

**SHEER WP4 Report, 12.11.2015
for the Progress / PTM Meeting in ...
(WP Leader S. Cesca GFZ, representative IGF-PAS, AMRA, KNMI, Keu, KNMI)**

Short summary of the progresses of the period

Please provide a concise overview of the progress of the work in line with the structure of Annex I to the Grant Agreement (DoA)

- List of the staff actively involved in the WP4

GFZ Potsdam: Dr. Simone Cesca (SC, WP leader), Dr. Jose Angel Lopez Comino (JLC, Postdoc), Dr. Daniela Kühn (DK, Postdoc 20% dedication)

Univ. Keele: Dr. Rachel Westwood (RW, Research fellow/Associates), Mr. Sam Toon (ST, Research fellow/Associates), Prof. Peter Styles (PT), U. Keele (now retired), Dr Nigel Cassidy (NC), SHEER co-investigator, replaced PT as KeU lead Task Leader 4.3.

IGF PAS: Prof. Stanislaw Lasocki (SL, Task 4.2 leader), Dr. Constantinos Leptokarpoulos (CL), Eng. Monika Staszek (MS)

AMRA: Dr. Alexander Garcia /Task leader, T4.4), Dr. Simona Esposito (Researcher)

- Objectives expected after 6 Month

The activity of WP4 on induced seismicity has four main objectives: the characterization of induced seismicity, tracking migration of induced fractures, and thus the motion of fluids, and assessment of the seismic hazard induced by shale gas exploitation operations.

The planned activity of WP4 include four tasks: advanced seismic data processing, statistical description of the induced seismic process, multi-physical modelling of the fracturing process and time-dependent seismic hazard assessment and mitigation.

- A summary of progress towards objectives and details for each task in the first six months;

General project achievements

Attendance at kick-off meetings, setting up project team, liaison with SHEER partners, project initial administration.

Task evaluation, defining roles and responsibilities within teams

Technical achievements

In agreement with the timeline and objective at this stage, the work of WP4 has been first driven towards the analysis of project recollected datasets (e.g. Preese Hall), optimization and assessment of the network performance at the Polish site, and first methodological developments. The following technical achievements have been reached:

- ✓ The surface network at the Polish site has been fully installed, and first significant datasets (4 months monitoring before and during drilling operations, with no fracturing activity performed yet) has been very recently obtained (SC, JLC, DK).
- ✓ Development of tools for the assessment of the array response functions and its application to potential network geometries (SC, JLC).

- ✓ Extension of tools to generate synthetic catalogues and waveforms, needed to simulate realistic seismicity and test planned techniques in Task 4.1 (e.g. detection, location, source characterization, clustering) in a controlled environment (SC, JLC).
- ✓ Preliminary evaluation of monitoring and geological data held for the Preese hall site and its application/value for developing the numerical models of the fracturing processes (RW, ST)
- ✓ Evaluation of the capabilities of the current modelling software (FRACMAN, etc) to model hydro-fracturing process and inter-related fluid flow (RW, ST)
- ✓ Liaison with supplier of FRACMAN software to ascertain capabilities, develop specific SHEER-related application and obtain new licences and version of software (RW, ST).
- ✓ Obtain and evaluate 3D Move software for use with SHEER programme.(RW, ST).
- ✓ Evaluate and re-parametrise current KeU code (Matlab) for inclusion and adaptation into FRACMAN models (ST); Evaluation and assessment of current Comsol modelling capabilities for use with FRACMAN software (RW).
- ✓ Initial parametrisation of Preese hall data for development of fractured subsurface models (RW, ST).
- ✓ Review of the possessed software for the statistical description of the induced seismic process and for the time-dependent seismic hazard analysis. Adaptation of the software for SHEER purposes. Testing. (SL, CL, MS)
- ✓ Review of methods for PSHA associated with induced seismicity, with particular interest on (1) requirements for accounting for (aleatory and epistemic) uncertainties in the process, and (2) identifying intensity measures useful to integrate the results of hazard in the risk assessment associated with induced seismicity.

- Highlight clearly significant results;

Preliminary implementation of a toolbox for the generation of a synthetic seismic catalogue and synthetic waveform dataset; the tool will offer a controlled framework to assess the performance of monitoring networks and microseismicity analysis techniques.

- If applicable, explain the reasons for major deviations from Annex I and their impact on other tasks.

Not applicable

- If applicable, explain the reasons for failing to achieve critical objectives and/or not being on schedule and explain the impact on other tasks as well as on available resources and planning.

Not applicable.

- If applicable, propose corrective actions.

Not applicable

- Publications and papers in print

Not available

This section should not exceed two pages.

Deliverables due at the date

Table 1. Deliverables due at the date											
Del. no.	Deliverable name	Version	WP no.	Lead beneficiary	Nature	Dissemination level	Delivery date from Annex I (proj month)	Actual / Forecast delivery date Dd/mm/yyyy	Status No submitted/ Submitted	Contractual Yes/No	Comments

Please complete this table if deliverables are due for the reporting period

Not applicable

Milestones in the reporting period

Please complete this table if milestones are specified for the reporting period

TABLE 2. MILESTONES IN THE REPORTING PERIOD							
Milestone no.	Milestone name	Work package no	Lead beneficiary	Delivery date from Annex I dd/mm/yyyy	Achieved Yes/No	Actual / Forecast achievement date dd/mm/yyyy	Comments

Not applicable