

**WellCAP Cross-Reference Tool\***  
**UNDERBALANCED DRILLING**  
**WCT-2UBS-X – SUPERVISORY LEVEL**

<b>WELLCAP WCT-2UBS-X SUPERVISORY LEVEL</b>		<b>REFERENCE TO APPLICATION MATERIALS</b> (Note Where Each Topic Can Be Found)			
<b>WELLCAP OUTLINE NO.</b>	<b>TRAINING TOPIC</b>	<b>MANUAL</b> (Cite Chapter and Page No.)	<b>LECTURE</b> (Note Day/Time of Course Outline)	<b>SIMULATION</b> (Identify Exercise)	<b>OTHER RESOURCE</b> (Identify Video, CBT Program, Handout, Etc.)
<b>I.</b>	<b>SIMILARITIES AND CONTRASTS BETWEEN CONVENTIONAL DRILLING AND UNDERBALANCED DRILLING</b>				
A.	Definitions of conventional and underbalanced drilling				
B.	Similarities				
C.	Differences				
<b>II.</b>	<b>UBD OVERVIEW</b>				
A.	Case studies				
B.	IADC classifications				
C.	HS&E				
<b>III.</b>	<b>UBD TECHNIQUES</b>				
A.	Air and natural gas drilling				
B.	Mist drilling				
C.	Foam drilling				
D.	Aerated fluid drilling				
E.	Flow drilling (gas flaring & onsite oil storage)				

\* To further facilitate cross-referencing, the proposed document may include a margin or parenthetical reference to the appropriate WellCAP outline number.

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F.	Mud cap drilling				
G.	Snub drilling				
H.	Production drilling (PD)				
I.	Liquid drilling				
<b>IV.</b>	<b>DOWNHOLE CALCULATIONS FOR UBD TECHNIQUES</b>				
A.	Dynamic (equivalent circulating density vs. static (hydrostatic))				
B.	Manual – kill fluid calculations (conventional)				
C.	Multi-phase flow modeling				
<b>V.</b>	<b>DETECTING SURFACE CONTROL PROBLEMS</b>				
A.	Fluid volumes at surface				
B.	Pressure				
C.	Determining need for conventional well control				
D.	Elastomer considerations/flow path				
<b>VI.</b>	<b>UBD EQUIPMENT AND RIG UP</b>				
A.	Rotating diverter control head				
B.	Separation equipment				
C.	Flare line sizing and hook up				

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D.	Flare line igniters				
E.	Flame arresters				
F.	Kill line hook ups				
G.	Choke manifold hook ups				
H.	Stripping manifolds/methods				
I.	Choke considerations				
J.	Drillstring floats				
K.	BOP stack configurations				
L.	Fluid transfer systems and level maintenance				
M.	Onsite fluid storage systems				
N.	Emergency well control equipment				
O.	Standpipe manifold				
P.	Gas vs liquid injections				
Q.	Compromise on conventional Pit Volume Totalizer (PVT) system				
R.	Coiled tubing				
S.	Snubbing				
T.	Deployment valves				
<b>VII.</b>	<b>ACCUMULATOR TESTING AND MAINTENANCE</b>				
A.	Scheduled maintenance				
B.	Scheduled testing				
C.	Written testing/maintenance report				

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D.	Special considerations				
<b>VIII.</b>	<b>SURFACE EQUIPMENT TESTING AND MAINTENANCE</b>				
A.	Trapped pressure issues				
B.	Gas vs liquid BOP stack tests				
<b>IX.</b>	<b>BOTTOMHOLE PRESSURE CONTROL</b>				
A.	Underbalanced margin				
B.	Choke control and surface pressure				
C.	Hydrostatic vs friction dominated flow				
D.	Surface pressure limitations				
<b>X.</b>	<b>MAKING TRIPS, COMPLETIONS, LOGGING AND CONNECTIONS</b>				
A.	Tripping in hole				
B.	Tripping out of hole				
C.	Making a connection				
D.	BHA deployment				
<b>XI.</b>	<b>PIPE "LIGHT" CALCULATIONS AND OPERATIONS</b>				
A.	Calculations				

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B.	Operations				
<b>XII.</b>	<b>COMPLICATIONS WHILE DRILLING UNDERBALANCED (SUPERVISORY LEVEL ONLY)</b>				
A.	Excessive surface pressures and high pressure pumping consideration				
B.	Leak in pressure control equipment				
C.	Loss of pumping capability				
D.	Plugged bit				
E.	Cut out choke or manifold or plugged choke				
F.	Loss of ability to circulate				
G.	Bit nozzle washout				
H.	Casing or cement failure				
I.	Drill pipe or coil washout				
J.	Parted drill pipe/coil				
K.	Open hole loss of circulation				
L.	Formation influx				
M.	Leaking float valves				
N.	Gas leak from BOPs to accumulator				
O.	Critical escalating problems				
P.	Injection line leaks				
Q.	Hole cleaning				

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R.	Hole stability/collapse				
S.	Corrosion				
T.	Down hole fire				
U.	Foam stability				
V.	Flash points				
W.	Hydrogen sulfide kick				
<b>XIII.</b>	<b>IADC UBD TOUR REPORT</b>				
A.	Purpose and importance				
<b>XIV.</b>	<b>SITE MANAGEMENT ISSUES</b>				
A.	Safe explosion radius for equipment				
B.	Crew training				
<b>XV.</b>	<b>SIMULATOR TRAINING (SUPERVISORY LEVEL ONLY)</b>				
A.	Drilling fluid design				
B.	Multi-phase flow characteristics				
C.	Problem detection and response				