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Topic: LCE 16 - 2014 Understanding, preventing and mitigating the potential environmental impacts and risks of shale gas exploration and exploitation

Project number: 640896

Project name: *SHale gas Exploration and Exploitation induced Risks*

Project acronym: SHEER

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Special interest for: ALL

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PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Content

1. Introduction

The SHEER First Annual Meeting was held in Napoli on June 7-9, 2016.
This deliverable represents a summary report of the main discussions and outcomes of the meeting.

2. Agenda

June 7, 2016	
13:00-14:00	***Buffet Lunch***
14:00-14:30	***Welcome addresses from the University of Napoli Federico II and the President of AMRA***
14:30-15:00	**Invited lecture: Grzegorz Pieńkowski (PGI - Polish Geological Institute)** ***Unconventional hydrocarbons – the Polish experience in the European dimension***
15:00-16:00	***State of the project after the first year (P. Gasparini - AMRA)***
16:00-16:30	***Coffee break***
16:30-18:30	***WP3 - Monitoring of the Wysin site (Chair: S. Lasocky, IGF-PAS)*** 16:30 – 16:35 Introduction (S. Lasocki, IGF-PAS) 16:35 – 17:00 Overview of on-site monitoring operations (J. Mirek, IGF-PAS) 17:00 – 17:25 GFZ contribution to WP3 (S. Cesca, GFZ) 17:25 – 17:45 Monitoring of groundwater condition (A. Gunning, RSKW Ltd) 17:45 – 18:00 Monitoring of air pollution 2015-2016 (J. Jaroslawski, IGF-PAS) 18:00 – 18:30 Discussion on the monitoring of the Wysin site (Chair: S. Lasocki, IGF-PAS)
16:30-18:30	***WP3 - Monitoring of the Wysin site (Chair: S. Lasocky, IGF-PAS)*** 16:30 – 16:35 Introduction (S. Lasocki, IGF-PAS) 16:35 – 17:00 Overview of on-site monitoring operations (J. Mirek, IGF-PAS) 17:00 – 17:25 GFZ contribution to WP3 (S. Cesca, GFZ) 17:25 – 17:45 Monitoring of groundwater condition (A. Gunning, RSKW Ltd) 17:45 – 18:00 Monitoring of air pollution 2015-2016 (J. Jaroslawski, IGF-PAS) 18:00 – 18:30 Discussion on the monitoring of the Wysin site (Chair: S. Lasocki, IGF-PAS)

19:30 – 21:00 PMT Dinner

June 8, 2016	
9:00-12:30	***WP2- Integration of SHEER data (Chair: B. Orlecka-Sikora, IGF-PAS)*** ***Integration process difficulties*** 9:00 – 9:10 The SHEER database environment, data access (M. Staszek, IGF-PAS) ***Type of data and information created during course of project*** 9:10 – 9:25 Wysin and Lubocino (M. Staszek, IGF-PAS) 9:25 – 9:45 Preese Hall and Beckingham (N. Cassidy - S. Toon, KeU) 9:45 – 9:55 The Geysers (M. Picozzi, University of Napoli Federico II) 9:55 – 10:05 Groeningen Field (E. Ruigrok, KNMI) 10:05 – 10:15 Gross Schoenebeck (D. Olszewska, IGF-PAS) 10:15 – 10:25 GEISER Project (S. Cesca, GFZ) 10:25 – 10:35 Wyoming Data (N. Cassidy, KeU) 10:35 – 10:45 Satellite data (G. Solaro, AMRA) 10:45 – 11:00 Discussion (Chair: B. Orlecka-Sikora, IGF-PAS)
11:00-11:30	***Coffee break***
11:00-12:30	11:00 – 11:40 Qualitative and quantitative summary of the present state of SHEER database with respect to the SHEER scientific objectives (B. Orlecka-Sikora, IGF-PAS) 11:40 – 11:55 Actions to improve the SHEER database – discussion (Chair: B Orlecka-Sikora, IGF-PAS) 11:55 – 12:05 Implementation of SHEER database to TCS AH (D. Olszewska, IGF-PAS) 12:05 – 12:15 Data Management Plan (S. Esposito, AMRA/B. Orlecka-Sikora, IGF-PAS) 12:15 – 12:30 Discussion (Chair: B. Orlecka-Sikora, IGF-PAS)
12:30-14:00	***Buffet lunch***
14:00-16:15	***WPs 4-5-6 - Induced seismicity, Assessment of groundwater chemistry and air quality impact*** ***Induced seismicity (Chair: S. Cesca, GFZ)*** 14:00-14:15 Realistic synthetic datasets to proof the performance of monitoring and seismological analysis in hydraulic fracturing environments (J. A. Lopez Comino, GFZ)

