Structural and Stratigraphic Characterization of X Field Niger Delta: Implication for Carbon Capture and Sequestration

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Abstract

The global atmosphere has continually been directly or indirectly affected by anthropogenic activities such as the production and refining of coal, oil and natural gas together with several other industrial activities. Carbon Capture and Sequestration technology has been a ground-breaking tool in tackling carbon dioxide (CO2) emissions worldwide but has limitedly been researched and practiced in Africa at present. Considering the vast growth and developmental level in the continent, there is a need to consider this option of mitigating global climate change. Reservoir characterization has been done in several fields of Niger Delta, but little has been reported regarding the structural characterization in relation to storage capacity of the potential host materials which creates a gap this research intends to fill to enhance the confidence in the sequestration technology. The subsurface process of sequestrating CO2 is examined in this study by integrating 3D Seismic data and well logs to define the structural architecture and build petrophysical models critical to carbon dioxide capture and sequestration within the X Field Onshore Niger Delta, Nigeria. Thirteen (13) sandstone reservoirs (Reservoirs A-M), divided into lower, middle and upper reservoirs levels were identified within the paralic Agbada Formation, correlated across the wells and mapped on the 3D seismic volume to identify and characterize suitable storage materials and estimate stochastic volumes of carbon dioxide that can be stored effectively. 3D stratigraphic and structural model of the field enabled the distribution of key petrophysical properties including net to gross, porosity and Volume of shales to be determined. The 3D stratigraphic and structural

framework indicated the middle reservoirs (Res. E, Res. F, Res. G, and Res. H) were compartmentalized as compared to the upper and lower reservoirs. The volume of CO2 estimated as STOIIP within all traps gave an average P10 of 167mbbl; P50 of 570mbbl and P90 of 898mbbl respectively. The study has shown that significant volumes of CO2 can be stored effectively within the field which will contribute to the mitigation of CO2 in the atmosphere and its associated risks.