



# Engineering 101

**Oil and Gas for Managers**



# Petroleum Engineering

- Drilling Engineering
- Production Engineering
- Reservoir Engineering



# Drilling Operations

- Drilling Rig Systems:
- Power
- Hoisting
- Rotating
- Circulating
- Blowout Prevention



# Wellbore Geometry

- Vertical Well
- Directional Well
- Costs



# Well Completion Operations

- Well Testing, Logging, Coring
- Casing and Cementing
- Producing Operations



# Well Testing

- Drill Stem Tests
- Electric Logs
- Cores



# Casing and Cementing

Surface Casing

Intermediate Casing

Production Casing

Liners

# Producing Operations





# Production Facilities

- Oil/ Gas/ Water Separator
- Heater Treater
- Dehydrator
- Storage Tanks, Oil and/or Water
- LACT Meter
- Gas Meter
- Water Disposal



# Reservoir Engineering

- Reservoir Parameters:
  - Porosity
  - Permeability
  - Water Saturation
  - Reservoir Pressure
  - Fluid Properties
  - Drive Mechanism
- Volumetrics
- Decline Curve Analysis



# Four Well Bore Casing Diagrams



# Summary

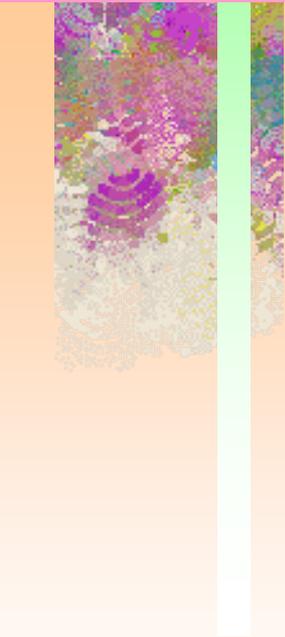
- Drilling Equipment and Function
- Production Equipment and Function
- Reservoir Engineering
- Well Plugging



# Part II



BLM at Work



Lease Operations

# Objective

- BLM's oil and gas program, specifically:
- Applications for Permit to Drill: APD's
- Sundry Notices
- Who does what?



# APD Statistics



Who Ya' Gonna' Call?

# Who Touches an APD?

- Legal Instruments Examiner
- Petroleum Engineer
- Geologist
- Surface Protection Specialist
- Archeologist
- Wildlife Biologist
- Realty Specialist
- Mining Engineer

# Notice of Staking (NOS)

- Optional
- Surveying and Staking
  - prior approval not needed for Fed
  - prior approval needed for Indian or Military
- Notice submitted
- Onsite inspection
- Still must file APD

# Application for Permit to Drill APD

- Not an option
- Surface: 13 Point Surface Use Plan
- Sub-surface: 8 Point Drilling Plan
- Requirements: OOGO #1
- OOGO #2
- OOGO #6



# APD Process

- Administrative review
- Surface management review
- Geological/engineering review

# Legal Instrument Examiner

- Post or log APD
- Completeness of application
- Administrative review
- 7-day letter
- Update AFMSS and Case Recordation



# Administrative Review

- Lease status
- Lease ownership
- Well location and spacing
- Bonding
- Operator certification

# Bonds

- Individual - \$10,000
- Statewide - \$25,000
- Nationwide - \$150,000



# Surface Protection Specialists

- Land use plan
- NEPA compliance
- Inspections
- Rights-of-way



# Oil & Gas Operations: Environmental Protection

43 Part 3161.2:

The authorized officer is directed to .... determine that the proposed plan of operations is sound both from a technical and environmental standpoint.



## Objective:

Managers will know how to determine whether a proposed oil & gas operation is environmentally sound



# Oil & Gas Order No. 1 highlights

- Minimum survey requirements
- Pre-APD Notice of Staking
- Onsite inspection within 15 days
- Archeological survey discretionary
- Other SMA's may identify concerns
- Impacts based on drilling plan



# Oil & Gas Order No. 1 highlights

- SMA identifies T&E concerns
- BLM leads NEPA & COA development
- Surface owner agreement optional
- Environmental review for other operations
- AO may require more in SUP's



# Surface Use Plan

map(s) showing:

- 1) Existing roads
- 2) Roads to be constructed
- 3) Location of existing wells
- 4) Location of proposed facilities
- 5) Location and type of water supply
- 6) Any ancillary facilities



# Surface Use Plan

list:

- 7) Construction material used
- 8) Methods for handling waste
- 9) Plans for reclamation
- 10) Type of surface ownership

# Surface Use Plan

- 11) Plat showing well site layout
- 12) Other information
- 13) Operator's signed certification



# Field Review

(Onsite or Pre-drill Inspection)

- BLM, operator, other SMA, dirt contractor
- Exception for infill wells
- Demonstrated on field tour

# Environmental Review

- Plan conformance
- NEPA compliance
- DNA
- EA
- EIS

# Conditions of Approval

- Reasonable
- Justified by RMP or NEPA analysis
- Plainly worded
- Accomplish the objective
- Allow exercise of lease rights



# Right-of-Way (ROW)

- Roads
- Oilfield facilities

# Geologist

- Geologic Markers and Formation Tops
- Fresh water sources & depths
- Oil, Gas, and Mineral bearing zones
- Potential Hazards





# Geologist, cont.

- Abnormal Pressure, H<sub>2</sub>S
- Casing Set Points
- Cement Tops
- Update AFMSS

