

**APPENDIX J:
STATEMENT OF COMPLIANCE
WITH DOE SEISMICITY PROTOCOL**

Calpine Corporation's response to DOE's required compliance with the "Protocol for Induced Seismicity Associated with Enhanced Geothermal Systems".

Calpine Corporation and other Geysers geothermal operators have long been actively involved in addressing induced seismicity, especially prior to and in conjunction with the startup of supplemental injection of reclaimed waste water into the reservoir. The following outlines Calpine's current practices in addressing seismicity at The Geysers in relation to the "Protocol for Induced Seismicity Associated with Enhanced Geothermal Systems" authored by Majer, E., Baria, R. and Stark, M. (2008). Calpine's current approach to seismicity will envelop any new Enhanced Geothermal System (EGS) injection well(s) initiated as a result of a DOE grant award.

"Step One: Review Laws and Regulations"

As explained in greater detail below Calpine Corporation's proposed EGS projects comply with all applicable local, state and federal laws and regulations. Beginning decades ago the subject of induced seismicity in the area became the subject of various scientific studies, and more recently has been part of various environmental impact evaluations imposed by the California Environmental Quality Act ("CEQA"). After completion of those seismicity impact evaluations Calpine Corporation received various governmental permits and authorizations to explore, develop and operate geothermal operations in the proposed project area, and is subject to numerous seismicity mitigation requirements pursuant to both the environmental review conduct for those operations, and pursuant to conditions in its permits and authorizations. Calpine continues to remain in compliance with its permits and authorizations. Calpine also remains in compliance with local and state laws and regulations governing its operations.

Calpine Corporation's projects to inject reclaimed waste water, which have been in operation for many years, include the Southeast Geysers Effluent Pipeline (SEGEP) and the Santa Rosa Geysers Recharge Project (SRGRP). Prior to construction and operation, each of these two large projects underwent an extensive environmental impact evaluation which resulted in an Environmental Impact Report (EIR). These evaluations were first for the initial projects and again for later stage increased water deliveries. These processes included evaluation of the induced seismicity associated with the injection of SEGEP and SRGRP water into the Geysers geothermal reservoir. Induced seismicity related mitigation measures were defined in those EIR's and Calpine continues to comply with these requirements.

In addition, Sonoma County recently completed two CEQA Environmental Mitigated Negative Declarations (MND) regarding the potential environmental impacts from geothermal exploration and development of Calpine's Buckeye and Wildhorse steamfield areas. The MNDs reviewed the applicability of the Santa Rosa Incremental EIR (SRIEIR) induced seismicity study to these projects and found the projects to be within the scope of the SRIEIR. In June 2009, relying upon the MNDs, the County granted Geysers Power Company, LLC two conditional use permits for exploration and development of these steamfields. These year-long environmental evaluations included

input from numerous local and state governmental agencies, as well as public comments. Calpine Corporation is unaware of any governmental entity or person asserting the proposed exploration and development of these steamfields would result in a violation of any applicable local or state law, ordinance or regulation. Calpine Corporation prudently operates its geothermal facilities and firmly believes its proposed project would not subject it to liability under local or state law.

“Step Two: Assess Natural Seismic Hazard Potential” and “Step Three: Assess Induced Seismicity Potential”

As stated above, the EIR’s for SEGEP and SRGRP assessed and addressed induced seismicity associated with the increased injection.

The seismic monitoring that evolved out of the first SEGEP EIR process resulted in the formation of the Seismic Monitoring Advisory Committee (SMAC). This committee is made up of representatives from community/environmental interest groups, California Division of Oil, Gas and Geothermal Resources, US Bureau of Land Management, US Geologic Survey (USGS), NCPA, Calpine, and Lake County Sanitation District (LACOSAN). The committee meets twice annually. Calpine participates by monitoring seismic activity in the southeast Geysers and presenting the seismicity and injection information to the members at each meeting. The second SEGEP EIR process also included a seismicity study as part of the EIR process titled “Potential Production Benefits and Changes in Seismicity Associated with Increased SEGEP Injection in the NCPA Area, The Geysers Geothermal Field” prepared by GeothermEx, Inc. (2002).

