Project acronym and title:
SECURe – Subsurface Evaluation of Carbon capture
and storage and Unconventional Risk

MINUTES OF SECURE SECOND GENERAL ASSEMBLY, MANAGEMENT BOARD AND ADVISORY BOARD MEETINGS 16 – 17 JUNE 2020

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	By	**Date**
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Public introduction

Subsurface Evaluation of CCS and Unconventional Risks (SECURe) is gathering unbiased, impartial scientific evidence for risk mitigation and monitoring for environmental protection to underpin subsurface geoenergy development. The main outputs of SECURe comprise recommendations for best practice for unconventional hydrocarbon production and geological CO_2 storage. The project is funded from June 2018–May 2021.

The project is developing monitoring and mitigation strategies for the full geoenergy project lifecycle; by assessing plausible hazards and monitoring associated environmental risks. This is achieved through a program of experimental research and advanced technology development that includes demonstration at commercial and research facilities to formulate best practice. We will meet stakeholder needs; from the design of monitoring and mitigation strategies relevant to operators and regulators, to developing communication strategies to provide a greater level of understanding of the potential impacts.

The SECURe partnership comprises major research and commercial organisations from countries that host shale gas and CCS industries at different stages of operation (from permitted to closed). We are forming a durable international partnership with non-European groups; providing international access to study sites, creating links between projects and increasing our collective capability through exchange of scientific staff.

Executive report summary

This deliverable comprises the minutes of the SECURe second annual meeting and General Assembly, June 16-17 2020, Management Board and feedback from the Advisory Board. The meeting was originally scheduled to be hosted at the BRGM Head Office, Orléans, France, but travel restrictions associated with the Coronavirus outbreak led the Management Board to agree, after also consulting the Project Officer, that a remote meeting on the original dates would allow for greatest participation by project beneficiaries. The 16 consortium beneficiaries were represented by participants (with 74 delegates attending by remote connection) from 7 member states of the EU and Norway. The Advisory Board was represented by 7 participants calling in from the UK and North America.

Tuesday 11th commenced at 13.00 with a welcome from host Philippe Freyssinet, Director, Strategy, Research and Communication from BRGM. The afternoon started with a project overview given by E Hough (UKRI-BGS, project co-ordinator). There followed a series of work package reports from the technical work packages 2–6, given by respective work package leads. This was followed by comments given by the Advisory Board. Day 1 closed with a reflection on the afternoon given by Jonathan Pearce (UKRI-BGS).

Wednesday 17th commenced with a series of individual work package meetings, with the MSTeams platform allowing attendance at more than one WP meeting for researchers involved in more than one work package. There was a short presentation on SECURe data management led by Mary Mowat (UKRI-BGS, SECURe data manager). An extended break allowed for the attendance by members of the Advisory Board based in north America. The afternoon session began at 14.45, with short presentations focussing on Innovation and SECURe (Rhian Kendall, UKRI-BGS, SECURe Innovation manager) and communications and dissemination activities within the project (Philippa Parmiter, SCCS-UEDNIN). Jonathan Pearce (UKRI-BGS) led an interactive session on the development of recommendations as the main project outcomes, considering both the content and format that recommendations could take; the Advisory Board offered feedback and observations on these. Prof Mike Stephenson (UKRI-BGS, Executive Chief Scientist) gave a final address illustrating how the SECURe research portfolio continues to be relevant to UK and EU efforts to decarbonise.

1 Introduction

The SECURe project was developed in response to the European Commission-INEA Horizon 2020 2016-7 'Secure Clean and Efficient Energy' work programme, LCE-27-2017 'Measuring, monitoring and controlling the potential risks of subsurface operations related to CCS and unconventional hydrocarbons'.

