

Natural & Induced Seismicity

Harnessing geothermal energy from the hot rocks beneath Cornwall depends on circulating water through networks of natural fractures. The best fracture zones are found along ancient fault lines, such as the Porthtowan Fault Zone, which is the target for the UDDGP project. One potential cause of public concern with geothermal energy is the possibility of triggering small earthquakes. This information sheet explains natural and induced seismicity and the steps that Geothermal Engineering Ltd (GEL) is taking to minimise any seismic disturbance to the community.

Natural Seismicity



For millions of years our planet's crustal plates have been moving around; changing the shape of the continents, creating mountains and volcanoes. The most active regions are at the boundaries of these plates, where they are moving apart, sliding past each other or colliding. This is also where some of the world's largest geological faults are found.

The movement along any fault is not smooth and continuous. The pressure builds up until the rocks cannot withstand it anymore, and then they slip. When that happens, the fault moves suddenly and there is an earthquake,



Earthquakes are generated by movements along faults

usually deep underground. Earthquakes can only be felt by people if the shock waves are strong enough to reach the surface and can only cause damage if they are strong enough to shake the ground forcibly. If an earthquake is small or very deep, the energy is absorbed by the surrounding rocks before it reaches the surface. Cornwall is in a stable tectonic region, so it does not get large earthquakes,

but it does sometimes get small ones. About 600 have been recorded since monitoring began in the early 1980s, the largest of them being a magnitude 3.8 near Penzance in 1996. In August 2019, there was a magnitude 2.3 event near Helston. Although it was quite widely felt and heard, it was still a very small earthquake. The risk of damage or injury from Cornwall's seismicity is extremely low.



Induced Seismicity

Induced seismic events are the same as natural ones except that the trigger for the movement is human activity rather than a gradual build-up of geological pressure over time. In the case of geothermal projects, this can be caused by water pressure helping to unstick the rock along faults or small fractures.

This is not the same process as Fracking, where the injection of large volumes of fluids at high flow rates and pressures is used to create multiple new fractures in intact rock, to drain out the oil or gas. The operation of geothermal reservoirs in Cornwall is likely to cause some minor seismicity, but most induced events will be much too small and too deep to be noticed at the surface. And even if any are large enough to be felt, they are still very unlikely to cause any damage.

In the 1980s, the 'Hot Dry Rock' geothermal research programme carried out in Cornwall generated about 10,000 induced seismic events over a number of years. Only two of them were felt at the surface and neither caused any damage. The largest had a magnitude of just 2.

Magnitude

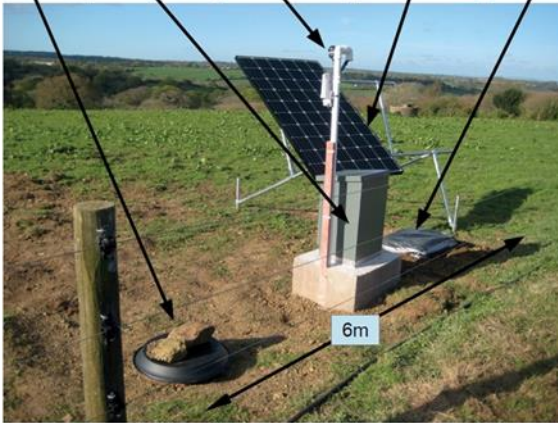
The strength of an earthquake is described by its magnitude. This is a logarithmic scale which means that a magnitude 2 is ten times bigger than a magnitude 1 and a magnitude 3 is ten times bigger than a magnitude 2 and so on. The largest earthquake ever recorded was in Chile in 1960, it had a magnitude of 9.5. This is about 30 million times bigger than a magnitude 2 event.



Some of the induced seismic events recorded at the HDR project in the 1980s

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Sensor pit Recorder Radio mast Panel Battery box



A seismometer installation in Cornwall Image courtesy of Alt.com

Seismic monitoring system

GEL has installed a network of seismometers that can detect earthquakes hundreds of times too small to be felt at surface. The data will be monitored continuously to alert GEL of any increase in seismic activity and to allow mitigating action to be taken if necessary. The British Geological Survey and GEL will report activity on their websites for complete transparency.

As well as providing environmental monitoring, the monitoring system is a valuable tool to help geologists and engineers understand the movement of water through the geothermal reservoir because it can detect any seismic events caused by the water circulation.

Management and control of induced seismicity

As GEL's operations are in Cornwall, the company uses existing British Standards and Cornwall Council's planning guidelines for blasting, quarrying and mining activity. Acceptable levels are based on how much ground vibration is measured at the surface, referred to as Peak Ground Velocity, or PGV, rather than on the magnitude of an induced event.

The vibration limits are very conservative. Humans cannot generally feel movements with a PGV of less than 2mm/s but site operations will enter a 'caution' state if PGVs greater than 0.5mm/s are detected.

For buildings to suffer cosmetic damage generally requires movements of more than 15mm/s but GEL will take action if PGVs of more than 8.5mm/s are detected.

Animation and Further Information

GEL has created an animation explaining the difference between natural and induced seismicity, it can be viewed on the GEL website or on the Geothermal Engineering Ltd YouTube channel. More information is available on the GEL website.

If you have any concerns or questions please contact Geothermal Engineering Ltd.

If you contact GEL regarding a seismic event you believe to be from the United Downs site, the following information will be required to deal with your concerns as quickly as possible.

1. Your name and the name of your business if you are calling from within the industrial estate.
2. Your address including your postcode.
3. The best phone number to contact you on (landline or mobile).
4. Your e-mail address if you have one.
5. You will need to explain precisely and concisely why you are contacting GEL, with locations, times and the nature and duration of the seismic disturbance.

24 Hour Phone:	01326 331920
Email:	info@geothermalengineering.co.uk
Postal Address:	Community Relations Manager Geothermal Engineering Ltd Unit 3, Gate B United Downs Industrial Estate Redruth Cornwall TR16 5HY
Website:	www.geothermalengineering.co.uk

For more information about geothermal projects please visit www.geothermalengineering.co.uk



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