WellCAP®
IADC WELL CONTROL ACCREDITATION PROGRAM

WIRELINE OPERATIONS
CORE CURRICULUM AND RELATED JOB SKILLS
FORM WCT-2WLS

SUPERVISORY LEVEL

The purpose of the core curriculum is to identify a body of knowledge and a set of job skills which can be used to provide well control skills for wireline operations. The curriculum is divided into three course levels: Introductory, Fundamental, and Supervisory.

The suggested target students for each core curriculum level are as follows:

INTRODUCTORY: New Hires
(May also be appropriate for non-technical personnel)

FUNDAMENTAL: Helpers, Assistants, “Hands” and personnel involved with the operational aspects of the unit

SUPERVISORY: Supervisors, Superintendents, and Project Foreman

Upon completion of a well control training course based on curriculum guidelines, the student should be able to perform the job skills in italics identified by a "■" mark (e.g., ■ *Identify causes of kicks*).

TABLE OF CONTENTS

I. REASONS FOR WELL SERVICING OPERATIONS

TRAINING TOPICS	*JOB SKILLS*
A. Definitions of well-servicing operations	■ *Describe well-servicing operations.*
B. Definition of well-servicing unit types	■ *Describe types of well-servicing units.*
C. Reasons for well servicing operations which may include wireline:	■ *Identify reasons for performing well servicing activities or working over a well.*
1. Completing for production from a new reservoir.	■ *List potential well control problems that could occur during well servicing and workover operations.*
2. Completing a well in more than one reservoir.	
3. Stimulating a completion in a producing reservoir.	
4. Reworking a producing reservoir to control water and/or gas production.	
5. Rework to reduce or eliminate water coning.	
6. Repair mechanical failure.	
7. Cement repair.	

II. DEFINITIONS AND CALCULATIONS

TRAINING TOPICS	*JOB SKILLS*
A. Pressure fundamentals 1. Definition of pressure a. Force b. Area 2. Types of pressure a. Pressure gradient 1) Liquid 2) Gas b. Hydrostatic pressure 1) General 2) Effect of fluid level change c. Total downhole pressure 1) Considering multiple fluid columns with varying densities 2) Considering shut-in surface pressures d. Bottomhole pressure e. Formation pressure 1) Balanced 2) Underbalanced 3) Overbalanced f. Differential pressure g. Trapped pressure h. Swab pressure i. Surge pressure j. Fracture pressure	■ *Define the following items:* • Force • Pressure gradient • Hydrostatic pressure • Bottomhole pressure • Differential pressure • Total downhole pressure • Formation pressure ■ *Calculate the above pressures.* ■ *Calculate effect of surface pressure on downhole pressures.* ■ *Demonstrate understanding of U-tube concept.* ■ *Calculate hydrostatic changes due to fluid level changes.* ■ *Calculate fluid column height to generate a specific hydrostatic pressure.* ■ *Explain causes and effects of swab and surge pressures in the wellbore.* ■ *Define and calculate equivalent fluid density.* ■ *Calculate overbalance or underbalance conditions.* *Definitions and Calculations continued on next page.*

3. Equivalent static fluid density a. Definition b. Pressures expressed as an equivalent fluid weight 4. U-tube principles	
B. Live Wells and Kicking Wells 1. Routine and non-routine operations a. Operations with wellhead pressure b. Operations without wellhead pressure 2. Definition of Live Well a. Producing b. Shut in 3. Definition of Kicking Well a. Undesired production b. Formation flow c. Pressure below bridge/blockage d. Unwanted swabbing	■ *Describe routine and non-routine operations.* ■ *Describe difference between routine and non-routine operations for pressured and non-pressure scenarios.* ■ *Define* • Production • Shut in • Unwanted flow/production • Possible scenarios for well kick
C. Force 1. Definition 2. Necessary tool string weight to overcome force. 3. Stripping (considering buoyed wireline/tool weight) 4. Packer, plug, etc. (considering differential pressure across packer, plug, etc.)	■ *Define force and buoyancy.* ■ *Calculate net force effects due to pressure against a surface and due to differential pressure.* ■ *Calculate buoyancy effects.* ■ *Calculate string weight (e.g. sinker bars) necessary for a given wellhead pressure.*