The potential environmental impacts of shale gas and CCS technologies need to be better understood. The recent expansion of the unconventional gas industry in North America and its potential advent in Europe has generated public concern regarding the potential detrimental impacts on air, water and the land. Mitigation of the steep rise of greenhouse gas emissions and the related climate changes will need to include CO_2 storage in deep geological reservoirs. Both activities utilise deep-lying geological formations and may induce similar impacts via similar pathways, including induced seismicity, detrimental fluid migration and displacement of brines.

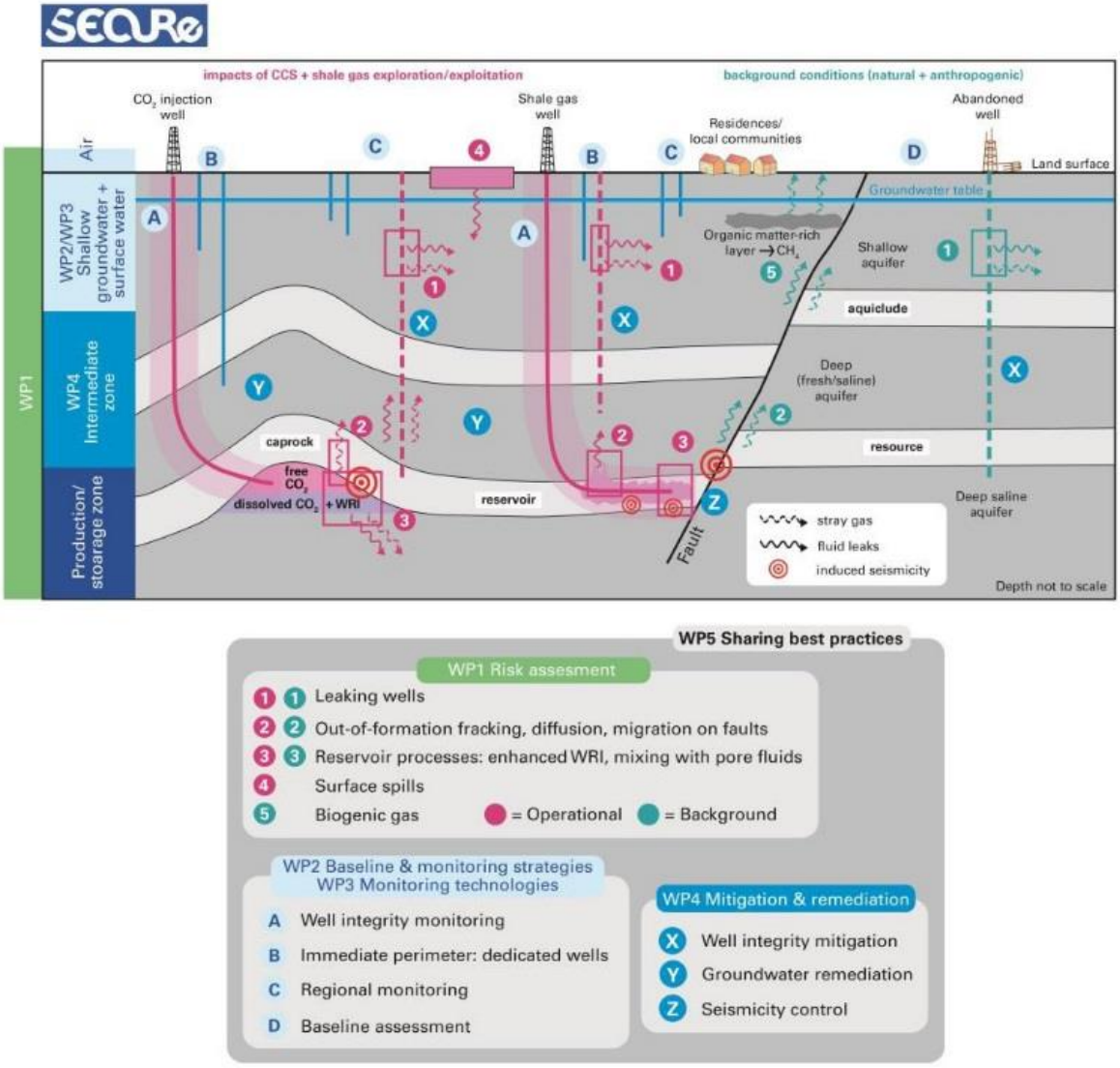


Figure 1 **The SECURe Concept – providing best practice recommendations across these domains for the protection of groundwaters, surface environments and local communities. Courtesy W. Kloppmann**

