DESTRESS

Demonstration of soft stimulation treatments of geothermal reservoirs

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Updating geothermal risk assessment on near real time during a soft stimulation experiment in Iceland

The rapid increase in energy demand in the city of Reykjavik has posed the need for an additional supply of deep geothermal energy and the hydraulic (re-)stimulation operations on the peninsula of Geldinganes (north of Reykjavik) is an essential component of to meet this target and exploit this energy source. Like all energy technologies, the exploitation of deep geothermal energy is not risk-free. Therefore, an essential part of the implementation and licensing is a quantitative risk assessment comparable to existing regulations for health, safety, and environment (HSE) procedures. This analysis allows balancing the risks against the (perceived and real) benefits. Over the last decade, induced seismicity has emerged as one of the risks – and often the most dominant one – to be faced. The Mw 5.5 Pohang earthquake occurred in South Korea is an extreme example of a triggered earthquake-related to geothermal activities that reopened the debate on the safety of these procedures and how effectively managed the related risks. In particular, fluid injection or extraction in tectonically active zones carries a risk of inducing a seismic event of a significant magnitude, and deep geothermal projects are a primary example. This contribution introduces a first-of-its-kind pre-drilling probabilistic induced seismic hazard and risk analysis for the site of interest before the stimulation operations by using advanced protocols to manage the risk associated with these operations in real-time. More specifically we provide estimates of peak ground acceleration, probability of light damage (damage risk), and individual risk before and during the stimulations by updating the a-priori risk model in real-time during as new data are available. The results of the risk assessment indicate that the individual risk within a radius of 2 km around the injection point is below 0.1 micromorts, and damage risk is below 10^(−2), for the total duration of the project. This is the first case of application of the Advanced Traffic Light System (ATLS) in real-time during field operations.

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