	14:15-14:30 IGF PAS activity in WP4 (S. Lasocki, IGF) 14:30-14:45 Parametric Modelling of Shale Gas Hydro-fracking (R. Westwood, KeU) 14:45-15:00 Fracture properties of fluid injection induced earthquakes at The Geysers geothermal field (A. Zollo, University of Napoli Federico II) ***Assessment of groundwater chemistry (Chair: A. Gunning, RSKW Ltd)*** 15:00 – 15:10 Overview of WP5 objectives for groundwater, progress on deliverables, context and forward plan (A. Gunning, RSKW) 15:10 – 15:25 The Development of Conceptual models and hydrogeological risk assessment for shale oil & gas basins in Europe – WP5.1 (C. Isherwood, RSKW; N. Montcoudiol, GLA; A. Gunning, RSKW) 15:25 – 15:35 Initial results from the processing and analysis of baseline hydrogeological and hydrochemical data collected to date, WP 5.2 (N. Montcoudiol, GLA; C. Isherwood, RSKW) 15:35 – 15:45 Discussion points, Q& A, planned publications (IAH, QJEGH, Univ of Birmingham Conference) (A. Gunning, RSKW; N. Montcoudiol, GLA; C. Isherwood, RSKW) ***Air quality impact (Chair: J. Jarosławski, IGF-PAS)*** 15:45 – 16:05 Results of air pollution measurements in the vicinity of Wysin site (J. Jarosławski, IGF-PAS) 16:05 – 16:15 Discussion
16:15-16:45	***Coffee break***
16:45-17:15 ***17:15-18:15***	**Invited speech: Franco Terlizzese (MISE – Italian Ministry of Economic Development)** ***Recent regulations on monitoring of on-land and off-shore hydrocarbons activities in Italy*** ***WP 7 - Multi hazard and multi risk analysis, vulnerability and economic issues (Chair: A. Garcia-Aristizabal, AMRA)*** 17:15 – 17:35 Framework for multi-hazard risk assessment of shale gas operations: Overview (A. Garcia-Aristizabal, AMRA) 17:35 – 17:55 Physical vulnerability and seismic risk associated with induced seismicity (title to be better defined) (S. Esposito, AMRA) 17:55 – 18:15 Identification of indicators for assessing socio-economic impacts (R. Russo, AMRA)
20.00-22.00	***Social Dinner***

June 9, 2016	
9:00-10:00	***WP8 - Best practices and Dissemination (Chair: N. Cassidy, KeU)*** 9:00 – 9:20 Presentation by N. Cassidy (KeU) covering: * Progress on dissemination and communication. * Methods for stakeholder identification and engagement. * Dissemination routes to the wider SHEER community - what works and what doesn't. * What we need to do next to link in with the scientific and end-user community. 9:20 – 9:50 "Open forum" question and answer session (KEU team to lead) on: * How do we make SHEER more widely accessible to the end-users? * How will integration with EPOS-IP help us? * Who do we need to target as Key SHEER partners for the future? * How best to engage wider industry with SHEER in each EU country and further overseas (e.g., US, China, Australia)? * What about Public awareness, education and training? 9:50 – 10:00 Minute summary of actions for the coming year (N. Cassidy, KeU).
10:00-10:30	***Findings of other H2020 projects*** 10:00 – 10:10 M4ShaleGas (J. ter Heege, TNO) 10:10 – 10:20 FRACRISK (C. McDermott, University of Edimburgh)
10:30-11:00	***Coffee break***
11:00-12:30	***Advisory Board meeting*** ***&*** ***Meeting with other projects' representatives to discuss participation to the call H2020-LCE-27-2017***
12:30-13:30	***Advisory Board report and discussion***
13:30-14:30	***Buffet Lunch***

3. **List of participants**

The list of participants is reported in Annex I.

4. Report

All of the above mentioned presentations will be available on the SHEER webpage.
During the first day, the Project Management Team was held.
The minutes of the PMT meeting are reported below.