A key objective of SECURe is to integrate the broad expertise that the consortium maintains in the fields of both CO_2 storage *and* shale gas monitoring across the key spatial and temporal domains relevant to geoenergy project development (Figure 1). The membership of the SECURe partnership is a major asset as it includes several National Geological Surveys and major research organisations from EU member states that host shale gas and CCS projects at different stages of operation (from permitted to closed), as well as companies actively involved in the deployment of CCS and exploitation of unconventional gas.

The SECURe project has the following specific objectives:

1. To produce a risk assessment framework for assessing the hazards and likelihoods of specific risks that relate to the protection of the environment in CO_2 storage and shale gas operations.
2. To demonstrate best practice in establishing baseline conditions for subsurface geoenergy operations by working across a network of both commercial, pilot and research-scale sites in Europe and internationally, underpinned by laboratory measurements and model up-scaling to the field scale.
3. To develop new technologies to improve the detection and monitoring of environmental impacts related to geoenergy projects.
4. To investigate new methods for remediating potential environmental impacts of geoenergy projects specifically to reduce leakage from wells or naturally occurring permeable pathways.
5. To develop best practice guidelines for the shale gas and CO_2 storage industries specifically in environmental baseline assessment and monitoring; the intention is that these will not unduly delay the development of new technologies or innovations.
6. To understand the needs of a range of stakeholders, including local communities, and to engage them through the development of appropriate communication strategies, including participatory monitoring and through the education of early-career researchers.
7. To leverage best practice through collaboration with leading groups in the USA, Canada and Australia.

SECURe will achieve this by:

1. Developing frameworks for quantifying and managing risks including impact assessment (monitoring and characterisation) for developing and implementing effective remedial strategies and to contribute to the evidence base underpinning policy making;
2. Investigating leakage processes and impacts at the laboratory and field-scale using a portfolio of existing European and North American facilities and field sites to better characterise and quantify relevant risk factors;
3. Developing, applying and testing a range of monitoring technologies, systems and strategies to contribute to effective (best practice) risk evaluation, establishment of baseline conditions and monitoring and management of impacts;
4. Explore opportunities of participative monitoring as an aspect of public engagement.
5. Provide a series of recommendations for best practice that can be used as a dataset to inform effective regulation and monitoring strategies for shale gas and CCS sites.

The SECURe project is funded June 1 2018 – May 31 2021, and this report is the minutes of the

second General Assembly meeting, held remotely via MS Teams, 16-17 June 2020 (originally planned to be held at BRGM in Orléans).

2 H2020 SECURe project Second Annual General Assembly meeting, 16-17 June 2020 (Held via Remote link)

Papers circulated prior to the meeting are given in Appendix 1. Appendix 2 gives minutes of the June 2020 management board meeting. The Powerpoint slides used to illustrate some of the innovative activities are given in Appendix 3.

2.1 AGENDA

Subsurface Evaluation of Carbon capture and storage and Unconventional Risk (SECURe), grant agreement reference: ENER/H2020/764531/SECURe
Held by remote MS Teams connection, 16-17 June 2020.

