Smart Automation Well Venting

Lessons Learned from Natural Gas STAR

Producers Technology Transfer Workshop

ExxonMobil Production Company,
American Petroleum Institute and
EPA's Natural Gas STAR Program

September 21, 2004

Smart Automation Well Venting: Agenda

- Methane Losses
- Methane Recovery
- Is Recovery Profitable?
- Industry Experience
- Discussion Questions

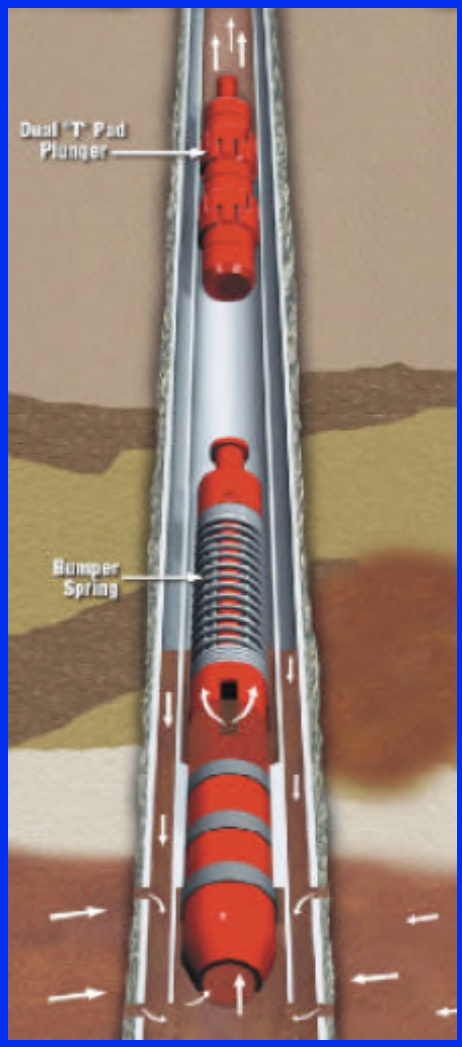
Methane Losses

- 360,000 condensate and natural gas wells (on and offshore) in the U.S.[1]
- Accumulation of liquid hydrocarbons or water in the well bores reduces, and can halt, production
- Common “blow down” practices to temporarily restore production can vent 50 to 600 Mcf/yr to the atmosphere per well
- Estimate 7 Bcf/yr methane emissions from U.S. onshore well venting[1]

[1]Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 - 2002

What is the Problem?

- Conventional plunger lift systems use gas pressure buildups to repeatedly lift columns of fluid out of well
- Fixed timer cycles may not match reservoir performance
  - **Cycle too frequently (high plunger velocity)**
    - **Plunger not fully loaded**
  - **Cycle too late (low plunger velocity)**
    - **Shut-in pressure can't lift fluid to top**
    - **Gas slippage around plunger and fluid (waste of motive energy)**



Source: Weatherford

Conventional Plunger Lift Operations

- Manual, on-site adjustments tuned plunger cycle time to well's parameters
  - **Not performed regularly**
  - **Do not account for gathering line pressure fluctuations, declining wells, plunger wear**
- Manual vent to atmosphere when plunger lift is overloaded

How Can Smart Automation Reduce Methane Emissions?

- Smart automation continuously varies plunger cycling to match key reservoir performance indicators
  - **Well flow rate**
    - **Measuring pressure**
  - **Successful plunger cycle**
    - **Measuring plunger travel time**
- Plunger lift automation allows producer to vent well to atmosphere less frequently