5. Minutes of the Project Management Team

Participants:

AMRA: Paolo Gasparini (PG), Alfonso Rossi Filangieri (ARF)
IGF-PAS: Stanislaw Lasocki (SL)
KeU: Nigel John Cassidy (NJC)

Angela Di Ruocco (ADR) *AMRA*, Ania Lisowska (AL) *IGF-PAS* and William L. Ellsworth (WLE) *Stanford University* have been invited to join the meeting

Agenda:

1. Budget issues
2. UW and data from USA
3. Relationship with other projects
4. Improvement of dissemination activities
5. Next annual meeting

All the aforementioned items have been widely discussed and the main outcomes and actions are described as follow:

1. Budget issues:
IGF-PAS has already undertaken actions that have increased their costs. Budget adjustments have been decided during past PMT meetings to face these needs. No further transfers to IGF will be possible in the future. Charge or transfer of other duties to IGF must be avoided. If necessary the coordinator will send an email to the partners.

2. UW and data from USA:
Data from Hydrocarbons extraction are missing. We are trying to get a data set from USA. NJC will contact people from Ohio to investigate this possibility (a free data set should be available). We will receive information in the next months.

3. Relationship with other projects:
Alex Garcia will participate to the M4SHALEGAS project meeting.
The participation to the new H2020 call has to be discussed with representatives from the other projects.
We will propose to participate having the Pomerania site as a laboratory for Europe.
Having a monitoring system already in place in the site could be a very strong point of this proposal.

4. Improvement of dissemination activities:
Partners will be emailed asking to send update for the "reference" section of the SHEER website.

At the moment the website is not outreaching and the main problem seems to be a lack in communication among the different SHEER research groups. They should be encouraged to improve the communications through for example webinars.

6. Minutes of the Advisory Board

The First Annual Meeting of the SHale gas Exploration and Exploitation induced Risks (SHEER) project was held on June 7-9, 2016 in Naples, Italy. The purpose of the meeting was to review progress made in the first year of the SHEER project, present plans for the coming year and share knowledge and experience among project members and with representatives of other Horizon 2020 shale-gas projects.

The Advisory Board (AB) provides the SHEER management with advice on the overall direction of the project, monitors progress in meeting milestones, and offers solutions to problems that it identifies or are referred to it by management. This report on the Annual Meeting covers both presentations made at the meeting and observations from the AB about the status and direction of the project.

The AB is encouraged by the many accomplishments made during the first year. It was particularly helpful for our review to have access to almost all of the presentations made at the meeting. The AB hopes that all will all be available in the future, as they contain a wealth of valuable information (http://www.sheerproject.eu/events/first-annual-meeting.html).

The overall goal of the SHEER project is to develop a scientific understanding of potential environmental impacts of shale gas development and the associated risks to society, and to develop options for preventing and mitigating those hazards. The SHEER workplan is divided into eight work packages, all of which were reviewed and discussed in detail during the course of the Annual Meeting. We report below our review comments and suggestions for each work package before concluding with some closing remarks.

WP1. Project Management and Coordination: Project Coordinator Paolo Gasparini reported that all benchmarks for the first year were achieved. As can be anticipated in a project of this scope and complexity, some adjustments to the budget were necessary, but overall the finances of the project are on-track.

WP2. Compilation of SHEER Database: The ambitious database project assembles a multidisciplinary suite of data from both retrospective case studies and SHEER field investigations. The objective is to provide a broad user community access to basic and synthesized data covering all the relevant environmental risks of shale gas development. The database is now online (sheerwer.igf.edu.pl/fa/) and had been accessed by researchers from over 40 institutions at the time of the annual meeting. The complexity of harmonizing the many different data types is well appreciated by the AB. Although some intended case studies have not as yet been assembled (North American experience with hydraulic fracturing, in particular), database development going forward should focus on new data, particularly that coming from the Wysin, Poland, site.

WP3. On Site Monitoring: The SHEER project is unique among its Horizon 2020 peers, as the only one conducting field experiments to collect environmental data during shale gas development operations. As a consequence, this workpackage is central to the success of the project. Impressive progress was made during the first year of the program to install the complete monitoring system for seismicity, groundwater and air quality at the Wysin, Poland site before hydraulic fracturing operations were underway. Adjustments made to the budget to install the monitoring systems were both necessary and prudent.

