A Day in the Life of a Gas-Lift Well Analyst

ASME/API/ISO Spring 2005 Gas-Lift Workshop

As presented by Dwayne Vetter, Larry Peacock, and Dan Dees with Special Thanks to our other guest stars

In Association with Bongo Productions
How do we turn this information into profit?

Basic Surveillance:

Surveillance is a Process, not a Project
TEAM CONCEPT

Recommended Surveillance Strategy:

- Convince management
- Create GL Team
- Analyze Wells
- Champion
- Spot Problems
- Implement Changes
- Improve Data & Systems
- Well Analysts
- Model Performance
- Gas Lift Team
- Re-design/re-distribute
- Support Process

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Our Focus: The Gas-Lift Well Analyst

- ACCURATE & COMPLETE WELL DATA
- SURFACE PRESSURE RECORDER CHARTS, REAL-TIME SCADA
- ACCURATE WELL TESTS
- SUBSURFACE PRESSURE & TEMPERATURE SURVEYS
- PROPER SURVEILLANCE TOOLS
- TRAINING
It’s Gallant the Super Analyst!
Vs. Goofus the Barely Analyst
GETTING STARTED

• REVIEW MORNING REPORTS FROM SCADA
GETTING STARTED

- ANALyzes wells individually
- diagnoses problems to determine most likely cause
- prioritizes problems based on production of well and severity of the problem as well as amount to be gained or the cost of the problem
- determines alternatives to address the problems
- predicts impacts of changes to wells’ operation
NEW WELL TESTS

• RECEIVES NEW DATA AUTOMATICALLY FROM COMPANY DATA STORE INTO ANALYSIS SOFTWARE
• REVIEWS NEW WELL TEST DATA THAT HAS COME IN; CONDUCTING A MINI-WELL REVIEW
• DETERMINES VALIDITY OF NEW DATA
• CONFIRMS TEST CONDITIONS
• IF CONSISTENT WITH PREVIOUS TESTS
  • UPDATE ANALYSIS PROGRAM
  • CALCULATE THE DOWNHOLE PERFORMANCE
  • PLOT CURRENT WELL TEST ON PERFORMANCE CURVE
• IF NOT CONSISTENT WITH PREVIOUS TESTS
  • MAY REORDER NEW WELL TEST
  • MAY ORDER PRESSURE SURVEY
  • MAY NEED TO REDO OPTIMIZATION
FLOWING PRESSURE/TEMPERATURE GRADIENT SURVEYS

• LOAD THE NEW SURVEY THAT HAS ARRIVED ALONG WITH THE WELL TEST

• FLOWING PRESSURE SURVEY DATA IS EXTREMELY USEFUL IN CALIBRATING TWO-PHASE PRESSURE MODELS TO COMPENSATE FOR INSTRUMENT DEFICIENCIES IN WELL TEST DATA

• FLOWING TEMPERATURE SURVEY DATA CAN BE USEFUL IN DETERMINING THE WELL LIFT DEPTH BY SEEING SUDDEN TEMPERATURE CHANGES IN THE WELL
## WELLTEST RESERVOIR RESULTS

![Well Test Software Interface](image)

### Original Parameters
- **Test Length**: 8.00
- **Test Sep. Press.**: 689.0
- **Man. Pressure**: 298.0

### Calculated Parameters

<table>
<thead>
<tr>
<th>Description</th>
<th>Original</th>
<th>Factor</th>
<th>Calib. Value</th>
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<tr>
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<tr>
<td>IPR Qmax</td>
<td>292.3</td>
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<tr>
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<tr>
<td>Lift Depth</td>
<td>1,645.923</td>
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### Description Table

<table>
<thead>
<tr>
<th>Description</th>
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<th>Factor</th>
<th>Calib. Value</th>
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<td>Oil Rate</td>
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<tr>
<td>Water Rate</td>
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<td>Form. Gas Rate</td>
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<tr>
<td>LG Rate</td>
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<td>11,793.08</td>
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<tr>
<td>Production Press.</td>
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<td>689.0</td>
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<tr>
<td>Injection Press.</td>
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<tr>
<td>Choke Size</td>
<td>25.4</td>
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<td>25.4</td>
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DEPTH vs. PRESSURE GRAPH
w/FLOWING SURVEY
MODEL CALIBRATION & WELLTEST BEFORE CALIBRATION
MODEL CALIBRATION & WELLTEST AFTER CALIBRATION

