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ABSTRACT

**GAS HYDRATES IN DEEP – WATER EXPLORATION ACTIVITIES -
IDENTIFICATION AND RISKING**

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Deep-water (DW) drilling activities now routinely occur in areas where water-depth, hydrocarbon availability and hydro- and thermodynamic regimes allow for the existence of gas hydrates. From an economic standpoint most of these gas accumulations are not commercially viable, since they occur either in (1) moderate to high concentrations in sandstone reservoirs as penetrated in the GOM and the Nankai Trough, Japan or in (2) massive deposits of fractured fine grained muds and shales where the cost of extraction is prohibitive. Until further technological advances are made to extract and produce gas hydrates from challenging lithologies and DW environments the resource potential of these accumulations are severely limited.

Of greater concern to the oil and gas industry is the potential hazard that gas hydrates may pose in exploration drilling and field development activities. Recently, a number of wells have been drilled, either in locations at which hydrates can theoretically exist, or in close proximity to locations where hydrates have been observed, e.g. Columbus basin, N Africa, SE Asia and DW Nigeria. During drilling operations, drilling hazards related to gas hydrates were encountered; unexplained gas flows, hydrate precipitation on seafloor equipment, borehole instability, or any combination of the three. In one case, the inferred hydrate concentrations were such that further investigation to mitigate against the effects of drilling through hydrated sediments was warranted. In this paper, aspects of this work will be discussed.

In 2004 the presence of gas hydrates in Shell's DW acreage in SE Asia was inferred based on seismic and log indicators, and subsequently substantiated by hydrate stability modeling. A multi-disciplinary study was consequently undertaken to de-risk the acreage. Three major investigations were carried out, specifically to:

- (1) Confirm the existence of gas hydrates and identify the extent of the gas hydrate zone
- (2) Quantify the concentration of gas hydrate accumulations
- (3) Model the effect of hydrate dissociation on sediment properties

In this paper, the discussion will be limited to the investigation of the extent of the gas hydrate zone and the hydrate concentrations, and how the results were then used to de-risk the acreage.