

A comprehensive seabed baseline for platform abandonment

By: Lauridsen, B.W., Hansen, K.E., Prins, L.T., Røy, H., Mukherjee, R. and Knutz, P. C.

Environmental monitoring of abandoned hydrocarbon production sites requires solid indicators of seabed health. Here we present a multi-disciplinary baseline to understand pre-production conditions and to investigate future changes linked to a potential failure of a reservoir seal. The study involved two oil/gas production sites in the Danish North Sea, and one off-platform site and differentiates anthropogenic impact from natural gas seepage. Our study combines shallow-marine geophysical information with ^{14}C based sediment core chronologies of multiple proxies involving geochemistry, microbiology, and marine fauna ecology. None of the study sites showed evidence of ebullition of thermogenic gas. No methane seepage has been encountered at platform 1 or at the off-platform site. In contrast, data from platform 2 suggests that methane seepage has been active for at least 6000 years indicating presence of naturally occurring, non-anthropogenic methane sources. At both platform sites the impact of hydrocarbon production was identified just below the sea floor. Our results show that the presence of gas in the sediments is primarily related to break down of organic matter ensued after the last glacial maximum. The environmental conditions is the key controlling factor for the differences in fauna composition between the localities. The study highlights the importance of site-specific baseline studies. As an approach for future monitoring of seepage from abandoned sites we recommend multidisciplinary data collection, including sediment coring, to produce a site-specific baseline. This initial campaign may be followed by semi-annual collection of surface samples for analyzing changes in living foraminifera, microbial fingerprints and gas composition.