Item		Day	Time (CET)
1	Welcome Address: Philippe Freyssinet, Directeur, Direction de la Stratégie, de la Recherche et de la Communication, BRGM	Tuesday 16 June 2020	14.00
2	Project overview (Ed Hough, project co-ordinator, UKRI-BGS) Standing Items: Agenda- AOB WP1 (Ethics) Refer to Deviations report from Reporting Period 1 report, and tables S1-S4 Deliverable and Milestone schedule		14.05
3	WP2 report (Jens Wollenweber, TNO)		14.30
	WP3 report (Wolfram Kloppmann, BRGM)		
	WP4 report (Mateo Icardi, UNOTT)		
	Break		***16.00***
4	WP5 report (Pierre Cerasi, SINTEF)		16.15
	WP6 report (Jonathan Pearce, UKRI-BGS)		
	Break		***17.15***
5	Comments and thoughts from the SECURe Advisory Board		17.30
6	Reflection on the day (Jonathan Pearce, UKRI-BGS)		18.00
	Meeting close		***18.15***
		Wednesday 17 June 2020	
7	Individual work package meetings		10.15 – 11.45
8	Data management (Mary Mowat, UKRI-BGS)		11.45 – 12.15
	Break		***12.15 – 14.45***
9	Innovation in SECURe- assessment of innovations (Rhian Kendall, UKRI-BGS):		14.45 – 15.15

	Individual innovations in SECURe- 1-2 slides per innovation Getting the message out (Jan Hennissen, UKRI-BGS)		
10	SECURe communications strategy (Philippa Parmiter, SCCS-UEDIN)		15.15 – 15.45
	Break		15.45 – 16.00
11	Recommendations as the main project outcomes- discussion session facilitated by Jonathan Pearce (UKRI-BGS), with input from WP leads and all beneficiaries; comment from Advisory Board		16.00 – 16.50
12	Final address and thanks (Mike Stephenson, Executive Chief Scientist, UKRI-BGS)		16.50 – 17.00
	Meeting close		**17.00**

2.2 ATTENDEES

Co-ordination

Ed Hough	(Meeting Chair)	BGS
Karen Kirk		BGS
Rhian Kendall		BGS
Jan Hennissen		BGS

WP leads

WP2: Jens Wollenweber	TNO
WP3: Wolfram Kloppmann	BRGM
WP4: Matteo Icardi	UNOTT
WP5: Pierre Cerasi	SINTEF
WP6: Jonathan Pearce	BGS

Invitees:
Beneficiaries

Aleksandra	Lis	Adam Mickiewicz University in Poznan
Krzysztof	Maczka	Adam Mickiewicz University in Poznan
Katarzyna	Iwinska	Adam Mickiewicz University in Poznan
Michaela	Blessing	BRGM
Mikael	Delatre	BRGM
Mariia	Dezes	BRGM
Philippe	Freyssinet	BRGM
Frederick	Gal	BRGM
Aochi	Hideo	BRGM
Thomas	Le Guenan	BRGM
Jean-Claude	Manceau	BRGM
Ben Rhouma	Sabrine	BRGM
Mike	Duijn	Erasmus Research & Business Support BV
Carsten M.	Nielsen	Geological Survey of Denmark and Greenland (GEUS)
Trine	Dahl-Jensen	Geological Survey of Denmark and Greenland (GEUS)
Rasmus	Jacobsen	Geological Survey of Denmark and Greenland (GEUS)

