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Geological Uncertainties in Reservoir Modeling - the Gorgon CO_2 Disposal Project

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The Gorgon Project in North-West Australia is a LNG project that requires the disposal of more than 100 millions tones of associated CO_2. It will become the biggest project in the world in terms of volume of CO_2 injected. For this purpose, the Dupuy Formation, approximately 2300m under Barrow Island, has been selected as the CO_2 target disposal site. The Dupuy Formation is 200-500m thick, and is comprised of massive sandstones and highly bioturbated siltstones that are interpreted as been deposited on an unstable sandy slope dominated by gravity driven processes including high and low density turbidites and mass transport complexes.

In order to define the development plan to inject this amount of CO_2 and demonstrate that it will remain in the subsurface, the reservoir characteristics and uncertainties should be thoroughly understood and modeled. The Dupuy Formation reservoir model is required to evaluate CO_2 injectivity, storage capacity and assess containment risks. The model covers an area of 25km x 38km. A Data Well was drilled in 2006 with core and image log through the Dupuy Formation designed specifically to narrow sedimentological and petrophysical uncertainties. Thirty other wells within the modeled area of 1960's to 1990's vintage are available with conventional wireline logs but suffer from a lack of core and image logs in the injection interval. The seismic data over the area includes three 3D seismic surveys and a limited number of 2D lines of variable quality.

The aim of this paper is to share best practices and lessons learned in the model building process and uncertainty analysis. We will show the impact in flow simulation of building an environment of deposition facies model using Multi-Point Geostatistical Simulation (MPS) versus a lithofacies model using Sequential Indicator Simulation (SIS). This paper will cover also an innovative approach to handle facies interpretation uncertainty and the way other geological uncertainties were assessed in terms of injectivity and containment risk.