III. KICK FUNDAMENTALS

TRAINING TOPICS	*JOB SKILLS*
A. Definition of a kick	■ *Define a kick.*
B. Causes of kicks (open hole, cased hole and tubing) 1. Swabbing the well 2. Insufficient fluid density 3. Failure to keep hole full 4. Loss of circulation	■ *Identify causes of a kick and how it can impact wireline operations.*
C. Kick detection (open hole, cased hole and tubing) 1. Kick indicators and warning signs including, but not limited to: a. Increase in surface pressures b. Unwanted flow c. Increase in fluid flow rate d. Gain in pit volume e. Hole not taking proper amount of fluid when pulling pipe or wireline f. Volume displacement change during trip in g. Change in string weight h. Oil or gas shows	■ *Identify indicators and warning signs of a kick* ■ *Rank indicators from most reliable to least reliable.*

Kick Fundamentals continued on next page.

Kick Fundamentals continued.

TRAINING TOPICS	*JOB SKILLS*
D. Importance of responding to kick indicators in a timely manner 1. Minimize kick volume 2. Consequences of not responding a. Kick becomes blowout b. Possible release of poisonous gases c. Pollution d. Potential for fire e. Loss of life, equipment resources f. Larger kick and higher shut-in surface pressure	■ *Identify the benefit of timely response to kick indicators.* ■ *Identify or describe potential consequences of improper or untimely response to kick indicators.*

IV. GAS CHARACTERISTICS AND BEHAVIOR

TRAINING TOPICS	*JOB SKILLS*
A. Pressure, volume, relationship (Boyles Law)	■ *Describe pressure and volume relationships for gas.* ■ *Calculate simple pressure-volume gas relationships.*
B. Gas expansion and migration relationships 1. In the wellbore a. Gas density based on pressure b. Effect on bottomhole pressure c. Effect on surface pressure d. Effect on uncontrolled pressure	■ *Describe the effects of gas migration (both expanded and unexpanded) on surface equipment and downhole pressures.*

V. FLUIDS

TRAINING TOPICS	*JOB SKILLS*
A. Characteristics 1. Density 2. Viscosity	■ *Describe desirable properties of fluids.* ■ *Describe undesirable properties and how it may effect running/pulling activities*
B. Fluid types 1. Oil and oil based fluids 2. Water and water based fluids a. Brines b. Muds 3. Gases 4. Packer fluids 5. Other types	■ *Identify various fluid types and their relative densities.* ■ *Describe why various fluid types would be used.*

VI. SURFACE EQUIPMENT

TRAINING TOPICS	*JOB SKILLS*
A. Types of wireline 1. Slickline 2. Braided line 3. Electric line	■ *Identify types and describe uses of different types of wireline* ■ *Describe limitations* ■ *Describe differences in handling procedures*
B. Components of wireline units 1. Reel/drum 2. Brakes 3. Wire measuring devices 4. Power pack 5. Sheaves/pulleys 6. Tools 7. Accessories	■ *Identify and describe components, function and configuration of wireline units* ■ *Indicate potential failure areas* ■ *Describe (where applicable) how to field repair or replace failed component*
C. Production (Christmas or Xmas) tree 1. Equipment a. Pressure gauges a. Gauge flange or cap b. Swab valve c. Flow or cross tee d. Wing valves e. Master valves f. Surface safety valves 2. Configuration	■ *Identify and describe function and configuration of the key Xmas tree components.* • Master, swab and flow line valves • Hanger nipple sealing mechanisms • Surface safety valve (SSV) • Control line pressure versus tubing pressure • Wireline cutting ability

TRAINING TOPICS	*JOB SKILLS*
D. General rig and coiled tubing and snubbing units blowout preventer equipment 1. Rig/unit Equipment that may be encountered a. Annular preventers and strippers b. Rams 1) Blind 2) Pipe/Multiple string 3) Shear 4) Blind/Shear 5) Variable bore and slip c. Ram locking mechanisms d. Sealing elements e. Safety valves f. Chokes and manifolds	■ *Identify function and configuration of key BOP stack components.* ■ *Describe major components and operating principles of BOP closing and locking mechanisms.* ■ *Identify flow path(s) used in well control operations.*
E. Auxiliary well control equipment 2. Kelly valves (kelly cock) 3. Full open safety valve a. Top drive valves b. Floor stabbing valves 4. Inside BOP 5. Floats/back pressure valves	■ *Describe function and use of the following rig/unit equipment that may be used during wireline activities:* • Kelly/top drive system valve • Full open safety valve • Inside blowout preventer • Floats/back pressure valves

Surface Equipment continued on next page.