Peter	Voss	Geological Survey of Denmark and Greenland (GEUS)
Tatiana	Goldberg	GFZ Potsdam
Cornelia	Schmidt-Hattenberger	GFZ Potsdam
Eunseon	Jang	GFZ-Potsdam
Andreas	Busch	Heriot-Watt University
Roberto	Rizzo	Heriot-Watt University
Audrey	Estublier	IFPEN
Pascal	Longuemere	IFPEN
Pascal	Ricroch	IFPEN
Piotr	Letkowski	INIG - PIB
Wieslaw	Szott	INIG - PIB
Mirosław	Wojnicki	INIG - PIB
Adam	Wójcicki	Polish Geological Institute - National Research Institute
Olga	Lipińska	Polish Geological Institute - National Research Institute
Joanna	Fajfer	Polish Geological Instiute-National Research Institute
Monika	Konieczyńska	Polish Geological Instiute-National Research Institute
Matt	Beeson	Risktec Solutions Ltd
Emma	Hurdle	Risktec Solutions Ltd
Michael	Kupoluyi	Risktec Solutions Ltd
Philippa	Parmiter	SCCS-University of Edinburgh
Bastien	Dupuy	SINTEF
Laura	Edvardsen	SINTEF
Hossein	Fazeli	SINTEF
Anouar	Romdhane	SINTEF
Ali	Taghipour	SINTEF
Amir	Ghaderi	SINTEF Industry
Logan	Brunner	TNO - Netherlands Organisation for applied scientific research
Thibault	Candela	TNO - Netherlands Organisation for applied scientific research
PA	Fokker	TNO - Netherlands Organisation for applied scientific research
Al	Moghadam	TNO - Netherlands Organisation for applied scientific research
Jan	ter Heege	TNO - Netherlands Organisation for applied scientific research
Bogden	Orlic	TNO - Netherlands Organisation for applied scientific research
Marianne	van Unen	TNO - Netherlands Organisation for applied scientific research
Jurgen	Foeken	TNO - Netherlands Organisation for applied scientific research
Anthony	Credoz	TOTAL
Eric	Cauquil	TOTAL
Megan	Barnett	UKRI-BGS
Simon	Gregory	UKRI-BGS
Colm	Jordan	UKRI-BGS
Melinda	Lewis	UKRI-BGS
Chris	Rochelle	UKRI-BGS
Mike	Stephenson	UKRI-BGS
Helen	Taylor-Curen	UKRI-BGS
Ceri	Vincent	UKRI-BGS
Jade	Ward	UKRI-BGS
Robert	Ward	UKRI-BGS

Jim	White	UKRI-BGS
Corin	Jack	University of Edinburgh
Yukun	Ji	University of Nottingham
Federico	Municchi	University of Nottingham
Nicodemo	Di Pasquale	University of Nottingham
Veerle	Vandeginste	University of Nottingham

Advisory Board

Ken	Cronin	Advisory Board	UK Onshore Operators Group
Marcella	Dean	Advisory Board	Shell Global Solutions International B.V.
Don	Lawton	Advisory Board	Carbon Management Canada Inc
Tony	Lemay	Advisory Board	AER|Alberta Geological Survey
Noramalina	Mansor	Advisory Board	UK Government- BEIS
Kevin	Parks	Advisory Board	Deep Time
Gerhard	van der Linde	Advisory Board	Golder Associates

Apologies
Pauline Smedley (UKRI-BGS)
Alwyn Hart (Advisory Board- UK Environment Agency)
Katherine Romanak (Advisory Board- BEG Texas)
Luke Warren (Advisory Board- CCSA)

2.3 MINUTES OF H2020 SECURE PROJECT SECOND ANNUAL GENERAL ASSEMBLY MEETING, 16-17 JUNE 2020

Tuesday June 11, meeting started at 14.00.

Item 1: Welcome (Philippe Freyssinet, BRGM)

A welcome was given by **P Freyssinet**. He highlighted the role of the subsurface and new energy technologies in the energy transitions that will be required to meet low-carbon targets of many member states. He also said that the SECURe project has a strong fit to the wider BRGM energy research strategy.

Item 2, 3: Project overview (Ed Hough, EH, SECURe co-ordinator)

EH introduced the format of the meeting and asked that slides used by various presenters be sent to Jan Hennissen (janh@bgs.ac.uk) (UKRI-BGS).

A summary of 'SECURe by numbers' informed of 3 papers, 17 conference presentations, 20 deliverables and 8 milestones completed to date. EH highlighted that there were, however, 32 deliverables yet to complete, and that distilling good practice from those deliverables would be a major challenge for the project.

