Frequently Asked Questions about the Newberry EGS Demonstration

When the Newberry EGS Demonstration began in 2010, AltaRock Energy[1] published Questions and Answers[2] and a Whitepaper[3] to our website, explaining the project.

We have recently finished the first phase of the project, a two year collaborative effort including federal agencies (Bureau of Land Management, US Forest Service, and Dept. of Energy), state agencies (Oregon Depts. of Geology and Mineral Industries, Environmental Quality, and Water Resources), government scientific labs (US Geological Survey and Lawrence Berkeley, Lawrence Livermore, Los Alamos, and Sandia National Laboratories), universities (Oregon State, Temple, and Texas A&M), and the well and geothermal lease owner (Davenport Newberry). This effort concluded with public comments on the project's Environmental Assessment[4] prepared by the Bureau of Land Management (BLM). Below, we answer the top ten questions about the project's plans to protect the environment.

FAQ #1: I've read that EGS uses water to stimulate cracks in underground rock. Is this the same as the fracking that has been getting so much negative press lately?

No. Hydraulic fracturing, or "fracking", is a method for extracting oil and natural gas in which water and chemicals are injected at high pressures, up to 10,000 psi at the surface, into an oil or gas well. The water pressure causes the rocks to fracture or crack open, and then propping agents, carried by gels, are injected to keep the hydrofracture open so that oil and gas can be collected and piped to the surface. Some of the chemical additives used in fracking and the recovered hydrocarbons can be toxic.

The Newberry EGS Demonstration Project is based on the concept of hydroshearing not hydrofracturing. Hydroshearing occurs when friction is reduced on natural rock fractures by increased water pressure, which allows the fracture walls to slip past each other slightly. Hydroshearing occurs at pressures much lower than those needed to break, or frack, the rock. At Newberry, we expect surface pressures less than 1,600 psi to initiate hydroshearing. Further, hydroshearing does not require gels or proppants, because the small, hydrosheared fractures will remain slightly open, less than a tenth of an inch, due to the irregularities on the fracture walls. We will add small amounts of non-toxic tracers and non-toxic diverter materials to the injected water (See FAQ #2), all of which have been reviewed and approved by regulatory agencies. Lastly, we will not be producing fossil fuels, but hot water and steam heated by the hot rock under Newberry Volcano, a renewable energy source.

FAQ #2: What chemicals will be injected into the ground?

AltaRock plans to use two types of non-toxic additives in the water injected into the well: tracers and diverters.

Tracers are benign chemicals that can be detected in very low concentration (parts per billion). Tracers are used to track the flow of water in many groundwater and surface water studies. For this project, small volumes of commonly used, non-toxic groundwater tracers will be added to the water injected into the geothermal well, and then will be flowed back out of the same well after the stimulation. Measuring the amount and timing of tracer returns will help us understand the conditions and pathways that the injected water encountered underground. More information about tracers can be found here[5].

Diverters are dry granular materials that we will mix in small quantities (less than 3 barrels over 3 weeks) into the water injection line to temporarily plug-up existing fractures intersected by the well bore. This will allow other fractures to be hydrosheared (FAQ #1) and opened. AltaRock has developed an inventory of non-toxic, thermally-degrading materials that that can be used as diverters that dissolve away with time and heat, making all the stimulated fractures available to heat circulating water in an EGS. Our trade name is TZIM (thermally degradable zonal isolation material); their exact compositions are trade secrets because we have invested significant research time and money to identify and test the synthetic and natural materials that fulfill our needs. Some of the synthetic materials are also used for clothing, high temperature disposable dinnerware, coatings on medical devices used inside the human body and biodegradable food storage containers. At the very high temperatures of this well, the breakdown products of the TZIMs will be mostly water, carbon dioxide, and naturally-occurring, dissolved ions that will not exceed any background levels. More information about the diverters can be found here[6].

FAQ #3: How much water will be used and where will you get it?

During the test this coming summer, a total of up to 24 million gallons (74 acre-feet) of water will be used over a 3 week period. How much water is that? It's about 3 hundredths of one percent (0.0003) of the estimated annual recharge to the Deschutes Basin from the west flank of Newberry volcano (73 billion gallons or 224,000 acre-feet), or about the amount of water that Bend uses on a single summer day.

AltaRock and Davenport have a limited-use license from the Oregon Water Resources Department (OWRD) that allows the use of groundwater from two existing shallow water wells (600 to 800 feet deep), both of which are capable of supporting the project's water demands. No water from the lakes in the caldera, Paulina Creek, or domestic supplies will be used.

