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WHEN IS CLASSIC SAND CONTROL NOT ENOUGH? – THE IMPACT OF FORMATION FINES

David Underdown
Chevron

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OUTLINE OF PRESENTATION

• INTRODUCTION
• CLASSIC APPROACH TO SAND CONTROL
• ANALYSIS OF FINES AND CONSEQUENCES
• CASE HISTORIES
• RECENT ADVANCES IN FINES STABILIZATION
• LESSONS LEARNED AND BEST PRACTICES
FACILITIES
DRILLING & COMPLETIONS
FLOW ASSURANCE
FINES PRODUCTION
OPERATIONS
FINES PRODUCTION CAN BE A BIG PROBLEM !!
FINES PRODUCTION CAN BE A REAL BIG PROBLEM!!
IS THE CLASSIC SAND CONTROL APPROACH ENOUGH ??

THE CLASSIC SAND CONTROL APPROACH

- Obtain sample of core material
- Measure particle size distribution
- Select screen size using $1 \times D_{10}$
- Select gravel size using $6 \times D_{50}$

REALLY FAIRLY STRAIGHT FORWARD....RIGHT ??
NORTH SEA FORMATION

Particle Size (microns)

Percent of Total

Del %
Cum %

Cum Percentage

Particle Size (microns)
HOW DO YOU KNOW IF FINES MIGHT BE A PROBLEM FOR YOU??

ONE APPROACH IS TO DO A PARTICLE SIZE ANALYSIS OF THE FORMATION SAND

BUT HOW ??

A SIEVE ANALYSIS

OR

LASER PARTICLE SIZE ANALYSIS (LPSA)

THE TWO METHODS GIVE DIFFERENT RESULTS WHY...AND WHAT IS THE CONSEQUENCE ???
THE DIFFERENCE BETWEEN LASER AND SIEVE ANALYSES

LASER PARTICLE SIZE ANALYSIS (LPSA)

SIEVE ANALYSIS
COMPARISON OF RESULTS

Particle Size (Microns)

Cumulative Wt. (%)
WHAT IF THERE IS A LARGE AMOUNT OF FINES?

- Knowing the amount of fines is not enough
- It is very important to know if the fines move at the production conditions of the well
- Therefore, core flow tests are required; i.e., Fines Migration Tests
GULF OF MEXICO FORMATION

The diagram shows a cumulative volume percent curve against particle size in microns. The curve indicates different percentages of fines, with 9% and 19% marked on the graph. The legend includes symbols for the finest, median, and 2-period moving average of the finest and median particle sizes.
FINES MIGRATION TEST – GOM FORMATION

![Graph showing permeability vs. injection rate for different flow rates (5 ml/min, 10 ml/min, 25 ml/min, 50 ml/min, 75 ml/min, 100 ml/min).]
THIN SECTION OF GOM FORMATION
SEM OF GOM FORMATION
CONSEQUENCE OF FINES MIGRATION TEST RESULTS

- Larger gravel used in frac pack
- Larger screens used in completion
- Topsides
  - Installed minimal sand handling equipment
  - Saved several million $$’S

WELL ON PRODUCTION FOR ~ 5 YEARS AT EXPECTED OIL PRODUCTION RATE; MAKING WATER AND NO SAND
WHAT ARE SOME OF THE LESS OBVIOUS CONSEQUENCES OF FINES PRODUCTION ??
WEST AFRICA DEEPWATER FORMATION
THIN SECTION OF WEST AFRICA FORMATION
SOLIDS PRODUCED IN FINES MIGRATION TEST
CONSEQUENCE OF FINES PRODUCTION

50 kbpd – 250 mD
SAND DEPOSITION IN FLOWLINES

- Pressure losses due to reduced flow area
- Pigging requirement to remove sand
- Under sand bed corrosion

Moving or stationary sand bed
ORGANIC POLYMER STABILIZATION

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ORGANIC POLYMER STABILIZATION

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INORGANIC POLYMER STABILIZATION
LESSONS LEARNED & BEST PRACTICES

- Sieve & laser methods of particle size analyses can show different results
- Use PSD’s, thin sections & SEM’s to screen for potential fines concerns
- Fines migration tests are needed to determine if fines actually move
LESSONS LEARNED & BEST PRACTICES

- Some consequences of fines production are not so obvious
  - Sand bed corrosion
  - Sand control design for water injectors
- New approaches to fines stabilization include organosilanes & organic polymers
- There is a great need for a good solids transport model