For the SRGRP project, the EIR’s included seismicity studies titled “Induced Seismicity Study, Geysers Recharge Alternative” prepared by Greensfelder & Associates and Parsons Engineering (1996), and “Induced Seismicity Analysis” prepared by Greensfelder & Associates and Parsons Engineering (2003). The EIR process resulted in a number of seismic related mitigation measures to be implemented as the SRGRP became operational. These mitigation measures were:

- 1) “... the local seismographic station network maintained by the Geysers operators ... shall be upgraded to focus coverage around the wells proposed for injection.”
- 2) “Accelerograph stations shall be added in Cobb and Anderson Springs to allow operators to determine relationships between seismic events within the Geysers steamfield and felt effects in nearby communities.”
- 3) “Software shall be improved to enable routine automated locating and mapping of epicenters ... and analysis of data”
- 4) “The Geysers operators shall analyze this data and determine which injection wells are more susceptible to felt induced seismicity. Injection shall be decreased at wells that produce higher levels of felt induced seismicity ... Success of redistribution of water and any other modifications in operations in reducing felt seismic events shall be continually evaluated.”

- 5) “Biannual reports shall be prepared by the Geysers operators and submitted to the City of Santa Rosa. Reports shall include plots of daily volumes of injection at each well, tables and plots of seismicity located within an agreed control radius of the well (e.g., 1 km) and planned operational responses.”

Mitigative actions have been taken by Calpine and others to fulfill these measures including:

- (1) A new digital microearthquake network funded by the California Energy Commission was installed and operated by the Lawrence Berkeley National Laboratory (LBNL) and incorporated into the USGS Northern California Seismic Network (NCSN) allowing for public access of the data;
- (2) The strong motion stations in the communities of Cobb and Anderson Springs were installed in 2003 and the data are evaluated on a routine basis and uploaded to a USGS FTP site allowing public access of the data;
- (3) the dataflow from the LBNL earthquake data are integrated into the NCSN system providing reliable detection and location of earthquakes down to magnitude (**M**) 1.0; and
- (4) All SRGRP wells are analyzed on a monthly basis and the injection-induced seismicity is evaluated to determine whether operational responses (e.g., decreased injection) are required. The results are summarized in a biannual report that is provided to the City of Santa Rosa.

Calpine’s grant applications for DOE-funded EGS injection wells will utilize existing water from the SEGEP and SRGRP projects. The amount of reclaimed waste water to be delivered to the Geysers will not be increased above previously analyzed levels in the EIR’s. Therefore, the proposed DOE funded EGS injection will be a redistribution of existing water, lowering the overall injection rate in other Calpine Geysers injection wells. Seismicity associated with these EGS projects will be incorporated in the established monitoring for SEGEP and SRGRP wells. EGS wells that receive SEGEP will fall within the boundaries of the SMAC and seismicity will be monitored and data presented biannually at the SMAC meeting. For EGS wells receiving SRGRP water, the wells will be enveloped in the SRGRP biannual seismic monitoring and reporting. Injection in EGS wells will be carried out in the same manner as other Calpine injection wells. Injection is initiated by briefly (over a few minutes) pumping water into the well. This causes a "collapse" of the steam to liquid water in the well bore and near-well bore fractures. The volume change of this phase transition is approximately 99%, which causes the well to "go on vacuum". Subsequently, injection is under vacuum conditions at the well head (without pressure applied to the fluid by surface pumping). Injection rates will be low to moderate. Induced seismicity is expected to be as predicted in previous seismicity studies.

The LBNL seismic network already in operation in conjunction with the strong motion instruments and the semiannual reporting obligations associated with the SEGEP and SRGRP projects are sufficient to monitor and report on induced seismicity associated with operation of the EGS projects.

“Step Four: Establish a Dialogue with Regional Authority” and “Step Five: Educate Stakeholders”

If Calpine is awarded EGS grant(s) from the DOE, there are several public outreach forums that are already in place for Calpine to communicate project information. As previously discussed, Calpine is a committee member of SMAC, which also includes community groups, seismological experts, regulatory agencies and local government participation. Calpine will make use of these biannual meetings to inform meeting attendees of the upcoming EGS project(s). Other forums Calpine could utilize are inclusion of project plans in annual newsletters that are mailed to all local residents. Calpine also holds annual community meetings which could be used to disseminate project information. In addition, at various times throughout the year Calpine has conducted free tours Geysers facilities which could be used as a forum for educating participants on future plans. Calpine operates a visitor center in the nearby community of Middletown. The visitor center has operating hours from 10am to 4pm, Wednesday through Saturday. The center has numerous geothermal displays including a seismicity display. The visitor center could also be used as a place to display information on any EGS grant award Calpine receives. Calpine also provides a toll-free seismic voicemail hotline available to the public so that people can report experiences and observations about an earthquake or can request a call back. Calpine transcribes every message and uses the information to better understand how seismicity affects our neighbors.

