



**Preliminary Environmental
Assessment and Analysis of EGS
Technologies**
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- Environmental Strategic Plan
- Phased approach
- Phase 1 results to date
- Induced seismicity mitigation measures
- Request for feedback
- Contacts

- National Environmental Policy Act (NEPA) compliance has the potential to be a critical path activity for EGS implementation
- DOE currently uses phased approach for implementing NEPA on many geothermal projects
- Phased approach to developing strategic plan for future NEPA compliance and environmental permitting
 - Phase 1 – literature review
 - Phase 2 – approach development
 - Phase 3 (potential) – programmatic NEPA document
- Staying dynamic – approach will be varied as necessary as feedback is received

- Task included reviewing literature on environmental studies of EGS projects (US and international)
 - Review team identified over 200 project documents prioritized by DOE Geothermal Program
 - 80 documents reviewed - 16 discrete projects (**expect to update**)
- Identify environmental issues, mitigation strategies and resolutions
- Evaluate analytical techniques and presentation methods
- Present initial findings at this Geothermal Program Peer Review and solicit feedback from community

- Identify key environmental permitting and impact issues associated with EGS technologies
- Develop step-wise permitting approach
- Define strategy for long-term NEPA compliance recognizing great differences in site geology, water availability, proximity to population, etc.

- If warranted, prepare a programmatic environmental assessment (EA) or environmental impact statement (EIS) for future EGS technologies
- Ability to tier off of programmatic NEPA for project-specific analyses
- Potential savings of time and money for specific project review
- Goal of minimizing the phased approach of multiple NEPA documents for single projects

- Identified environmental resource areas and topics with potential for impact significance as heightened by public concern (many are common to hydrothermal and EGS)
 - Geology and soils*
 - Water resources*
 - Socioeconomics
 - Cultural resources
 - Air quality
 - Biological resources
 - Health and safety*
 - Visual resources
 - Noise

(* indicates areas with topics driven more by public reaction)

- Geology and soils
 - Induced seismicity*
 - Public perception of hydroshearing*
 - Land subsidence from liquid withdrawal (atypical for EGS)
 - Changes in surface activity (e.g., geysers, hot springs, etc.)
 - Potential triggering of landslides
- Water resources
 - Water availability and demand
 - Geofluid additives*
 - Discharge of hot and/or contaminated wastewater
 - Effects on drinking water aquifers
 - Surface spills of contaminants

- Socioeconomics
 - Conflicts with “way of life” and tranquility in remote areas
 - Conflicts with existing resource uses (hot spring spas, recreation, tourist attractions)
 - Uncertainty in long-term sustainability of resource
 - Beneficial impacts
 - Reduction in reliance on imports of fossil fuels
- Cultural resources
 - Native American viewpoint of geothermal exploitation
 - Land disturbance impacts involving potential artifacts

- Air quality
 - Release of non-condensable gases from geofluid*
 - Construction-type emissions (equipment exhaust and PM₁₀)
 - Potential for radon and asbestos from subsurface formations
 - Beneficial impacts for reduction of greenhouse gases
- Biological resources
 - Land disturbance type impacts to habitat, vegetation, wetlands
 - Noise impacts to wildlife (i.e., disturbance of nesting sites)
 - Heat effects on local vegetation (scalding)
 - Changes in fragile and/or unique hot springs ecosystems
 - Comparative beneficial impact of lower land disturbance footprint

- Health and safety
 - Catastrophic events (e.g., well blowouts)
 - Hazardous constituents in geofluids
 - Radon, asbestos, H₂S, arsenic*
 - Accumulation of radioactive residues in pipe scale
 - Acknowledge and characterize radiological exposure
- Visual
 - Land disturbance and vegetation removal
 - Tall features (drill rigs, steam plumes)
 - Impacts to viewpoints (in recreational & tourism areas)
- Noise
 - Normal operations and periodic steam venting
 - Impacts to sensitive wildlife

- Induced seismicity - unique and challenging technical issue to gaining public acceptance of EGS
- Identified mitigation measures:
 - Reduce or control seismicity
 - Location
 - Operational controls
 - Characterize potential and reduce public concern
 - Induced seismicity protocol
 - Characterize the risks
 - Establish an outreach and communication program (in addition to NEPA process)
 - Ongoing characterization and communication

Induced Seismicity Summary

- Early evaluation of potential
- Develop plan to control/manage it
- Be prepared to modify that plan
- Keep the public informed along the way

Other measures will be further defined in Phase 2

- Geofluid additives
- Hydroshearing discussion
- Radiological materials characterization

- Our goals this week:
 - Present the initial findings of our Phase 1 literature review and to get the geothermal community thinking about how DOE can aid in the streamlining of the NEPA and permitting processes.
 - Listen to other participants during the week to gain additional insight into potential environmental issues and improved methods for communicating these issues to the public.
- Any questions or other input?

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