IWCF well control drilling L 2
COURSE OUTLINE
DAY 1

Time	Subject	Lesson plan
08:00-08:30	**Well Control Incidents** • The impact of a well control incident. The potential impact of a well control incident on: - Personnel - Employment - Environment. **Well Control Training and Assessment** • The need for well control training and assessment. "why are we here?" including: Capability to apply well control skills Responsibility to colleagues Reduce the severity of impact of a well control event.	**Lesson Plan (1)**
08:30-9:00	**Hydrostatic Pressure** • Parameters that affect hydrostatic pressure: Explaining the hydrostatic pressure and factors that can affect it. • Hydrostatic pressure calculations. Calculation of hydrostatic pressure at a given depth. **Formation pressure** • Formation pore pressure. Explaining what formation pore pressure is and calculating normal formation pore pressure. • Formation pore pressure as the lower limit of the mud weight window. Explaining why hydrostatic pressure must exceed pore pressure. **Fracture Pressure** • Fracture pressure. Explaining fracture pressure. • Fracture pressure as the upper limit of the mud weight window. Explaining why hydrostatic pressure must be less than fracture pressure.	**Lesson Plan (2)**

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9:00 -10:00	**Primary Well Control** • Primary well control. Explaining the main principles of primary well control, and why hydrostatic pressure must be kept above formation pressure and below fracture pressure.	
10:00-10:15	Coffee Break	
10:15-10:30	**Secondary Well Control** • Secondary Well Control Explaining secondary well control.	**Lesson Plan (2)**
	Subsea Factors and Complications for Surface Candidates • The differences between surface and subsea drilling operations. Describe the effects of: - Vessel movement and weather (emergency disconnect) - BOP on the sea bed - Water depth - Riser above the BOP - Choke and kill lines.	
10:30-11:00	**Barrier Concept** • Well barrier philosophy in drilling and workover operations. identifying examples of primary and secondary barriers: - Procedural (monitoring), mud weight, and BOP testing - Mud, cement, casing, liners, pack-offs, BOPs and packers. Description best practice of two independently tested well barriers between the source of pressure in the well and the environment.	**Lesson Plan (3)**
	• The term 'barrier'. Definition of the term 'barrier'.	
	• The well barrier envelopes in well operations. Definition of a well barrier envelope.	
	• The well barrier elements in well operations. Definition of a well barrier element.	
	• The principles of different well barrier element types. Describe the principles of different well barrier element types and explain the differences between: - Mechanical barriers - Hydrostatic barriers.	

	• Barrier terminology – 'primary' and 'secondary' barrier elements. Describe the terms 'primary' and 'secondary' barriers elements	
	• Verification of well barrier elements. Explaining why well barrier elements must be verified.	

11:00-11:30	**Well Control and Emergency Drills** • Risk management. Description the main processes of risk management: - Hazard identification and mitigations - Crew meetings and handovers - Use instructions - Toolbox talks. The Management of Change (MOC) process.	**Lesson Plan (4)**
	• The Management of Change (MOC) process. Explaining why a MOC process is required.	
	• The need for well control drills. Description the main well control drills and explaining why they are important: - Pit drill - Trip drill - Choke drill - Diverter drill.	
11:30-12:30	**General** • The causes of kicks. Identifying situations that can cause hydrostatic pressure to be less than formation pressure.	**Lesson Plan (5)**
	Loss of Hydrostatic Pressure • The consequences of failing to keep the hole full. Description of what can happen: - When pipe is pulled and the hole is not full	

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	- When circulation is lost circulation - When there is a formation fracture • Factors that affect fluid density. Listing the possible causes of a reduction in fluid density: - Adding water to the mud system - Use of centrifuges - Gas cut mud.	
	Gas Cutting • Gas cutting of drilling fluid. Explaining what gas cut mud is and its effect on Bottom Hole Pressure (BHP).	
	Lost Circulation • The methods to recognize losses. Identifying how losses are recognized: - The pit levels - The rate of returns.	
12:30 - 13:00	**Lunch break**	
13:00-15:00	**Swab and Surge Effects** • The causes of swabbing and surging. Outline the factors that cause swabbing and surging: - Mud density - Mud viscosity - Pipe running speeds - Well and pipe/BHA geometry - Measured depth. • The consequences of swabbing and surging. Outlining the potential effects of swabbing and surging on BHP: - Formation breakdown - Losses - Swabbed influx.	**Lesson Plan (5)**
15:00-15:15	Coffee Break	
15:15-17:00	**Tripping** • The tripping process. Description of the tripping process: - Pulling out of hole (POOH) - Run in hole (RIH) - Tripping in and out of the hole. • The risks associated with tripping. Identifying the primary risks encountered during tripping:	