A strength of the consortium rests in the multiple field sites, diverse laboratory work, trans-Atlantic connections and engagement with the public and stakeholders. However, these also represent significant risks to the project given current working restrictions associated with the

Coronavirus pandemic. Many deliverables have been delayed (with the agreement of the Project Officer), and any further delays from the list at https://core.opentext.eu/app/#/files?1294248365084645885 should be discussed with the relevant WP lead and EH for agreement with the Project Officer; a project risk register is also stored at https://core.opentext.eu/app/#/files?1299230535410785154, and again any revisions to this should be forwarded via WP leads to EH.

Project highlights include several workshops, the completion of a successful fact-finding mission to North America (September 2019), and the release of results from laboratory and field experiments; along with the results of the Bow-Tie risk assessment, these will provide the foundation and evidence-base of the good practice recommendations from the project.

Standing items were discussed:

- Project plan- deviations from this must be discussed with WP leads in the first instance; a revised project plan (incorporating deviations reported in RP1 and also revised delivery dates following the Coronavirus pandemic) is being compiled and will be released via OpenText and email. Deviations to the project are captured in the RP1 documentation (also circulated to consortium in the meeting papers); it is important that any major changes to budgets be discussed and agreed before actions are implemented;
- Ethics- EH invited comment on the following, and also for all to keep a watching brief on related activities and report any changes via WP leads. We have a duty to maintain:
    - Informed consent procedures;
    - Follow H2020 Ethics standards and guidelines;
    - To mitigate potential harm to the environment stemming from SECURe activities.
- Data management- covered by Item 8.

EH gave a summary of main points of feedback from the RP1 reporting (January 2020) and subsequent meeting (February 2020). Results of this process had been circulated previously, and are also available on the EU project portal. EH reminded project partners:

- "as the project has just started the last reporting period…important that no delays are accumulated during implementation"
- Gender balance- "keep appropriate documentation about steps and measures in place- to be incorporated in the next periodic report"
- Certificate on the Financial Statement if actual costs + unit costs is above €325,000 (failure of this may delay and/or reduce payments);
- No critical review of the deliverables has yet taken place and revisions may be required during end of project reporting.

Additionally, there is a requirement for all project partners to check the project spend in terms of cash vs. person months.

ACTION: ALL to review person months vs. cash spend and let EH know of any significant deviations (e.g., 10 – 15%) from what was originally proposed.

EH reminded all to circulate deliverable reports to allow for comments from co-authors, WP lead, an independent WP lead and co-ordinator to be incorporated; the use of OpenText is

encouraged (all but French partners), and associated datasets generated or modified using SECURe funds also to be discussed with the SECURe data manager. It is important that project templates are used for deliverable reports, and acknowledgement of funding given in presentations, papers and other outputs. For deliverable reports, an additional thumbnail image and short description of the deliverable will allow it to be linked from the SECURe website. Early circulation of draft deliverables is especially important as we move into the final year of the project, as a contingency of additional time to complete deliverables becomes much less. As a project, we also need to report on the green/gold open access of papers, and this information should be submitted along with the text of any papers for linking through from the project website.

EH also asked that any activities related to dissemination were flagged via the WP leads- as conference presentations, posters and papers can be publicised via the SECURe communications team and website, and also websites of partner organisations.

EH reviewed some of the requirements related to financial matters:

- Payments following RP1- beneficiaries to confirm details
- Keep reviewing gender balance
- Keep reviewing person months vs cash cost to project- we will work through partner's submissions following RP1 submissions and advise where there are discrepancies
- Final financial reporting- remind that these need to be submitted in a timely way - 60 days following 1 June takes us to 31 July- summer holidays, partners will need the PLSIGN available to approve submissions and financial officers who are familiar with the process
- When submitting financial reports, refer to wording on original proposal and use this where possible (unless costs were not foreseen)
- Procurement; subcontracts- follow your institutes guidelines (adhere to H2020 rules)

ACTION: Partners to confirm bank details to facilitate payments from UKRI-BGS (if not already done).