It was revealed at the meeting that Polish Oil and Gas SA would begin fracking of the first of two wells in June and planned to complete the second well by mid-July. The AB looks forward to a

report on the operations, what was observed and what was learned in the near future. This should ideally include not only the monitoring results, but also lessons learned from local residents and politicians about both the frac job itself and the SHEER monitoring program. Communication of the findings to the local community as well as broader audiences is strongly encouraged.

We also recommend that efforts to engage with the company continue, as the need to maintain monitoring systems and understand their outputs does not end with the completion of the well stimulation. Even if little or no progress is made in this regard, developing a geological model from public data remains an important gap that needs to be filled. Such a model is needed not only for interpretation of the deep processes and potential pathways to the near surface, but also for microzonation studies in support of the hazard and risk assessment in WP7.

WP4. Assessment of Induced Seismicity: Work in WP4 during the first year of the project focused on testing and improving the seismic monitoring system, analysis of data from analog sites, and application of geomechanical models for parametric studies of hydraulic fracturing. Now that operations have taken place at the Wysin site, work should pivot toward analysis of data collected there. For example, planned work on seismic interferometry to monitor time-dependent changes in the subsurface should now go forward. Similarly, seismological knowledge gleaned from analog sites, such as The Geysers geothermal field, should now be applied to the Wysin observations. Computational modeling of the fracture process should also advance. The AB recommends the inclusion of shear failure modes (hydroshear) and hydraulically conductive fractures and faults as essential elements of the geomechanical model, in addition to tensile failure modes.

WP5. Assessment of Groundwater Chemistry: The successful installation of the groundwater monitoring sites at Wysin represents a major accomplishment for the project. The pre-frac model estimate of 6 years for diffusion from the horizontal wells to the monitoring wells will be important to test, for obvious reasons, emphasizing the need for the development of a stable, forward-looking monitoring program. Periodic communication of findings, even if no changes are detected is encouraged.

WP6. Assessment of Air Quality Impacts: This element of the project also appears to be on-track and will continue to play a central role in the development of lessons-learned and conclusions from the Wysin experience. Should the Wysin site move into production of shale gas, release of methane into the atmosphere from either the wells or surface facilities has the potential to become an important societal issue. Will the monitoring system have the ability to provide authoritative and unbiased data?

WP7. Multi-Hazard and Multi-Risk Analysis: The development of an integrated approach to hazard and risk analysis from multiple treats presents challenges on many levels. It is not only an important area of research synthesizing contributions from many disciplines that are rarely in direct contact (geological sciences, social sciences, economics, etc.), but must also grapple with the need to communicate findings to diverse audiences with potentially very different levels of knowledge. The presentations by this workpackage at the annual meeting were helpful in two ways. First, the AB received a useful tutorial in the approach to multi-hazard risk assessment being employed for SHEER (i.e. the bow-tie approach). The presentations also clarified differences between nuisances that pose a serious risk to the license-to-operate to companies and extreme events that pose a physical danger to people and property. The lack of trust on the part of the public, as amplified through most media, potentially stems from a perceived lack of transparency. How can the SHEER project best contribute knowledge that reach the diverse audiences that are all legitimate stakeholders?

The difficulty of characterizing the seismic response of buildings in the study areas, already pointed out in the kick-off meeting, still persists. This information is crucial to assess the vulnerability (and in part the exposure) of the study areas and consequently to quantify the risk. From an engineering point of view, we know that the onset of structural damage can be associated with

earthquakes as small as magnitude 4 to 5. Since induced seismicity is more likely to produce smaller magnitude events (3 to 4), particular attention should be paid to the characterization of heavy, non-structural elements (roof covers, chimneys, etc.) that can be damaged by small seismic events.

WP8. Guidelines for Best Practice and Dissemination: There is broad agreement among the participants in SHEER and the AB that communication presents both a huge challenge and critical opportunity for the project. A clearer definition of the communication goals is needed. With limited resources, the project must sharpen its focus by better defining the stakeholder groups and the most effective ways of communicating with them. In particular, WP8 should make tools available to all participants so that all can work in a coordinate manner to achieve the goals. WP8 should also explore ways to motivate the entire team to promote the whole project, not just their specific part.