	Pulling out of hole: - Swabbing Running in hole: - Surging. • The use of a trip tank and trip sheet. Explaining the purpose of a trip tank and how fluid enters and leaves it. Explaining the purpose of a trip sheet. • Actions to take when there are deviations from predicted trip tank volumes. Description of the trip tank indications that an influx or loss is occurring. • The actions to take after trip sheet evaluation shows an influx. Description the trip tank indications that an influx or loss is occurring. • Common tripping practices. Explaining what pumping a 'slug' means and its intended result. Explaining why it may be necessary to pump out of the hole.	

Homework	**Find these Questions at STC exercise book then solve all of them:** ➢ IWCF PRINCIPLES & PROCEDURES EXCERCISE SEC 2 – Page #32 Qs (2:6) , (9:17)

DAY 2		
08:00-08:30	**Homework Review** **Kick Warning Signs and First Actions** • Kick warning signs while drilling and/or circulating. Identifying kick warning signs including: - Rate of penetration changes - Cuttings size and shape - Drilling fluid temperature increase - Changes in gas trends at the shakers - Increase in torque and drag.	**Lesson Plan (6)**

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	• Actions to take after recognizing a kick warning sign. Explaining the actions to take: - Communicate to the Driller.	
08:30 -9:00	**Kick Indicators** • Kick indicators and the importance of early kick detection. Definition of what a kick indicator is: - An increase in flow - An increase in tank volume. Outlining why detecting a kick early is important: - Minimise kick volume - Minimise pressures on the well - Minimise the chances of losses	
9:00-10:00	**Shallow Gas** • Shallow Gas Definition shallow gas as a potentially uncontrollable (by conventional methods) flow of gas to surface. • The consequences of shallow gas kicks. Identifying that shallow gas accumulation can: - Unload very rapidly - Have extremely high abrasive flow rates - Have very high noise levels. • Implications of drilling top hole with or without a riser. Outlining the advantages of drilling top hole without a riser: -No gas directly to the rig. - Move rapidly off site.	
10:00-10:15	Coffee Break	

10:15-12:30	**Definition and Principles** • The circulating system. Description of the drilling fluid circulating system.	**Lesson Plan (7)**
	• The role of drilling fluid in well control. Description of the main uses of drilling fluid: - Maintaining primary control - Carry and suspend drill cuttings - Filter cake.	

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	• Pressure losses around a circulating system and how they can affect pump pressure and the BHP. Identifying the frictional pressure losses in a circulating system: - Pump pressure - Annular Pressure Losses (APL) - Calculate the dynamic BHP.	
	• The various types of mud cleaning equipment and what they do. Explaining of the role of: - Shakers - Desanders/desilters - Centrifuges.	
	• The use of barite. Explaining the use of barite as a weighting agent.	
	• The effects of switching pumps on/off or changing pump speed. Explaining the effect on: - Flow - Pit levels - Pressures.	
	• The relationship between pump pressure and pump speed. Calculation of how changes in pump speed can affect pressures.	
	• The relationship between pump pressure and mud density. Calculation of how changes in mud density affect pressures.	
12:30-13:00	Coffee Break	
13:00-13:30	**Slow Circulation Rates (SCRs)** • Why well control operations must be performed slowly and in a controlled way. Explaining why well control operations must be performed slowly and in a controlled way: - To control BHP - To control the choke. • The process of taking Slow Circulation Rates (SCRs). Describe when you should take SCRS and where they are measured. • The differences in the circulating system when using a subsea BOP.	