TRAINING TOPICS	*JOB SKILLS*
F. Wireline BOP/valve and pressure control equipment 1. Manual and hydraulic slickline BOPs 2. Braided line BOPs 3. Pressure ratings 4. Stuffing boxes 5. Control heads/grease injectors 6. Risers 7. Lubricators 8. Tool traps 9. Back pressure (inside blowout preventer) valve	■ *Identify components, function and configuration of key BOP stack components.* ■ *Distinguish between types of rams for various operations (i.e., blind, shear/cutter, slick line and braided, etc.)* ■ *Recognize the different types of sealing elements on schematic drawings and answer questions about proper installation (e.g.; including any lubrication that may be required).* ■ *Recognize critical seals and parts that are exposed to pressure and/or may fail through wear and be able to explain requirements for replacing it.* ■ *Describe operating principles (i.e. closing and operating sequences, well pressure assistance on the closure, operating pressures, lining up and hydraulic connections, etc.).* ■ *Describe operational limits such as maximum shear capacity.*

Surface Equipment continued on next page.

TRAINING TOPICS	*JOB SKILLS*
G. Lubricator/Stripper/stuffing box assemblies 1. Lubricators 2. Strippers 3. Stuffing boxes	■ *Describe general functions of lubricators, strippers and stuffing boxes and their use* ■ *Recognize the different types of sealing elements and describe proper installation and use.* ■ *Identify potential risks when using lubricators, strippers and stuffing boxes.* ■ *Determine if a stuffing box would seal if the wire were not present* ■ *Describe how to regain a seal on the wire following a leak.* ■ *Calculate net forces associated with the use of lubricators, strippers and stuffing boxes* ■ *Recognize seals that may fail or wear and understand requirements for replacing it.*
H. Gas detection and gas handling systems 1. Gas detectors	■ *Describe locations and principles of gas detection equipment.*
I. Safety systems and Emergency Shutdown Devices (ESDs) 1. Alarm systems 2. ESD	■ *Describe general functions of safety systems applicable to wireline operations.* ■ *Describe the functions of platform shut down devices and general areas where they are located.*

VII. SUBSURFACE EQUIPMENT

TRAINING TOPICS	*JOB SKILLS*
A. Workstring and production tubing, and drillstring components 1. Ratings a. Burst b. Collapse 2. Washouts 3. Inside BOPs (IBOPs)	■ *Identify tubing ratings (burst and collapse).* ■ *Identify or troubleshoot possible tubing failure (washouts, etc.).* ■ *Identify IBOP options and safety considerations for each.*
B. Completion equipment 1. Tubing hanger 2. Surface controlled subsurface safety valves 3. Packers and bridge plugs 4. Landing nipples and plugs 5. Sliding sleeve 6. Multiple completions	■ *Identify potential well control complications and solutions when running completion equipment.* ■ *Describe the function and positioning of landing nipples* ■ *Describe the function of tubing hangers:* • Seal off annulus • Support tubing weight • Provide locking or threaded profile for Tubing Hanger Profile (TBH) ■ *Describe the primary function of the circulation and communication devices (sliding sleeves and ported nipples).* ■ *Describe the primary function of side pocket mandrels, either with a working valve (gas lift, circulation, and chemical injection) or with a dummy valve installed.* ■ *Describe the manipulation of all circulation and communication devices with respect to pressure control.* ■ *Describe the primary function, applications and positioning of sub-surface safety valves.* ■ *Recognize and describe the advantages/disadvantages*

	of: • Maximum tool size versus DHSV ID, requirements and possibilities of pulling DHSV's before intervention and use of wear sleeves or lock out devices. • Sub-surface controlled sub-surface safety valves (differential pressure design or ambient pressure design). • Surface controlled sub-surface safety valves (wireline retrievable and tubing retrievable). ■ *Calculate potential pressure differentials across packers, plugs, etc.* ■ *Identify proper ram selection for multiple completions.*

VIII. PROCEDURES

TRAINING TOPICS	*JOB SKILLS*
A. Pre-recorded well information 1. Well configuration a. Well measured and true vertical depth b. Hole angle c. Top and bottom of perforations d. Packer/Tool locations e. Tubing dimensions, lengths and strengths f. Problem locations (e.g., junk, collapsed or narrow sections, etc.) 2. Maximum safe casing pressures a. Wellhead rating b. Casing burst rating c. Tubing collapse and burst ratings d. Production zone/perforations 1. Fluid density (ies) in well 2. Reservoir data a. Pore pressure b. Fracture pressure 3. Line limits 4. Others (H_2S and flammable/explosive gas sensors)	■ *Demonstrate an ability to document pre-recorded data significant to maintaining safe operations and to well control situations (perforation interval, packer locations, tubing strengths, safe working pressures, etc.).* ■ *Identify limitation of wireline* ■ *Describe the purpose for and locations for H_2S and explosive mixture gas sensors.*

Procedures continued on next page.