An independent hydrology study[7] completed in February 2011 found that there would be no significant effects to the groundwater levels beyond the immediate test area, far from wells used by local residents several miles down the mountain.

FAQ #4: Will any water that you inject or produce enter the local or regional aquifers?

No. Water injected into the well will not connect to local groundwater resources. The existing demonstration well is cased and cemented into the ground for the first 6,500 feet below the surface with multiple layers of steel and cement as required to meet groundwater protection standards. The planned EGS reservoir will be created 6,500 to 11,000 feet below the ground surface, a vertical mile below the shallow groundwater aquifer in a thick section of impermeable rock.

An extensive array of seismometers and a temperature sensing fiber optic cable installed in the well will help monitor EGS reservoir growth and movement in the subsurface (see FAQ #6). If too much upward growth is observed, the stimulation will be halted in that zone and started at a deeper zone. An independent review of potential hydrologic impacts can be found here[8].

FAQ #5: Do you expect any toxic material in the water that returns from the test well?

Geothermal fluids often contain dissolved minerals that naturally occur in the rock, sometimes in high concentrations. However, the target well, drilled by the lease-owner in 2008, is not connected to significant geothermal waters which is why the well is available for this demonstration.

During the 30 day stimulation test, the injected water will not spend enough time at depth to absorb large quantities of minerals. Regardless, all water flowing back out of the well after stimulation will be contained in double-lined retention ponds. Ultimately the water will be re-injected into the deep EGS reservoir and, if applicable water quality standards are met, evaporated with the aid of sprinklers positioned on the drill pad.

FAQ #6: Will the demonstration cause damaging or felt earthquakes?

It is very unlikely. As part of the first phase of the project, a number of independent engineers and scientists were asked to evaluate the risk of generating earthquakes or seismicity of concern to the local population and structures. These studies determined that the seismicity created by the project had a very low risk[9] of being felt by people in the vicinity of the project and an even lower risk that any damaging earthquakes could occur. The risk is low due to the short time span of injection (less than 30 days), the remote location (~10 miles to the nearest town) and the fact that there are no seismically active faults identified near the well or project area.

During the stimulation, we will use a network of highly sensitive seismometers to map the microseismicity generated by hydroshearing, and we will take proactive measures to prevent microseismicity from escalating into felt earthquakes.

Resources:

- Before, during, and after the stimulation, the public will be able to view an interactive seismicity map[10] hosted by Lawrence Berkeley National Laboratory.
- The main text of the Induced Seismicity Mitigation Plan[11] (ISMP) for the EGS Demonstration is available on AltaRock's website (2.6 MB).
- The complete ISMP[12] is 60 MB and includes 14 appendices, including independent engineering reports on
  - seismic hazards and risks (URS Corporation[13]),
  - modeling the magnitude and probability of felt earthquakes (Fugro Consultants[14]),
  - a structural assessment of buildings in the Newberry National Volcanic Monument (Simpson Gumpertz & Heger[15]), and
  - geotechnical assessment of the natural slopes and Paulina Lake diversion dam (Treadwell & Rollo[16]).
- A glossary of induced and natural seismicity terms can be found here[17].

FAQ #7: Can the stimulated fractures grow in an uncontrolled way into undesirable places?

No. Friction, imposed by the weight of rock, will prevent the fractures from growing and extending in an uncontrolled way. Only where water pressure is increased by injection at the well will friction be reduced enough to cause fracture stimulation.

Starting at the well, a zone of increased water pressure will relieve the frictional forces on fractures and allow for small slip events, creating an EGS reservoir marked by a cloud of microseismicity (see FAQ #6). The increased water pressure zone and microseismic cloud will grow as the stimulation progresses until the EGS reservoir extends 1500 feet from the injection well. Outside this zone of excess water pressure, the fractures will not slip. When the increased pressure is relieved- off at the end of the 30 day stimulation, the microseismicity will die off in the EGS reservoir.

Monitoring the locations of microseismicity with the seismic network will allow us to map where the fractures have been stimulated. If microseismicity occurs outside the volume approved for stimulation, we will take corrective measures. The upward growth limit is 6000 feet below the ground surface, which leaves more than 5000 feet of impermeable rock between the EGS reservoir and the local groundwater aquifer. You can read more about induced seismicity, the analysis of independent experts, and our mitigation plan here[18].