	Identifying how the system changes once the BOP is closed: -Choke line/kill line - No riser circulation.	

13:30-15:00	**Principles** • The different types of influx and the hazards they present. Describe the different types of influx fluids: - Gas - Oil - Water.	**Lesson Plan (8)**
	• The importance and use of the gas laws. Explaining how gas behaves as it is circulated up the well (No calculations) using Boyle's law (P1V1 = P2V2).	
	• Influx migration. Explaining what can happen when an influx migrates: - In an open well - In a shut-in well.	
15:00-15:15	Coffee Break	
15:15-17:00	**Fracture Pressure and MAASP** • Methods used to determine fracture pressure. Description of what a leak off test (LOT) is and what a formation integrity test (FIT) is. Explaining the differences between a leak off test (LOT) and a formation integrity test (FIT). • The generation of the MAASP value from LOT or FIT. Explaining how the results from LOT and FIT affect the MAASP value.	**Lesson Plan (8)**

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Homework	**Find these Questions at STC exercise book then solve all of them:** ➢ IWCF PRINCIPLES & PROCEDURES EXCERCISE SEC 2 – Page #32 Qs (37:41), (43:47)

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DAY 3		
08:00-08:30	**Homework Review** **General Principles** • A suitable shut-in procedure if a primary barrier fails. Explaining the hard shut-in procedure after a kick is detected for: - Drilling - Tripping. Explaining the responsibility of the Driller and his crew. • The correct equipment line-up before drilling or tripping. Identifying simple line-ups of standpipe and choke manifolds before: - Drilling - Tripping. • Monitoring the well after it is shut-in. Outline how to monitor the well after it is shut-in: - Monitor the well for flow - Record well pressures at regular intervals.	**Lesson Plan (9)**
08:30-09:00	**Hang Off** • When and how to hang off the string in a well control situation. Explaining what it means to 'hang off' a drill string.	
	Interpretations • Recording shut-in well pressures. Explaining why pressures are recorded after the well has been shut-in to establish stabilized pressures. • The possible differences between Shut-in Drill Pipe Pressure (SIDPP) and Shut-in Casing Pressure (SICP) gauge readings. Explaining SIDPP and SICP, and the reasons for the differences between the pressures. Calculating formation pressure using initial stabilised SIDPP. Calculating kill mud density using SIDPP/formation pressure.	
09:00-10:00	**Observations** • The use of dedicated gauges for SIDPP and SICP. Identifying the specific gauges used to measure SIDPP and	

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	SICP.	
10:00-10:15	Coffee BREAK	
10:15-11:00	**Principles** • Standard well control methods. Explaining the essential steps of killing a well: - Removing the influx - Regaining primary control - Controlling the BHP to avoid another influx or break down of the formation - The method for rounding kill mud weights. • The difference between controlling and killing a well. Outlining the principles of controlling the well compared to killing the well.	**Lesson Plan (10)**
11:00-11:30	**Kill Sheets** • A kill sheet Describing the purpose of a kill sheet and list the basic elements.	
11:30-12:30	**Calculations** • Oilfield calculations. Calculating: - Pipe volumes and capacity - Annular volumes and capacity - Open hole volumes and capacity - Displacement volumes and capacity - Volume and length calculations when tripping pipe - Circulation strokes and times.	
12:30 – 13:00	Lunch Break	
13:00-13:30	**Driller's Method and Wait and Weight Method** • The Driller's Method of well kill operations. Outlining the Driller's Method: - First circulation removes the influx - Second circulation displaces to kill fluid. • The Wait and Weight Method of well kill operations. Outlining the Wait and Weight Method: Circulate out influx while displacing the well with kill fluid.	