TRAINING TOPICS	*JOB SKILLS*
B. Rigging up and deployment into well 1. Rig up/down 2. Tool string deployment 3. Flow a. Normal flow back b. Abnormal flow back	■ *Describe or demonstrate rig up/down procedures for pressure related components.* ■ *Describe or demonstrate how to deploy tool string in pressured environments* ■ *Identify signs of a kick via flow checks.* ■ *Recognize U-tube effect.*
C. Running, shifting and pulling tools	■
D. Shut-in 1. Procedure (steps not necessarily in order) a. While on bottom 1) Individual responsibilities 2) Shut-in well 3) Notify supervisor b. While tripping 1) Individual responsibilities 2) Space out and tool string considerations 3) Shut-in well 4) Notify supervisor c. Other operations	■ *Describe or demonstrate shut-in techniques (and sequence of execution).*

Procedures continued on next page.

TRAINING TOPICS	*JOB SKILLS*
E. Verification of shut-in 1. Annulus a. Through BOP b. At the flow line 2. Workstring a. Pump pressure relief valves b. Standpipe manifold c. Lubricator/wireline BOPs/valves 3. Wellhead/BOP/Xmas tree a. Casing valve b. Crown, wing, master valves, etc. 4. Manifold a. Manifold valves b. Choke(s) (manual and remote)	■ *Identify appropriate valves/BOP equipment that are to be closed to effect a proper shut-in.*
F. Well monitoring during shut-in 1. Record keeping a. Time of shut-in b. Tubing and casing pressures 1) At initial shut-in 2) At regular intervals c. Estimate pit gain d. Pressure increase at surface and downhole due to: 1) Gas migration 2) Gas expansion e. Pressure between casing strings	■ *Explain or demonstrate recommended procedures to use for well monitoring during well shut-in.* ■ *Read, record and report well shut-in record keeping parameters.* ■ *Describe effects of trapped pressure on wellbore pressure.* ■ *Demonstrate procedure for relieving trapped pressure without creating underbalanced conditions.* ■ *Perform choke manipulation to achieve specific pressure or volume objectives.* ■ *Identify two causes for pressure between strings.*

Procedures continued on next page.

TRAINING TOPICS	*JOB SKILLS*
G. Tripping 1. Procedure for keeping hole full a. Using rig pump b. Using trip tank (gravity fill) c. Using recirculating trip tank (continuous fill) 2. Methods of measuring and recording hole fill volumes (trip sheet) 3. Wet trip calculations (non open-ended) a. Return to fluid system b. No return to fluid system c. Hole fill-up volumes 4. Dry trip calculations (open-ended) a. Hole fill-up volumes	■ *Describe methods for filling hole during trips.* ■ *Calculate hole filling requirements when pulling pipe and displacement when running pipe.* ■ *Describe the use of a trip tank.*
H. Stripping operations 1. Line up for bleeding volume to stripping tank 2. Stripping procedure for BOP 3. Measurement of volumes bled from the well 4. Calculations relating volumes and pressure to be bled for a given number of tubing or workstring stands run in the hole 5. Stripping with or without volumetric control	■ *Describe purpose and procedure for stripping operations (with and without volumetric control).* ■ *Perform calculations for bleed volumes or pressures, as method requires.* ■ *Demonstrate ability to line up to stripping tank.* ■ *Demonstrate sequence of BOP/rams when stripping.*

TRAINING TOPICS	*JOB SKILLS*
I. Shearing wireline	■ *Identify complications that require shearing and cutting the wireline* ■ *Describe cutting sequence* ■ *Describe secondary method of cutting wireline* ■ *Describe how to obtain pressure seal after wireline is cut*
J. Fishing wireline	■ *Identify tools that may be necessary for fishing operations* ■ *Describe the differences between fishing with wireline in pressured and non pressured environments* ■ *Describe procedure for deploying, catching and retrieving fish (include how to fish wire from well).*
K. Well control drills 1. Pit drill 2. Trip drill	■ *Describe wireline crew responsibilities during pit and trip drills, etc.* ■ *Describe procedure for pit and trip drills and proper response to each.*