“Step Six: Establish Microseismic Monitoring Network”

An established seismic network already exists at The Geysers. There is a combination of seismic stations operated by the USGS and LBNL. Both types of stations are incorporated into the NCSN, which is a much larger regional network operated by the USGS. This data is available to the public via the USGS website. In the immediate Geysers vicinity there are 23 LBNL stations and 6 USGS stations. In addition, at least four new stations are planned to be installed in August 2009 by LBNL to extend the network to the north. These stations will allow better coverage for potential development in the north Geysers and will also be incorporated into the NCSN.

“Step Seven: Interact with Stakeholders”

See Calpine’s existing seismicity community outreach discussed in “Step Four” and “Step Five”.

“Step Eight: Implement Procedure of Evaluating Damage”

Calpine is committed to being regarded as a partner in every community where we have power plants, offices or other facilities. We recognize the importance of demonstrating our good intentions through concrete actions.

In an effort to renew the company’s commitment to its closest neighbors, Calpine has offered to provide funds to address the needs and concerns of the two nearest

communities to the Geysers, Anderson Springs and Cobb. Both the County of Lake and Northern California Power Agency (NCPA) have offered to establish community funds as well. Because of their differing backgrounds and structures, each of the three entities that are providing these funds has different criteria for the granting/distribution of its funds. The County has established the “Geothermal Impact Mitigation Fund Committee” (GIMFC) to govern the disposition of their funds (AB 1905 Geothermal Funds).

Calpine provides its funds to a “Calpine Community Investment Committee” (CCIC) for each community. The CCIC monitors and addresses the disposition of the Calpine community investment funds.

NCPA’s funds are distributed through the County’s GIMFC.

There is a separate GIMFC and CCIC for each of the two communities. The make-up of the Anderson Springs GIMFC consists of:

- Lake County District 1 Supervisor
- Anderson Springs Community Services District
- Northern California Power Agency
- Anderson Springs Community Alliance
- Anderson Springs Homeowners Assn
- Calpine Corporation (consulting only)
- County of Lake (facilitator only)

The Cobb GIMFC consists of the following members:

- Lake County District 5 Supervisor
- Cobb Area County Water District
- Two Cobb Community Member at Large
- Calpine Corporation (consulting only)
- County of Lake (facilitator only)

The Calpine Community Investment Committees for each community are made up of the same community members and the Calpine representative only.

Funds are requested by members of the communities using an application process created by the community committees.

The Calpine representative on the County GIMFC serves on the committee as a “silent” member, available to answer questions or provide technical expertise to the County on matters regarding geothermal power generation. The Calpine representative does not have a vote on how funds are to be dispersed from the County (or NCPA) funds.

On the CCICs, the Calpine representative acts as a facilitator and provides guidance (pursuant to Calpine’s community investment fund guidelines) on the type of projects Calpine will (and will not) fund, but will not generally vote on the distribution of funds for a specific project.

The following table summarizes the three funds available to the communities and how they are to be administered:

	County	Calpine	NCPA
Type of Entity	Local Government	Private Company	Public Power Agency
Source	Federal Royalties distributed in accordance with AB 1905	Annual Operating Budget	Funds approved by the NCPA Commission
Funding Criteria	By law, funding is for mitigation of impacts associated with geothermal development	Infrastructure and/or service. Benefit to the entire community is preferred	Mitigation of direct verifiable impacts associated with geothermal development; may result in incidental private benefit
Funding Level	Subject to Board of Supervisor approval	\$70,000 for 2009, \$35,000 each for Cobb and AS	\$30,000 for Anderson Springs
Fund Administration	Lake County Board of Supervisors	Calpine Community Investment Committee	Northern California Power Agency

REFERENCES

GeothermEx, Inc., 2002. Potential Production Benefits and Changes in Seismicity Associated with Increased SEGEP Injection in the NCPA Area, The Geysers Geothermal Field.

Greensfelder and Associates and Parsons Engineering, 1996. Induced Seismicity Study, Geysers Recharge Alternative.

Greensfelder and Associates and Parsons Engineering, 2003. Induced Seismicity Analysis.

Majer, E., Baria, R. and Stark, M., 2008. Protocol for induced seismicity associated with enhanced geothermal systems. Report produced in Task D Annex I (9 April 2008), International Energy Agency-Geothermal Implementing Agreement.