13:30 - 14:00	**Running and Pulling Casing and Liner** • The factors that increase risk of swabbing and surging	**Lesson Plan (11)**

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	when tripping large diameter tubulars (reduced annular clearance). Explaining the factors that increase the chance of kicks when running and pulling casing: - Swab - Surge. • How returns are monitored when tripping large diameter tubulars (reduced annular clearance). Explaining how to monitor returns when running and pulling casing: - Monitor the trip tank - Monitor fill up	
14:30-15:00	**Well Control Drills** • The concept and implementation of well control drills as specified by API standards. Explaining the role of crew members during well control drills.	**Lesson Plan (12)**
15:00 – 15:15	Coffee Break	
15:15 – 17:00	**BOP Stack Configuration** • BOP function, configuration and the well control operations that can be carried out. Identifying the main features of a BOP, and describe the role of: - The annular preventer - The pipe rams (fixed and variable bore) - The blind/shear ram - The choke and kill lines - Manual and hydraulically operated side outlet valves. • The overall pressure rating requirements of a BOP stack. Identifying the rated working pressure of a BOP stack. • The configuration of the Marine Riser, Lower Marine Riser Package (LMRP) and subsea BOP. Describing the role of the main parts of the marine riser: -Ball/flex joint -Telescopic/slip joint -Tension ring and tensioners -Buoyancy -Drill string compensator. Describing the role of the main parts of the Lower Marine Riser Package (LMRP): -Pods -Annular Preventer	**Lesson Plan (13)**

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	-Subsea accumulators. Describing the role of the main parts of the subsea BOP stack: -Accumulators -Annular preventer -Pipe rams -Blind/shear ram -Fail safe valves - Choke and kill lines	

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DAY 4		
08:00-09:00	**Homework Review** **Ram Type Preventers** • The operational limits associated with particular BOP ram equipment. Describing the capabilities and limitations of what each BOP ram type can do, including: - Sealing direction - Pipe sizes. - Hang off the drill string. • The function and operating principles of ram locks. Explaining why ram locks are fitted to BOPs.	**Lesson Plan (13)**
	Blind/Shear Ram Preventers • The operating principles of BOP blind/shear equipment. Explaining why and when to use blind/shear rams: - Cuts the pipe in the hole (inside the BOP) - Closes and seals the well.	
09:00-10:00	**Annular Preventers** • The operating principles of annular preventers. Explaining how annular preventers work and what they can and cannot do: - Operating principle - One size fits all - Pressure limitations compared to rams - Stripping - Full closing.	**Lesson Plan (13)**
	Diverters • The principles of diverter operations. Explaining the purpose and function of diverters	
10:00-10:15	Coffee Break	
10:15-11:30	**Inside BOPS (IBOPs) and Drill Pipe Safety Valves (DPSVs)** • The different types of safety valves. Explaining the different types of safety valves available, what they do, and why the correct size of crossover must be available on the drill floor.	**Lesson Plan (14)**
11:30-12:30	**Manual and Remote Chokes**	**Lesson Plan (15)**

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	• The operating principles and limitations of adjustable chokes. Describe what a choke does.	
12:30 – 13:00	Lunch Break	
13:00-13:30	**Mud Gas Separators (MGS)** • The operating principles and limitations of a Mud Gas Separator (MGS). Outlining the principles and limitations of the MGS. **Vacuum Degasser** • The operating principles and the role of a vacuum degasser. Describing the role of Vacuum Degassers and when they are used.	**Lesson Plan (16)**
13:30-14:00	**BOP and Equipment Testing** • The importance of the procedures for maintaining and testing BOP stack and choke and kill manifolds (with reference to API standards). Explaining the need for testing: - High pressure - Low pressure - Function testing - Direction - Frequency. **Inflow Testing** • The principles of inflow testing. Explaining the principles of an inflow test.	**Lesson Plan (17)**

14:00 - 15:00	**BOP Control Systems** • The general operating principles of the remote-control panel. Describing the operating principles of a BOP control system: - Remote panel - Accumulator bottles.	**Lesson Plan (18)**
15:00 – 15:15	Coffee Break	
15:15 - 17:00	**Subsea BOP Control Systems** • The general operating principles of subsea BOP control systems. Describe the operating principles of a subsea BOP control	

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	system: -Panels -Hydraulics -Pilot lines -Accumulator bottles -Pods -Shuttle valve.	

Homework	**Find these Questions at STC exercise book then solve all of them:** ➢ IWCF EQUIPMENT EXCERCISE SEC 1 – Page #6 Qs (3:11), (23:31), (42:51)