# Petroleum Engineer

- Casing and Cement program
- Drilling Fluids program
- Pressure control system
- Testing, Coring, and Logging
- Update AFMSS





# Mud Program

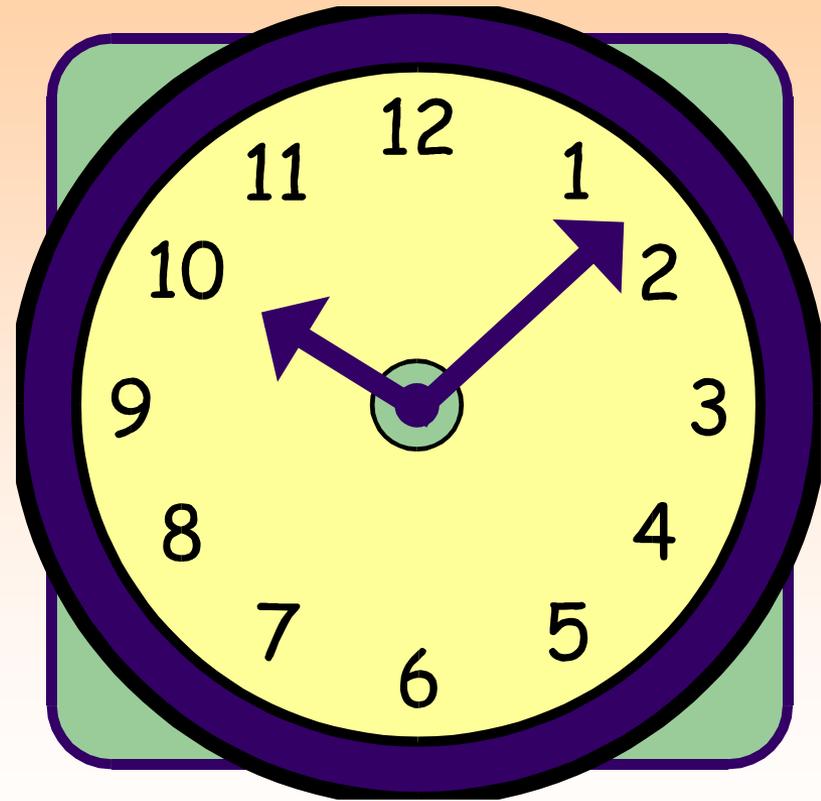
- Type of circulating medium:
  - Water based
  - Oil based
  - Air
- Characteristics:
  - Weight
  - Water Loss
- Sufficient Quantity on Hand or Backup
- Monitoring Equipment

# Pressure Control

- Blowout Prevention Equipment (BOPE)
  - Pipe and Blind Rams
  - Annular Preventer
  - Upper Kelly Cock
  - Stabbing Valve
  - Chokes; Manual/Remote
- Sizes:
  - 2M, 3M, 5M, 10M, 15M

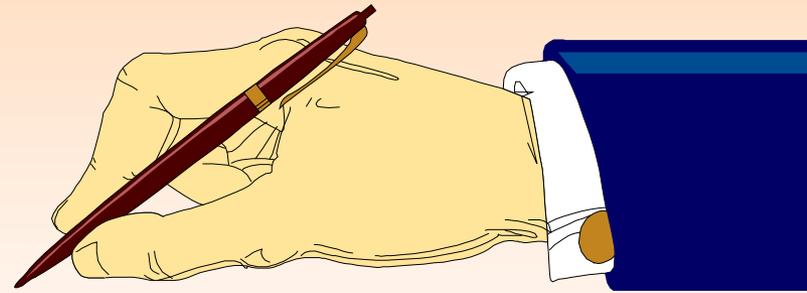
# Timing

- 30 days minimum
- 45 days average



# Approved APD

- May start work immediately
- Good for one year
- May be renewed



# Delays

- Lose available rig
- Lose lease

# Sundry Notice

- Notice of Intent - NOI
- Subsequent Report - SR



# Examples of Actions

- Casing repair
- Perforate and/or acidize
- Recomplete to a new zone
- Convert to water disposal
- Change in drilling plans
- Commingling
- Abandonment - SRA
- Final Abandonment - FAN

# Non-Producing Wells

- Shut-In - SI
- Temporarily Abandoned - TA

# Shut-In

- Definition:  
"A completion which is physically and mechanically capable of production in paying quantities or capable of service use".
- Source: IM No. WO88-8, 10/2/87

# TA, Continued

- Limited period
- Justification required
- Casing integrity test

# Temporarily Abandoned

- Definition:  
"A completion that is not capable of production in paying quantities but which may have value as a service completion".
- source: IM No. WO88-8, 10/2/87



# Idle/Inactive Well Chart

# BLM's Idle/Inactive Well

## Problem:

- Small Operators are "Walking Away" from their Leases and Wells.
- When this happens Wells become "Orphaned" even with a Bond in Place. Bonds often are Inadequate.
- BLM takes Responsibility for the permanent Abandonment & Surface Reclamation.
- BLM has expended Several Million Dollars to Plug Wells over the last few years - Could Use \$ Elsewhere.

# Plug and Abandon

- End of life cycle
- Plugging requirements - OO #2
- Reclamation
- Restoration



# AFMSS

- Automated Fluid Minerals Support System



# LR2000

- Lands and Minerals Information System
- Data formerly in Case Recordation

# Summary

- APD's
- Sundry Notices
- TA/SI
- AFMSS
- LR2000 (LRIS)