

# IEA-GIA Annex XI and IPGT Working Group on Induced Seismicity Results of May 3 Joint Meeting

## **Meeting Attendees:**

- Domenico Giardini – ETH Zurich, Swiss Seismological Service (Switzerland)
- Ernie Majer – Lawrence Berkeley National Lab (USA)
- Michael Malavazos – PIRSA (Australia)
- Chris Bromley - GNS Science (New Zealand)
- Stefan Wiemer - ETH Zurich, Swiss Seismological Service (Switzerland)
- Yoonho Song - Korea Institute of Geoscience & Mineral Resources (Republic of Korea)
- Hirofumi Muraoka - North Japan New Energy Research Center (Japan)
- Mike Mongillo – GNS Science, IEA-GIA Secretariat (New Zealand)
- Steve Bauer – Sandia National Lab (USA)
- Alexandra Long – PIRSA (Australia)
- Takatsune Ito – IEA Headquarters
- Ella Thodal – SRA International in support of US DOE and IPGT Secretariat (USA)

## **Country Updates on Induced Seismicity Efforts and Relevant Reports:**

- Switzerland
- USA
- Australia
- Republic of Korea
- New Zealand
- Japan

## Moving Forward:

In the next year, the IPGT and IEA-GIA will work together on the tasks described in the following slides. This work will inform the IPGT white paper and comprise IEA-GIA tasks under Annex XI. A delineation between the two groups may come in the future.

All milestones will be reviewed at next meeting in Australia to coincide with:  
**Australian Geothermal Conference/IGA/IPGT Steering Committee Meeting in Melbourne Monday the 14<sup>th</sup> and Tuesday the 15<sup>th</sup> of November 2011 (joint meeting).**

Individual tasks can meet whenever possible, potentially at:

- IEA-GIA ExCo Sept 28-30 2011 in England
- Soultz meeting first week October
- GRC Oct 2011 San Diego
- AGU San Francisco December 2011
- Stanford Jan/Feb 2012 one half day meeting on test sites

Issue	Current Action	Task	Lead
<b>1) Terms and definitions</b>	Some terms defined in the US Updated IS Protocol	A) Circulate documents (US updated IS Protocol and IS Roadmap when publically available) B) From these create a glossary and update as necessary.	All
<b>2) Data</b> Evaluate centralized data access and availability. Develop a common understanding of an open data policy		A) Define data categories and formats. Data discussed will include waveform, magnitude, focal mechanism and metadata of induced seismicity and production/injection information. B) Identify primary data sets from past and existing experiments and develop a reference list with contact information (on a website linked between the IPGT and IEA-GIA sites).	Australia
<b>3) Demonstration Areas</b> This will establish the conditions by which a site can be called a global “demonstration” site, meeting a threshold of data quality, quantity and availability adherence to protocols.		A) Compile a list of demonstration/test areas (not necessarily public), their locations, adherence to protocols and best practices used, geologic conditions, milestones and the expected outcomes. B) Qualify each site based on threshold of data quality, quantity and availability adherence to protocols. For example, does the site meet a requirement for the ability to locate a seismic event within a certain distance.	Switzerland & US co-leads

Issue	Current	Task	Lead
<p><b>4) Global Test Sites</b>            Establish a suite of test sites in different representative geologic and geothermal conditions to test all aspects of geothermal science and technology and demonstrate the scalability.</p>		<p>A) Each country should define test site conditions that they would like or may have available. This task will also look at what has been done by other scientific communities including physics (ESFRI, ICDP, EarthScope).</p> <p>B) Hold a one-day workshop to discuss wishes for a test site at the next Stanford meeting. <i>Note that this will apply to all geothermal technologies and tools.</i></p> <p>C) Develop a series of international public/private-funded test sites with common standards. These site will bring together a large research community. Research teams will make proposals for what to do at the sites. Open to international groups as a “window of opportunity.”</p>	<p>Switzerland &amp; US co-leads</p>

Issue	Current Action	Task	Lead
<p><b>5) Hazard and Risk Assessment</b>            Develop a framework for hazard and risk assessment for all phases of a project from site selection, to stimulation and operation and decommissioning.</p>	<p>Existing Risk Assessments in all countries.</p> <p>List of questions from DOE/GEISER October 2010 workshop in Iceland.</p>	<p>A) Circulate and review the questions from the DOE/GEISER workshop.</p> <p>B) Develop a white paper reviewing the following:</p> <ul style="list-style-type: none"> <li>• Current actions in this area</li> <li>• Methods industry uses to perform a hazard study</li> <li>• Maximum possible event (is this induced or triggered?)</li> <li>• Standardization for hazard assessment – perhaps similar to EPRI for nuclear</li> <li>• The importance/relevance of frequency</li> <li>• Characterization of natural seismicity</li> </ul>	<p>US, New Zealand &amp; Switzerland co-lead</p>

Issue	Current Actions	Task	Lead
<p><b>6) Mitigation Options</b>            Develop a set of risk mitigation strategies and best practices to help project stakeholders in all phases of a project.</p>	<p>Addressed in Updated US IS Protocol from technical and non-technical standpoints (education and insurance).            Modeling on this topic was presented at the Stanford workshop in January 2011. GEISER is working on science behind this using modeling.</p>	<p>A) Review the US IS Best Practices and GEISER Work Package results as they become available.            B) One year from now, re-assess with upcoming information, perhaps compiling and linking case studies. The focus will be on technical and communications aspects. It will include a synthesis of past events including cause and effect and will seek to move beyond traditional traffic light systems. Another issue that will need to be explored is how to incorporate delayed large events for stimulation and long-term operation.</p>	<p>US &amp; Switzerland co-leaders</p>

Issue	Current Action	Task	Lead
<p><b>7) Website</b></p>	<p>IEA-GIA and IPGT each have a web page</p>	<p>A) Create a functioning website for this group            B) Link the IEA-GIA page and IPGT?            C) Compile relevant search engines, references from past 5 years (including pdfs and/or links).</p>	<p>Mike Mongillo and Ella Thodal</p>
<p><b>8) Communication</b>            This task will discuss what should be communicated in general and what should be communicated at what stage of a project.</p>	<p>The updated US Induced Seismicity Protocol has information on this (pre-project as well).</p>	<p>A) The updated US Protocol will be distributed and reviewed.            B) Develop a sheet on Facts and Answers on Induced Seismicity. This paper will discuss what scientists in the geothermal community agree on and what is not agreed on.            C) Submit fact sheet to the IEA's "Open Bulletin."            D) Potentially develop a wikipedia-style living document.            E) Conduct interviews and report on the common experiences of induced seismicity from operators.</p>	<p>Revisit in 6 months at next meeting</p>