### Model Calibration

<table>
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<tbody>
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<tr>
<td>Total Gas</td>
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<tr>
<td>Oil</td>
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<td>Water Cut</td>
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<td>Formation Gas</td>
<td>3,681,190</td>
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<tr>
<td>Lift Gas</td>
<td>12,742,582</td>
</tr>
<tr>
<td>GOR</td>
<td>102,055</td>
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Update IPR

Hold Constant

- Liquid
- Gas

OK  Apply  Cancel

### Well Test

- **Date**: 12-Oct-1994
- **Information Only**: [ ]
- **Delete Well Test**: [ ]

**Original**

<table>
<thead>
<tr>
<th>Test Length</th>
<th>Test Sep. Press</th>
<th>Main. Pressure</th>
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<tr>
<td>0.00</td>
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**Calculated**

- **FDHP**: 20,438.0
- **IPR Gmax**: 442.3
- **Pf**: 0.031
- **Lift Depth**: 1,402.083

**Description**

<table>
<thead>
<tr>
<th>Description</th>
<th>Original</th>
<th>Factor</th>
<th>Calib. Value</th>
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<tr>
<td>Oil Rate</td>
<td>19.1</td>
<td>1.000</td>
<td>19.1</td>
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<tr>
<td>Water Rate</td>
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<td>Form. Gas Rate</td>
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<td>LC Rate</td>
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<td>Production Press</td>
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<tr>
<td>Injection Press</td>
<td>5,376.0</td>
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<td>5,376.0</td>
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<tr>
<td>Choke Size</td>
<td>25.4</td>
<td>1.000</td>
<td>25.4</td>
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</table>

**Well Test Description**: [ ]

OK  Apply  Cancel
CALIBRATED PRODUCTION PRESSURE MODEL
UPDATING RESERVOIR INFO
BASED ON WELLTEST & FLOWING SURVEY
LIFT GAS PERFORMANCE CURVE
OPTIMIZATION

• REVIEW WELL CHANGES
• FINALIZE ANALYSIS OF WELLS
• DETERMINE NEED FOR NEW OPTIMIZATION RUN
• CREATE AND DOWNLOAD NEW OPTIMIZATION TABLE TO REAL TIME SYSTEM IF NECESSARY
KA-BOOM!!!!!!!
## RUN AN OPTIMISATION MANAGEMENT REPORT

10-Feb-2005

Opt. Management

Field YIBAL

<table>
<thead>
<tr>
<th>Well</th>
<th>Lease Strg</th>
<th>Date</th>
<th>LG Rate</th>
<th>Oil</th>
<th>LG Rate</th>
<th>Oil</th>
<th>diff</th>
<th>% diff</th>
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<td>22653.48</td>
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WELL TEST AND THEN SOME

• LOCATE ANY WELLS WITH OLD WELL TEST
• REVIEW STATUS OF WELL TEST VS. PERFORMANCE CURVE PREDICTION
• REVIEW WELLS WITH DEVIATIONS GREATER THAN 20%
• CHECK TEST TO SEE IF IT MATCHES THE CURRENT MODEL USING AN OLD SURVEY
• IF NOT, CALIBRATE AND THEN CHECK FACTORS TO SEE IF CALIBRATED FACTORS FOR THE LAST FEW TESTS ARE REPEATABLE
• IF REPEATABLE AND GAS RATES ARE INVOLVED, CONTACT FIELD TO ASK FOR CHECK OF LIFT GAS AND TEST SEPARATOR GAS METERS
• CHECK TO SEE IF WELL TEST FALLS ON THE PERFORMANCE CURVE WITH OTHER TESTS
• IF NOT NEAR PERFORMANCE CURVE, MAY CHECK WITH RESERVOIR ENGINEER TO SEE IF IT IS POSSIBLE THAT THE RESERVOIR PRESSURE OR PI MAY HAVE CHANGED
UNDERSTANDING ROOT CAUSE OF PROBLEMS

