

SEISMIC SURVEY

About seismic surveying

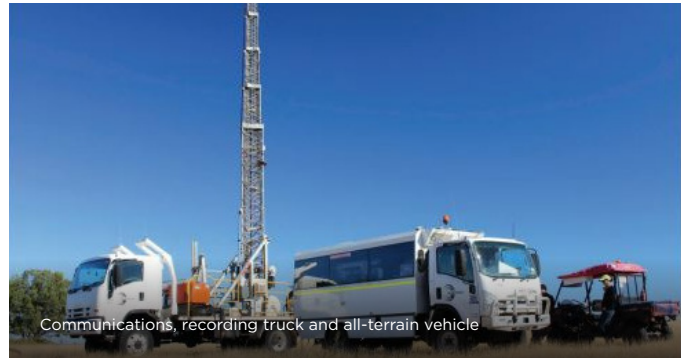
To identify if an area is prospective for natural gas (or not), low impact seismic surveys are used to investigate the subsurface geological formations. Seismic surveys are the most common method used to image the subsurface of the earth. The technology has been used in Australia since the late 1940s and has evolved over this time.

The process involves using vibroseis trucks to transmit acoustic energy into the ground. The acoustic energy is reflected back from the underground formations and recorded by lightweight wireless data acquisition nodes at the surface. The data is processed to produce subsurface images that identify if the geology of the area supports structures in which gas may have accumulated.

Before a seismic survey begins, geophysicists position seismic lines so their locations will optimise the imaging of the subsurface formations, taking into consideration the environmental and cultural heritage restrictions and any existing infrastructure at the activity site. Where possible, seismic surveys are undertaken on public roads and the adjacent road reserve to minimise disturbance.



Line crew installing geophone nodes



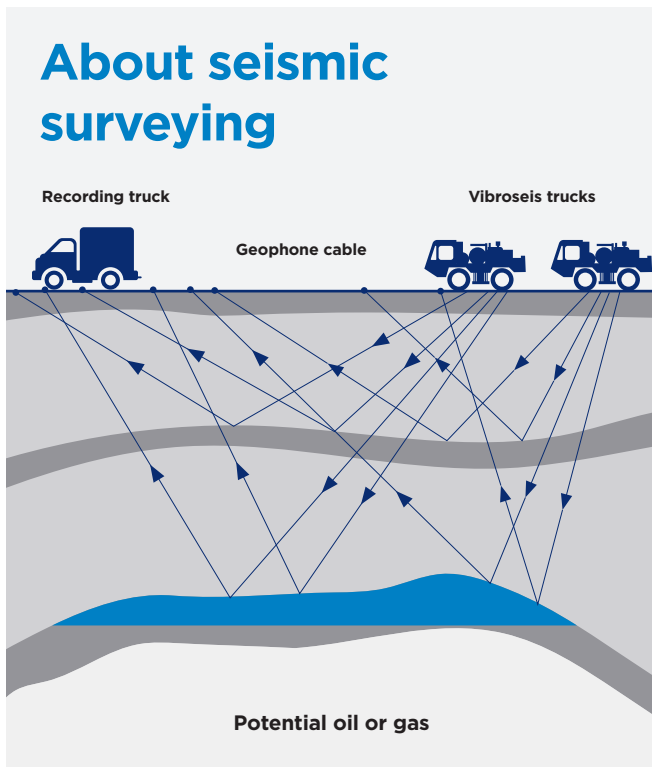
Communications, recording truck and all-terrain vehicle



Example of vibroseis units crossing a wheat field



Wireless geophone node installed in the ground



Santos provides reliable, affordable energy for progress and seeks to provide lower carbon energy over time. Santos is a global energy company with operations across Australia, Papua New Guinea, Timor-Leste and the United States. For 70 years, Santos has been working in partnership with local communities, providing jobs and business opportunities, safely developing natural gas resources and from there powering industries and households.

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Activity areas

The NSW Government has approved Santos to undertake seismic activity on public roads in the Gunnedah area. Landholders adjacent to the road that the approved survey area encompasses will be provided with at least 21 days' written notice of the activity.

Preparation

Preparation for seismic activity involves slashing, stick raking and moving any large rocks from the seismic lines. If dense strands of vegetation block the seismic line, the vegetation will be detoured to minimise environmental impacts. Surveyors then mark and survey the prepared line to be ready for the arrival of the recording crew and vibroseis trucks.

Recording

Acoustic energy is generated by small, specially-designed vibroseis trucks that operate alone or in fleets of up to three. The trucks have metal base plates connected to a vibration mechanism. When these base plates are hydraulically lowered to the ground, they transmit acoustic energy into the ground for five to eight seconds over a range of frequencies. This process is repeated at regular intervals of approximately 10-20 metres along the seismic line. Several thousand of these recordings can be done in one day, resulting in daily progress of approximately 7-10 kilometres.

Vibration from the equipment will not be felt beyond approximately 10 metres from the source location and can be likened to a cattle truck driving down a road.

The acoustic energy returning from the subsurface formations is picked up by small and very sensitive detectors called geophones that are mounted on lightweight wireless data acquisition units called nodes. The geophones are inserted up to 10 centimetres into the ground along the seismic line. Once recording of the seismic line is completed, this stored data is then collected and sent to an off-site processing centre that produces images of the subsurface geological structures lying beneath the seismic lines.

Pack up and rehabilitation

When the seismic survey is completed all seismic line equipment and survey markers are collected and removed by crew members. Where required, the land will be rehabilitated back to its original state.

Timeline

PREPARATION

**Activity duration**

Up to two months for entire projects. However, this will vary greatly between sites.

**Equipment used**

Slasher, stick rake, mulcher, grader, light 4WD vehicles.

**Personnel on site**

Up to 6 onsite.

RECORDING

**Activity duration**

One day for every 7-10 kilometres of seismic line.

**Equipment used**

Vibroseis trucks, service truck, recording truck, all terrain vehicles, light 4WD vehicles.

**Personnel on site**

Santos field representative, peak workforce of up to 30 personnel.

PACK UP

**Activity duration**

One - two days.

**Equipment used**

Light 4WD vehicles, all terrain vehicles.

**Personnel on site**

Santos field representative, peak workforce of up to 30 personnel.

REHABILITATION

**Activity duration**

Generally, no more than 4 days.

**Equipment used**

Light 4WD vehicles, grader.

**Personnel on site**

Santos field representative, up to 3 personnel.

Protecting environmental values through all project and operational stages

Santos is committed to preventing harm to the environment. We operate in diverse locations that have unique biodiversity and land features and we have strong processes in place to identify and understand environmental values, and mitigate potential risks. Subject matter experts are engaged to conduct ongoing measurement of water, waste, air and biodiversity indicators to ensure that we comply with all government environmental regulations and meet Santos' high environmental standards.

Koalas

Santos has worked with an environmental expert to conduct a full risk assessment of the seismic surveys and we are confident that our activities will have no impact on the koala population in the area. As a precaution we have put in place a number of additional protection measures including monitoring and a fauna spotter. The fauna spotter will be used to identify any koalas in the area and that area will be avoided.