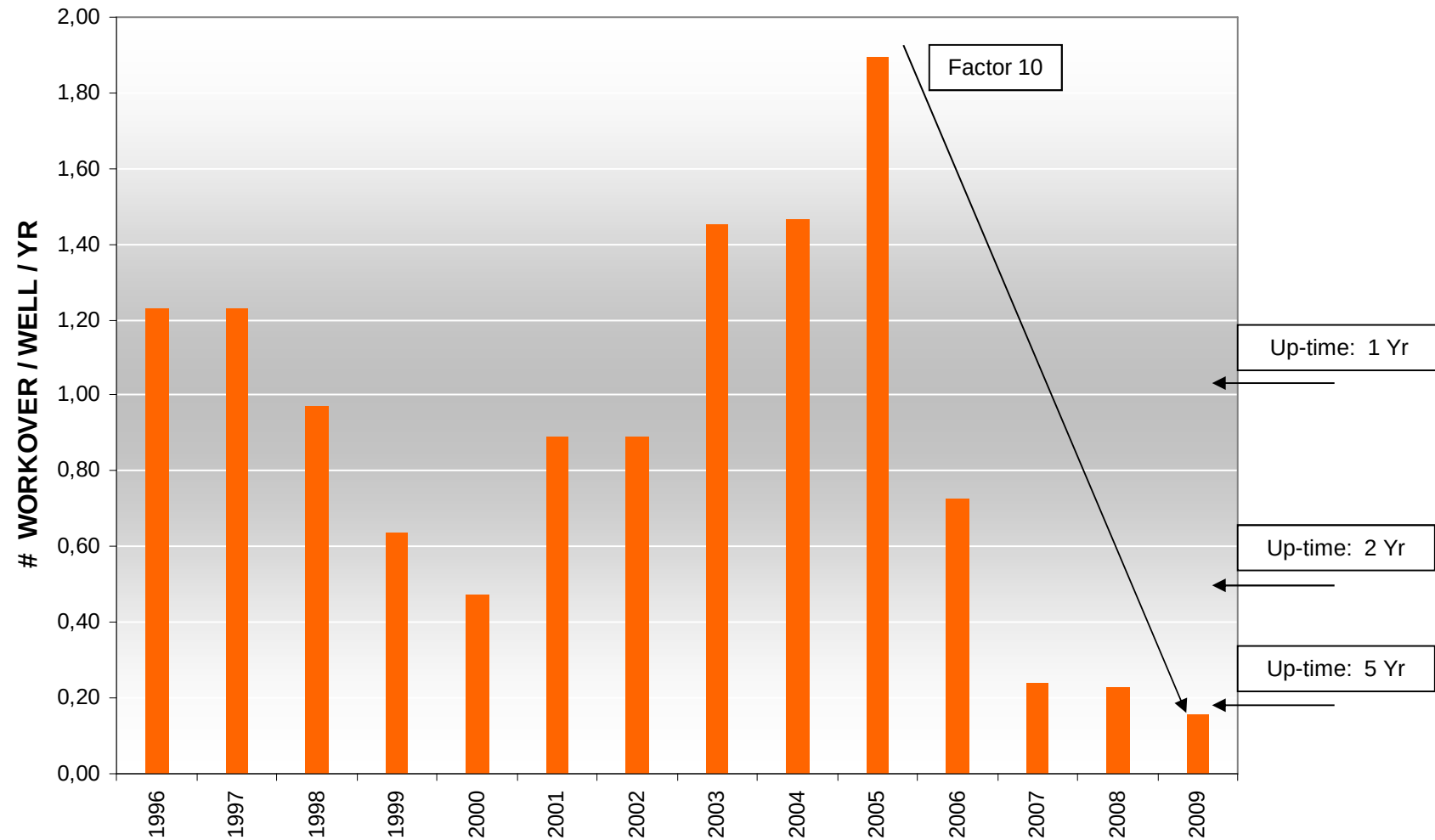
Corrosion Inhibitor – Corr. Rate Survey Results