Stakeholders are many, their technical knowledge highly varied, and the sources they use for obtaining information span the range from the most traditional media to the latest internet sensation. Key stakeholder classes discussed at the meeting include the energy industry, academic partners and the public at large. The public alone is comprised of many different groups. At the local level alone they include residents, elected officials, government agencies, businesses, etc., all of which may use and trust different sources of information.

The AB was encouraged to learn that the newsletter has been well received with currently about half of the subscribers in the energy industry and approximately 40 percent in government. One AB member shared that they had received it from six different sources. A new issue of the newsletter featuring initial results and conclusions from Wysin should be a priority. If politically feasible, pushing the same information to mainstream media, where it would be seen by many, should also be explored.

We were also encouraged to learn that outreach efforts to residents of the Wysin area have gone well during the period of instrumentation installation. What additional information, if any, has been shared with them following the fracking of the wells? Much can be gained from this experience about communication methods and message content.

Increased coordination with the three other Horizon 2020 projects should also be developed. We were encouraged by the positive response at the meeting from FRACRISK to develop more inter-project cooperation, particularly on the complementary parts, of which there are many. More can be done to engage with industrial stakeholders and the broader academic community, potentially through professional societies (SPE, SEG, AAPG, etc.). The AAPG European meeting schedule for the fall of 2017 might be an excellent target for a session highlighting the work of all four projects.

Going Forward: The clock on the SHEER project is rapidly advancing. A decision will need to be made soon on proposed follow-up work, possibly in partnership with participants in the other Horizon 2020 projects. It is for this reason that we strongly encourage a joint workshop involving all four projects at an early date, as the other projects are on an even tighter time schedule. Among many critical questions to explore are the specific, practical recommendations for future regulatory guidelines that emerge from the projects. SHEER has a key role to play here as it synthesizes the lessons from its monitoring and societal engagement experiences at Wysin.

ANNEX I

List of participants

N°	SURNAME	NAME
P. N° 1 - AMRA - ANALISI E MONITARAGGIO DEL RISCHIO AMBIENTALE SCARL		
1	BASCO	ANNA
2	CAPUANO	PAOLO
3	DI RUOCCO	ANGELA
4	ESPOSITO	SIMONA
5	GARCIA	ALEXANDER
6	GASPARINI	PAOLO
7	ROSSI FILANGIERI	ALFONSO
8	RUSSO	RAFFAELLA
9	SOLARO	GIUSEPPE
P. N° 2 – IGF- PAS- INSTITUTE OF GEOPHYSICS, POLISH ACADEMY OF SCIENCES		
1	JAROSLAWSKI	JANUSZ
2	LASOCKI	STANISLAW
3	LISOWSKA	ANNA
4	LIZUREK	GRZEGORZ
5	OLSZEWSKA	DOROTA
6	ORLECKA SIKORA	BEATA
7	STASZEK	MONIKA
P. N°3 KeU - UNIVERSITY OF KEELE		
1	CASSIDY	NIGEL
2	TOON	SAM
3	WESTWOOD	RACHEL
P. N°4 - GEOFORSCHUNGSZENTRUM POTSDAM		
1	CESCA	SIMONE
2	COMINO	JOSE' ANGEL LOPEZ
3	DAHM	TORSTEN
P. N°5 – KNMI - KONINKLIJK NEDERLANDS METEOROLOGISCH INSTITUUT		
1	RUIGROK	ELMER
P. N°6 – RSK - RSK W Ltd		
1	GUNNING	ANDREW
2	ISHERWOOD	CATHERINE
P. N° 7 – UGL - UNIVERSITY OF GLASGOW		
1	MONTCOUDIOL	NELLY
ADVISORY BOARD		
1	DOLCE	MAURO
2	DI BUCCI	DANIELA
3	ELLSWORTH	WILLIAM
4	GREEN	ROBERT
5	MARKIEWICZ	JAN KACPER
6	PIENKOWSKI	GRZEGORZ
7	TERLIZZESE	FRANCO

MINISTRY OF ECONOMIC DEVELOPMENT – ITALY		
1	ANTONCECCHI	ILARIA
TNO		
1	TER HEEGE	JAN
UNIVERSITY OF EDINBURGH		
1	MC DERMOTT	CHRIS
UNIVERSITA' DI NAPOLI FEDERICO II		
1	ZOLLO	ALDO
2	PICOZZI	MATTEO
3	COLOMBELLI	SIMONA
UNIVERSITA' DI SALERNO		
1	SCARPA	ROBERTO