Managed Pressure Drilling: Advances and Technology Needs

Abstract: Today’s difficult drilling environments of oil and gas wells make wellbore construction a challenge. Drilling hazards—such as wellbore instability, lost-circulation zones, over pressurized formations, and shallow flows threaten the economic and operational viability of the well. In Managed Pressure Drilling (MPD) operations the well is sealed which allows controlling annular pressure during drilling. Over the last decade MPD has been proven to be highly successful in mitigating different drilling problems. Rotating Control Devices (RCDs) is a critical part of any MPD system. They allow maintaining a pressure-tight barrier between the fluid returns and personnel on the rig floor. The RCD enables the drilling fluid to be safely contained and diverted below the rig floor to the returns system without interrupting operations. In a high-pressure rotating control device elastomeric elements provide the seal around the drill string. We will discuss main principals and challenges in designing elastomeric sealing elements and qualifying them for different operational conditions and well environments. MPD systems use state-of-the-art sensors measuring critical drilling fluid properties and flow rates, automated chokes to precisely maintain desired annular pressure, and they also have ability to aggregate, analyze and display this real-time information in rig cabins and in remote centers. This real time flow monitoring data and detection capability based primarily on a volumetric flow balance helps our clients to drill complex wells safely and efficiently by early identification, interpretation and mitigation of critical events such as gas influxes or drilling fluid losses.

We will review MPD control systems, Coriolis mass flow meters and principles of mass balance to measure and compare the volume and density of the drilling fluid (mud) injected into the well and returned from the well to characterize measure and automatically control downhole events. We will discuss advances in high pressure flow metering as well as need for real time rheology measurements.

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Dr. Lev Ring is currently Director, Technology Development at Weatherford International Inc. He is a widely recognized expert and leader in developing and commercializing emerging technologies and experienced in corporate and start-up environments. He also has over 15 years of experience in managing Oil Field R&D and Engineering organizations. Dr. Ring holds degrees from Moscow, Russia; a M.Sc. Aerospace Engineering (1984) from the Institute of Physics and Technology and a Ph.D. in Physics and Mathematics (1991) from the Institute of Problems in Mechanics, Russian Academy of Sciences. Dr. Ring holds over 150 US and international patents, has published more than 30 papers and has given technical presentations at numerous conferences. Dr. Ring is a recipient of multiple scientific achievement awards including the Spotlight on New Technology Award presented at the 2008 Offshore Technology Conference. He is a member of the Society of Petroleum Engineers.