IX. COMPLICATIONS AND SOLUTIONS

TRAINING TOPICS	*JOB SKILLS*
A. Trapped pressure 1. Wireline plugs (e.g., nipple plug, plug set in tubing, etc.) 2. Subsurface safety valves (storm chokes) 3. Surface controlled subsurface safety valve 4. Bridge plugs 5. Sand bridges 6. Paraffin 7. Hydrates 8. Beneath packer	■ *Identify sources of potential trapped pressure.* ■ *Determine potential pressures beneath various downhole plugs, valves, etc.* ■ *Describe procedure for resolving sources identified at left.*
B. Pressure on casing 1. Hole in tubing 2. Hole in casing 3. Seal or packer leak. 4. Pressure or temperature pulled seals out of seal bore 5. Failed squeeze job or patch	■ *Identify sources of pressure on casing and explain the well control implications.*
C. Lost circulation	■ *Identify signs of lost circulation.* ■ *Describe sticking potential in lost circulation zone* ■ *List at least two possible remedies to lost circulation.*
D. Underground flow	■ *Based on surface parameters, identify underground flow and possible solutions.*

Complications and Solutions continued on next page.

TRAINING TOPICS	*JOB SKILLS*
E. Collapsed tubing	■ *Identify signs of collapsed tubing* ■ *Describe potential complications and solutions as a result thereof.*
F. Junk in hole	■ *Identify signs of junk in hole* ■ *Describe potential complications and solutions as a result thereof.*
G. Hole in tubing	■ *Identify signs of hole in tubing string* ■ *Describe complications that may arise from a hole in the tubing.*
H. Stuck tool string	■ *Identify signs of collapsed tubing* ■ *Describe potential complications and solutions as a result thereof.*
I. Fishing under pressure	■ *Describe tools, equipment and precautions that must be used while fishing with wireline under pressure.* ■ *Identify potential complications and list possible solutions.*
J. Hole angle	■ *Describe how hole angle affects deployment of wireline tools* ■ *Identify factors allowing or preventing continuation of wireline as hole angle increases*

X. ORGANIZING OPERATIONS

TRAINING TOPICS	*JOB SKILLS*
A. Personnel assignments	■ *Describe personnel assignments and indicate those personnel (if any) not required during a well control operation.* ■ *List required information that is available prior to a well control event.* ■ *Given certain well information, define most likely well control scenarios.* ■ *Identify personnel who must coordinate effectively to affect a well kill and name their main responsibilities.*
B. Pre-recorded information	■ *Describe locations of pre-recorded information, collection process, and where supervisor will keep well documentation.*
C. Plan responses to anticipated well control scenarios	■ *Describe procedures for implementing responses to well control scenarios.*
D. Communications responsibilities	■ *Describe chain of command and each individual's responsibility to timely and properly convey pertinent information.*

XI. TESTING

TRAINING TOPICS	*JOB SKILLS*
A. Testing of pressure control equipment 1. BOPs/wireline valves 2. Surface pressure control accessory equipment 3. Packers 4. Lubricators 5. Xmas trees 6. Test trees	■ *Demonstrate the ability to line up piping and valving to perform test.*
B. Installation of rings, flanges and connections	■ *Describe proper installation of rings, flanges and connections and their importance to the pressure control.*
C. Pressure and function tests 1. Maximum safe working pressures of well control equipment 2. Reasons for de-rating 3. Areas exposed to both high and low pressures during shut-in and pumping operations	■ *Identify the maximum safe working pressure for a give set of well control equipment.* ■ *List two reasons for de-rating the maximum safe working pressure of well control equipment.*

XII. GOVERNMENT, INDUSTRY AND COMPANY RULES, ORDERS AND POLICIES

TRAINING TOPICS	*JOB SKILLS*
A. Incorporate by reference 1. API and ISO recommended practices, standards and bulletins pertaining to well control 2. Regional and/or local regulations where required 3. Company/operator specific requirements where required	■ *Describe or identify appropriate regional government or company specific regulations pertaining to job being completed.*