FAQ #8: Can injecting cold water on hot rock disturb the Newberry volcano and cause a volcanic eruption?

No. The volcano won't be affected by project activities. The youngest flows at Newberry Volcano are 1,300 years old[19] but there has been no known activity since. The volume of heat and rock affected by the EGS project is tiny compared to the total volume of hot rock, the depth and size of the magma chamber, and the distance to the plumbing of the volcano.

Some of the most productive geothermal power plants in the world are located in volcanic regions such as the Philippines, Indonesia, Iceland[20], and Hawaii. In these geothermal fields, no eruptions have been caused by geothermal drilling or production. In fact, in Hawaii[21], operators drilled into magma[22], or lava chamber, with no negative results except for a drill bit that was damaged by the encounter – but still was pulled back to the surface. The magma, or lava in the hole simply solidified, plugging the drill hole back up.

FAQ #9: Will you build a power plant to generate electricity from the hot, circulated water as part of this project?

No. The Newberry EGS Demonstration Project aims to demonstrate[23] improved technology for creating geothermal reservoirs and extracting heat from the earth in locations where high temperatures can be reached by conventional drilling techniques.

If the EGS demonstration is successful, further study, environmental analysis, and financial planning will be required before the next steps of building a power plant to generate electricity could be considered.

FAQ #10: How can I find out more?

AltaRock, Davenport Newberry and the Department of Energy are committed to educating the public about EGS and sharing with the geothermal community the EGS best practices that we have developed. Because this project is partially supported by public funds, many of the materials prepared for regulatory and funding agencies are available on AltaRock's website (http://www.altarockenergy.com), including reports on water usage and monitoring[24], induced seismicity[25] risks and mitigation planning, and a video explaining why EGS is the "future of geothermal energy."

Our Facebook page (http://www.facebook.com/NewberryEGS) and Blog (http://blog.newberrygeothermal.com/) are usually the most up-to-date sources for recent activities, including links to recent television, radio, and newspaper coverage of the project. We also have a toll-free information line at 855-USA-4-EGS.

Links shown in FAQ text

[1] http://altarockenergy.com/

[2] http://altarockenergy.com/projectupdates/NewberryQandA.pdf

[3] http://altarockenergy.com/projectupdates/WhitePaper.pdf

[4] http://www.blm.gov/or/districts/prineville/plans/newberryegs/index.php

[5] http://altarockenergy.com/projectupdates/Tracers_Newberry_EGS.pdf

[6] http://altarockenergy.com/projectupdates/Diverters_at_Newberry_EGS.pdf

[7] http://blog.newberrygeothermal.com/2011/03/07/newberry-kleinfelder-independent-hydrology-review-report/

[8] http://altarockenergy.com/projectupdates/Newberry Kleinfelder Independent Hydrology Review Report 24Feb11.pdf

[9] http://blog.newberrygeothermal.com/2010/12/03/independent-induced-seismicity-and-seismic-hazards-risk-analysis-is-complete/

[10] http://esd.lbl.gov/research/projects/induced_seismicity/egs/newberry.html

[11] http://www.altarockenergy.com/projectupdates/Newberry_ISMPlan.pdf

[12] http://www.altarockenergy.com/projectupdates/Newberry EGS Demonstration ISMP 3Aug11.pdf

[13] http://www.urscorp.com/

[14] http://www.fugroconsultants.com/

[15] http://www.sgh.com/

[16] http://www.treadwellrollo.com/

[17] http://altarockenergy.com/projectupdates/Seismicity_glossary.pdf

[18] http://www.altarockenergy.com/projectupdates/Newberry EGS Demonstration ISMP 3Aug11.pdf

[19] http://vulcan.wr.usgs.gov/Volcanoes/Newberry/description_newberry.html

[20] http://en.wikipedia.org/wiki/Geothermal_electricity#Utility-grade_plants

[21] http://www.punageothermalventure.com/

[22] http://www.agu.org/meetings/fm08/fm08-sessions/fm08_V23A.html

[23] http://blog.newberrygeothermal.com/2010/12/10/demonstration-defined-putting-the-newberry-egs-demonstration-in-context/

[24] http://blog.newberrygeothermal.com/2011/03/07/newberry-kleinfelder-independent-hydrology-review-report/

[25] http://blog.newberrygeothermal.com/2010/12/03/independent-induced-seismicity-and-seismic-hazards-risk-analysis-is-complete/