

10. 2D AND 3D SEISMIC INVESTIGATIONS FOR STAGES 1 AND 2C

10.1 Introduction

Active time-lapse seismic monitoring was an important component of the Otway Project Stage 1. The main objective of a seismic monitoring programme is to provide assurance that the injected CO₂ remains confined to the storage reservoir. However, from the start, it was recognised that there were substantial challenges in monitoring the migration of the CO₂ plume within the Waarre C reservoir. These challenges arose from the fact that the reservoir (Waarre C Formation) was just a few metres thick, geologically complex and rather deep (approximately 2000 m). Furthermore, it was recognised that due to the presence of residual methane gas in the formation, the effect of the injection of a gas mixture (containing approximately 80% carbon dioxide and 20% methane) on elastic properties was likely to be very small, making the detection of the injected gas in the Waarre C reservoir even more difficult.

At the same time, it was likely the presence of even relatively small amounts of gas mixture in overlaying aquifers would cause significant changes in elastic properties, and hence a detectable time-lapse seismic signal. Thus high resolution time-lapse seismic information could potentially offer a means to provide assurance that no significant amount of gas had leaked into the overlaying aquifers—an indirect assurance that the $\rm CO_2/CH_4$ mixture had remained in place in the storage reservoir.

With this in mind, the seismic programme for the Otway Project Stage 1 was designed to maximise the possibility of detecting very small time-lapse signals from the Waarre C reservoir, and at the same time to detect any timelapse signals in overlaying strata. It was intended that a subsequent phase of the Otway Project (Otway Stage 2C) involve injecting and monitoring of up to 30,000 t of the CO_2/CH_4 mixture directly into a saline aquifer, accompanied by time-lapse seismic monitoring.

Stage 2C would then provide the opportunity to test the leakage modelling undertaken for Otway Stage 1. To date Project 2C has not been carried out, but what has been undertaken is extensive modelling of the acoustic signature of the proposed 30,000 t injection which is in any case relevant to the recognition of leakage if it were to occur