XIII. SPECIAL SITUATIONS (OPTIONAL)

TRAINING TOPICS	*JOB SKILLS*
A. H2S considerations	■ *Describe additional procedures, precautions and supplemental safety equipment necessary while operating in an H2S environment.* ■ *Describe equipment addition, limitations, modification or replacement necessary to work in an H2S environment.* ■ *Provide documentation of successful completion of a H2S training course.*
B. Subsea considerations	■ *Identify components of a subsea wellhead/production tree.* ■ *Describe how the subsea wellhead/production tree and/or BOP stack is functioned and the similarities/disparities between surface wireline BOP/valve applications.* ■ *Identify components and describe running procedure of wireline lubricator/valve assembly and installation onto subsea wellhead/production tree.* ■ *Describe wireline entry procedures into a subsea wellhead.* ■ *Describe wireline tool deployment methods.* ■ *Describe safety controls and limitations while wireline activities are taking place.* ■ *Describe the complications and consequences of wireline operations in subsea environments*

TRAINING TOPICS	*JOB SKILLS*
C. Coiled tubing operations	■ *Identify and describe basic coiled tubing unit components and functions.* ■ *Demonstrate or describe procedures to rig up wireline pressure control equipment while a coiled tubing unit is rigged up on location.* ■ *Describe electric line considerations for coiled tubing delivered wireline.* ■ *Describe the complications and consequences of wireline operations rigged up on coiled tubing pressure control equipment.*
D. Snubbing and HWO operations	■ *Identify and describe basic snubbing unit components and functions.* ■ *Demonstrate or describe procedures to rig up wireline pressure control equipment while a snubbing unit is rigged up on location.* ■ *Describe the complications and consequences of wireline operations rigged up in a snubbing unit's workbasket and/or pressure control equipment.*

TRAINING TOPICS	*JOB SKILLS*
E. Small tubing unit	■ *Identify and describe basic small tubing unit components and functions.* ■ *Demonstrate or describe procedures to rig up wireline pressure control equipment while a small tubing unit is rigged up on location.* ■ *Describe the complications and consequences of wireline operations rigged up on a small tubing unit's pressure control equipment.*
F. Drilling operations	■ *Identify and describe basic drilling rig components and functions.* ■ *Demonstrate or describe procedures to rig up wireline pressure control equipment while a drilling rig is rigged up on location.* ■ *Describe open hole wireline and logging well control considerations.* ■ *Demonstrate or describe general rig up procedures of wireline pressure control equipment on the rig's BOP stack.* ■ *Describe the complications and consequences of wireline operations rigged up on a drilling rig's pressure control equipment.*

TRAINING TOPICS	*JOB SKILLS*
G. Workover operations	■ *Identify and describe basic workover rig components and functions.* ■ *Demonstrate or describe procedures to rig up wireline pressure control equipment while a workover unit is rigged up on location.* ■ *Describe open hole wireline and logging well control considerations.* ■ *Demonstrate or describe general rig up procedures of wireline pressure control equipment on the rig's BOP stack.* ■ *Describe the complications and consequences of wireline operations rigged up on a workover rig's pressure control equipment.*
H. If pump unit is utilized by wireline crew: Techniques for controlling or killing a producing well 1. Bullheading 2. Lubricate and bleed 3. Constant bottomhole pressure (BHP) techniques a. Wait and weight b. Drillers's method 4. Reverse circulate	■ *Describe a technique for controlling or killing a producing well.*

TRAINING TOPICS	*JOB SKILLS*
I. If pump unit is utilized by wireline crew: No returns pumping technique (e.g., bullheading) 1. Well shut-in will stop influx when BHP equals formation pressure 2. Determine status of shut-in tubing pressure (SITP), shut-in casing pressure (SICP) 3. Pump rates and pressure limitations a. Maximum pump pressure b. Friction of fluids vs. rate c. Gain in hydrostatic pressure vs. volume pumped d. Burst pressure of tubulars e. Collapse pressure of tubulars f. Formation fracture pressure 4. Determine volume to be pumped a. Theoretical volume to formation b. Overdisplacement (if any) c. Volume to pump to load surface lines 5. Pump rate vs. volume pumped 6. Gas migration vs. pumped fluid viscosity 7. Determine if well has been successfully killed 8. Barrier concept	■ *Demonstrate bullheading technique when applicable.* ■ *Monitor and record pressure.* ■ *Select appropriate pump rates.* ■ *Calculate maximum pressures.* ■ *Calculate volumes.* ■ *Discuss effect of gas migration vs. kill attempt.* ■ *Check pressures to verify if well has been successfully killed.* ■ *Explain barrier concept and give four examples.*