

Shallow Water Flow in the Deepwater: Recent Advances

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The basic principles of shallow water flow (SWF) and the remedies that were developed in mid to late 1990's have been described in previous papers and are now fairly well understood within industry. Namely, the geologic setting where SWF may occur consists of overpressured sands in the first 1000 m below the seafloor, which results in narrow drilling margins and risk of shallow flows and/or formation break down. SWF has resulted in the loss of wells and even development sites. The solution to the problem requires integrated application of geoscience, petrophysical and drilling technologies. Drilling technologies and practices include improved cementing technologies, better estimation of regional fracture gradient and pore pressure trends, utilizing additional casing strings to isolate sands, drilling with Pressure While Drilling (PWD), and riserless drilling with weighted mud. Petrophysical technologies include logging while drilling, and synthetic seismograms to improve well to seismic ties. In the geoscience area, the use of high-resolution 3D seismic data has facilitated the interpretation of the geologic settings and better defined the SWF risk at particular sites. While SWF risk has by no means been eliminated, the problem has been shown to be manageable through technology and engineering. The challenge now is to manage the risk at the lowest cost possible. Doing so requires improved techniques for predicting SWF potential, and the application of prudent well designs and drilling practices. In this regard, newly acquired 3D seismic surveys and high-resolution reprocessing of existing regional 3D seismic surveys have added to the understanding of near-surface geology in the deepwater, and seismic attribute analysis, particularly frequency-dependent attributes, are providing improved stratigraphic resolution. Techniques for velocity-based shallow pore pressure prediction have advanced. Furthermore, Expedition 308 of the Integrated Ocean Drilling Program has acquired in situ measurements of overpressured sediments that have shed new light on the relationship between sedimentation rates, overpressures and fluid flow. On the drilling side, reduced casing schemes and "fast drill" techniques (riserless drilling with seawater at high rates of penetration) have recently been employed on a selected basis in areas with moderate to high SWF potential. Such techniques may prove a useful tool in managing SWF risk while reducing cost.