Automated Controllers

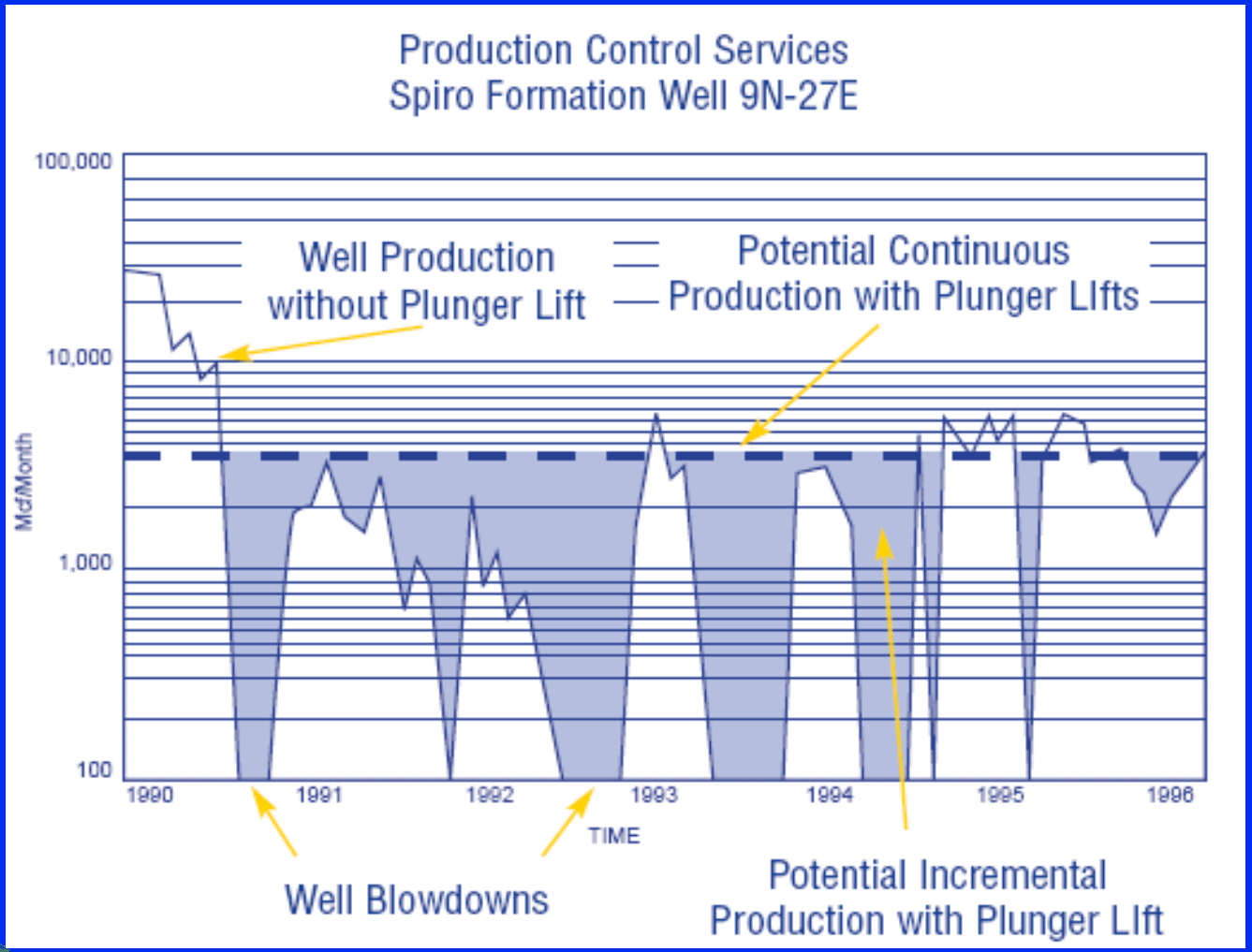
Source: Weatherford

- Low-voltage; solar and battery powered
- Monitor well parameters
- Adjust plunger cycling

- Remote well management
  - **Continuous data logging**
  - **Remote data transmission**
  - **Receive remote instructions**

Source: Weatherford

Plunger Lift Cycle



Methane Savings

- Methane emissions savings a secondary benefit
  - **Optimized plunger cycling to remove liquids increases well production by 10 to 20%[1]**
  - **Additional 10%[1] production increase from avoided venting**
- 500 Mcf/yr emissions savings for average U.S. well

[1] Weatherford

Other Benefits

- Reduced manpower cost per well
- Continuously optimized production conditions
- Remotely identify potential unsafe operating conditions
- Monitor and log other well site equipment
  - **Glycol dehydrator**
  - **Compressor**
  - **Stock Tank**
  - **VRU**

Is Recovery Profitable?

- Smart automation controller installed cost: ~$11,000
  - **Conventional plunger lift timer: ~$5,000**
- Personnel savings: double productivity
- Production increases: 10% to 20% increased production
- Savings =

  (Mcf/yr) x (10% increased production) x (gas price)

  + (Mcf/yr) x (1% emissions savings) x (gas price)

  + (personnel hours/yr) x (0.5) x (labor rate)

  $ savings per year

Economic Analysis

- Non-discounted savings for average U.S. Well =

(50,000 Mcf/yr) x (10% increased production) x ($3/Mcf)
+ (50,000 Mcf/yr) x (1% emissions savings) x ($3/Mcf)
+ (500 personnel hours/yr) x (0.5) x ($30/hr)
- ($11,000) cost

$13,000 savings in first year

- 10 month simple payback

Industry Experience

- BP reported installing plunger lifts *with* automated control systems in ~2,200 wells
  - **900 Mcf reported annual savings per well**
  - **$12 million costs including equipment and labor**
  - **$6 million total annual savings**
- Another company shut in mountaintop wells inaccessible during winter
  - **Installed automated controls allowed continuous production throughout the year[1]**

[1]Morrow, Stan and Stan Lusk, Ferguson Beauregard, Inc. Plunger-Lift: Automated Control Via Telemetry. 2000.

Discussion Questions

- To what extent are you implementing these technologies?
- What are the barriers (technological, economic, lack of information, regulatory, focus, manpower, etc.) that are preventing you from implementing this technology?