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An Assessment of CO2 Storage Potential Within Carboniferous Aquifers of the Onshore Clare Basin, West Ireland - A Case Study for Pre-feasibility Appraisal of Storage Sites

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SUMMARY

The Irish Environmental Protection Agency (EPA) commissioned an international group led by Aurum Exploration Services, DMT GmbH & Co. KG and TNO Built Environment and Geosciences to conduct a pre-feasibility study to assess the CO2 storage potential in the vicinity of Ireland s largest single point emitter at Moneypoint Power Station (currently 3.95 Mt CO2 per annum).

The Ross Sandstone Formation and Dinantian Limestones were identified as potential reservoirs for CO2 storage within the Clare Basin with the Clare Shale and Gull Island Formations as seals. Structurally, the area is dominated by open folds of Variscan age with subordinate thrusting and faulting.

Extensive data compilation of surface data from heterogeneous sources was undertaken in addition to limited subsurface information from deep boreholes and historical 2D seismic surveys.

Two new borehole locations were selected for wireline logging and core sampling to provide key information on the potential reservoir and seal horizons.

The resultant data was assimilated into a final 3D subsurface model which provides a description of the structural setting and the spatial reservoir/seal property distribution; allowing an early assessment of the potential storage volume and suitability.

The study reveals that the Clare Basin in unsuitable for CO2 storage in saline aquifers for the following reasons:

- The Dinantian limestones are developed over large areas at depths in excess of 800m with the overlying Clare Shale Formation providing a suitable seal. However, core data suggest the development of an unfavourable basin facies over large portions of the project area. A relatively small theoretical trap volume of some 11 Mt is estimated.
- Limited portions of the Ross Sandstone Formation are developed within the required depth window (<800m). The validity of the Gull Island Formation as a potential seal to the Ross Sandstone Formation remains subject to further examination (internal mudstone continuity is unknown). Analysis of surface tectonic features suggests that the majority of anticlines are plunging and therefore prone to potential leakage. Very limited trap potential remains within domal anticlines which may be further compartmentalised by brittle deformation.
- Permeability and porosity tests carried out as part of this study clearly demonstrate that the Ross Sandstone Formation and Dinantian Limestones have a tight character. The results for both horizons range from 0.003-0.009 mD. To ensure adequate injection rates and storage, permeabilities in the order of 200 mD (milli-Darcy) are considered necessary to ensure injection at sufficient rates.