

Empirical Analysis of Sealing Models: A Reality Check from Worldwide Field Analogues

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We have tested the most popular seal models in over 980 reservoirs located in 190 basins worldwide, by correlating the attributes of successful seals with the height of hydrocarbon columns and with the degree in which traps are filled to their maximum capacity. A comprehensive classification was developed for this purpose, based on the number, type, location and combination of sealing surfaces. This empirical approach provides a strong foundation for pre-drill seal risking based on the independent assessment of the chances of success of each seal category.

Simple top seals consisting of a convex or irregular surface retain nearly half of the oil equivalent URR of the reservoirs studied and hold hydrocarbon columns averaging 980 ft up to a maximum of 7500 ft. Seal thickness is not a reliable predictor of hydrocarbon column height, and fault breaching is the most common cause of top seal failure. Updip lateral fault seals retain hydrocarbon columns averaging 800 ft, but over 75% of the reservoirs are underfilled. Fault juxtaposition is the most efficient sealing mechanism when fault throw is greater than reservoir thickness. The lower limit for fault sealing occurs when throws are less than 15% of the reservoir thickness. Lateral stratigraphic seals retain hydrocarbon columns averaging 775 ft and up to 6500 ft. Most reservoirs with stratigraphic seals are filled-to-spill or 'overfilled' and the majority have dips <10. Over half of the reservoirs studied are sealed by a combination of mechanisms and the most common combination is simple top-lateral fault sealing.