• FOR PROBLEMS, CAN THEY BE SOLVED AT THE SURFACE
  • CLEANING FLOW LINE
  • FIXING LEAK
  • CHANGING INJECTION RATE

• OR DOWNHOLE
  • CHANGING A LEAKING VALVE OR A VALVE THAT IS NOT SET CORRECTLY
  • REDESIGN OF THE STRING
PROBLEM IDENTIFICATION

• TO EVALUATE SOME PROBLEMS, MAY NEED TO ORDER PRESSURE SURVEY TO
  • CONFIRM WHERE WE ARE LIFTING
  • DETERMINE IF MULTIPOINTING
  • DETERMINE INFLOW PERFORMANCE OF WELL

• BUT DUE TO COST, TIME, RISK, DEFERRED PRODUCTION MIGHT USE ALTERNATIVE APPROACH
  • NON-INVASIVE CO2 TRACE TO HELP DETERMINE LEAKS, LIFTING POINT, AND WHETHER MULTIPOINTING IS OCCURRING
VALVE ISSUES

• DETERMINE IF THERE IS A VALVE PROBLEM
  • REVIEW THE VALVE PERFORMANCE DATA FOR THAT VALVE
  • CALL THE GAS-LIFT SHOP TO FIND OUT ABOUT THE SPECIFIC VALVE IN THAT MANDREL
  • WHAT IS ITS HISTORY?

• FOR NEW VALVES, RUN THEM THROUGH A GASLIFT VALVE PERFORMANCE TESTER

• FOR OLD VALVES REMOVED, EXAMINE BELLOWS, SEATS, SIGNS OF PLUGGING DUE TO SALT, SAND OR PARAFFIN
SOFTWARE – WHAT IS IT GOOD FOR?

• GOOD CONNECTIONS BETWEEN SCADA AND SURVEILLANCE/DESIGN TOOLS
• CHECKS FOR NEW UPDATES TO SOFTWARE TOOLS IN USE
• PERFORMS RESEARCH ON THE INTERNET FOR LATEST NEWS
• PROVIDES FEEDBACK FOR FUTURE MODIFICATIONS OF TOOLS IN USE
THAT AIN’T ALL THE
SUPER ANALYST DOES

• CONSULTS WITH OTHER TEAM MEMBERS AS REQUIRED
  • FIELD OPERATORS
  • EXPLORATION STAFF
  • GAS-LIFT ENGINEERS

• READS LOTSA LITERATURE TO IMPROVE HIS SKILLS

• KEEPS CURRENT ON ALL FIELD ASPECTS FOR HIS AREA

• DETERMINES WHEN AND HOLDS WELL REVIEWS WITH PEERS

• ENJOYS SHARING NEWFOUND KNOWLEDGE WITH COLLEAGUES AND INTERNS

• TAKES PAPERWORK HOME TO REVIEW
CHARACTERISTICS OF A GOOD ANALYST

• HANDS ON WITH WELL PROBLEMS
• WILLING TO BE CLOSE TO THE FIELD
• INTERACTS WITH FIELD STAFF
  • WELL SERVICING
  • WELL TESTING
• DOCUMENTS ACTIONS
• COMMUNICATES ACTIVITIES TO PERTINENT STAFF
• WILLING TO TRAIN OTHERS
• BECOMES A DOCTOR OF WELLS TO BE ABLE TO OBSERVE SYMPTOMS AND QUICKLY PRESCRIBE CORRECTIVE ACTIONS
ANALYST REACTIONS

• EATS AT HIS DESK
• CARES ABOUT MISSING OPPORTUNITIES TO SAVE MONEY OR INCREASE PRODUCTION
• DREAMS OF REACHING FULL POTENTIAL
END OF THE DAY

• DETERMINES WHAT WORK IS TO BE DONE ON WHICH WELLS
  • SCHEDULES FUTURE EFFORTS WITH APPROPRIATE PERSONNEL
  • PROVIDES A PROGNOSIS FOR EACH ACTION
  • TELLS WHY THE ACTION IS BEING PERFORMED
A GAS-LIFT ANALYSTS REWARD

• TRAINING
• WORKSHOP ATTENDANCE
• BIG RAISE AFTER HE IS RECOGNIZED FOR HIS CONTRIBUTION
• RECEIVE NEWLY CREATED NOBEL PRIZE IN GAS-LIFT