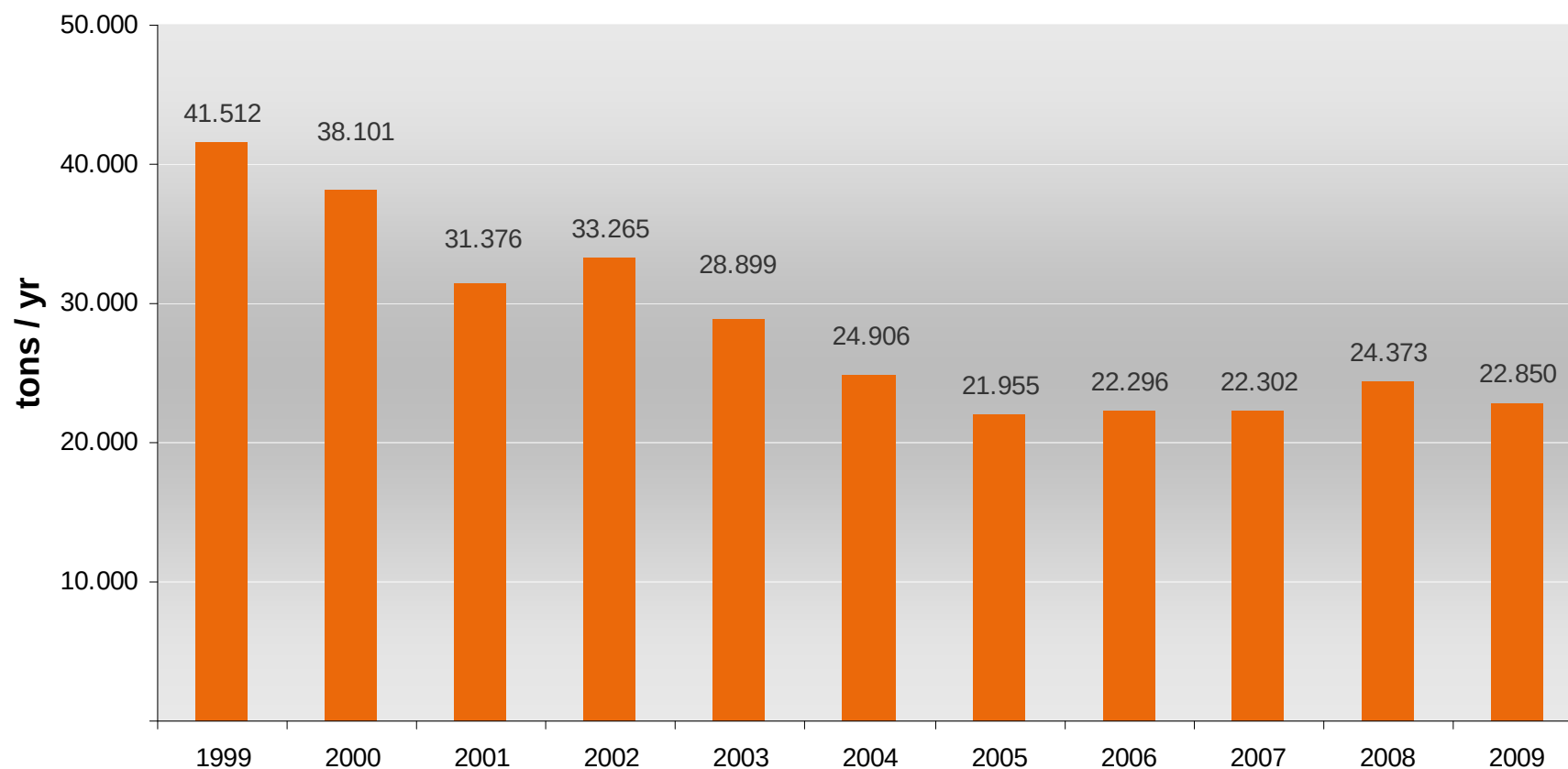
Failure Statistics I



Failure Statistics II

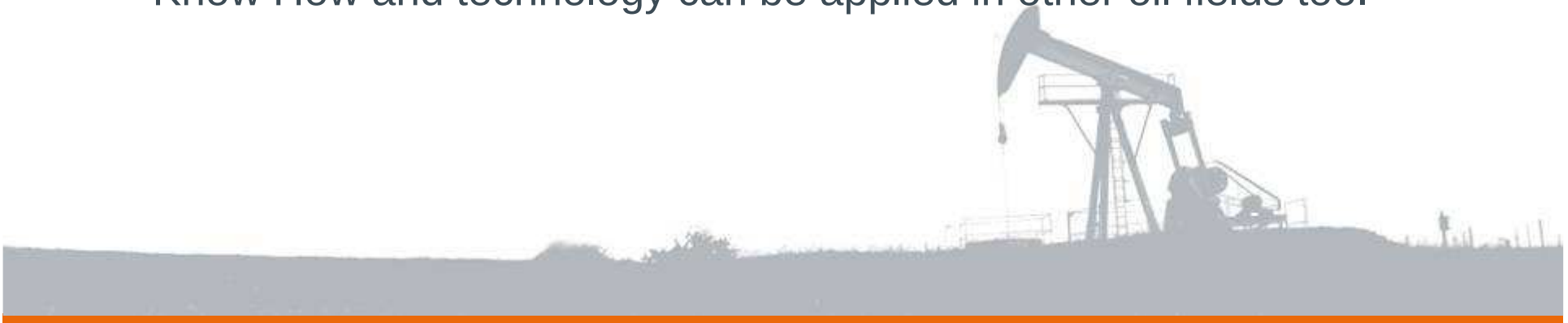


Oil Production Statistics



Summary

- Up-Time of Lifting and Production equipment significantly improved (factor 10 !)
- Production Decline could be stopped
- Unit Cost savings about 25%
- No experiments in the field – structured approach from lab scale to field scale.
- Know How and technology can be applied in other oil fields too.



Thank you for your attention!