EH closed by reminding partners that a main output of the project is to understand the relevance of research, in terms of how SECURe work can improve CO_2 storage, shale gas and other energy (e.g., geothermal) operations. He suggested some of these thoughts could be captured in the conclusions of deliverable reports, which will allow main messages to be fed in a clear way to work package 6 that will collate the good practice recommendations coming from the work.

Finally, EH said that the final meeting would be hosted by UKRI-BGS, likely April 2021, with the location to be agreed.

EH invited any questions or points for other business; there being none, EH confirmed the minutes and papers circulated prior to the meeting as valid.

Item 3,4: Work package meetings

Work Package 2- Jens Wollenweber (JW, TNO)

In **WP2** well integrity, fractures, fault permeability, induced seismicity and water quality impacts will be evaluated in geological settings typical for CO_2 injection and unconventional gas exploitation. In this context, numerical models that predict leakage and induced seismicity threats will be produced. Ultimately, this will result in a set of guidelines that permit conducting transparent and verifiable risk assessments.

JW gave an appraisal of the developments and initial research results from the past year.

The work package has seen significant site specific results from field sites (Borden, Vrogum and Borzecin), many of which have already been reported in deliverable reports 2.2 and 2.3. There are strong links between P2 and 5, especially on the topic of wellbore integrity. JW said that the work package was working to address which risks associated with CCS/shale gas are most important (acknowledging that risks may be different for the different industries), and also looking at which risks need to be the focus of monitoring.

Work Package 3- Wolfram Kloppmann (WK, BRGM)

WP3 will develop multi-scale strategies for environmental baseline assessment and operational to post operational monitoring. Synergies between approaches designed for CCS and unconventional gas operations will be explored. Emphasis will be on cost-effective monitoring of the whole lifecycle of both subsurface energy operations.

WK gave an overview of developments within WP3.

The two themes: 'synergies of monitoring approaches' and 'establishing an environmental baseline' run consistently through the research in WP3. Progress is being made to identify deviations from baselines using the dataset from the Groundwater Observation Well Network (GOWN) at Alberta. Naturally Occurring Radioactive Material (NORM) is being investigated in collaboration with Calgary and Duke, although the physical presence of SECURe researchers at either institute is not possible due to current travel restrictions.

WK emphasised that a particular strength of the consortium is having access to field sites at different stages of operation- these now importantly include the Preston New Road shale gas exploration site, for which we have access to environmental data from the pre-drilling, drilling and now post-drilling stages of two lateral shale gas boreholes.

Work Package 4- Matteo Icardi (MI, University of Nottingham)

WP4 enhanced seal and fracture characterisation by developing state-of-the-art sensors to monitor flow leaks and geomechanical stresses. Within the scope of WP4, new technologies will be tested to improve sensor measurement thresholds for toxic quantities that fall below the detection limit of current state-of-the-art sensors.

MI gave an update on progress within WP4.

WP4 comprises a diverse array of activities that are brought together in the advance of monitoring, geo modelling and sensor technologies. A highlight was a successful collaborative field campaign with WP3 researchers at the French Alpine sites near Grenoble(La Gua and Rochasson). This was in addition to the field testing of the down hole noble gas sampler, being developed by IFPEN and their partner SEMM Logging. Unfortunately, delays at the

GeoEnergy Test Bed site in Nottingham, UK, resulted in little relevant activity at that site, although CO_2-injection is planned for this autumn.

Work Package 5- Pierre Cerasi (PC, SINTEF)

WP5 contributes to the development and implementation of effective remedial and mitigation strategies for subsurface geoenergy operations. The focus in WP5 lies on near well and far-field leakage monitoring and seismicity prediction and mitigation.

PC gave an overview of the aims and objectives of WP5, and highlighted progress, with particular emphasis on some of the innovations in the work package. These include the use of tailor-made fluids in experiments, and the approach taken to examine processes at the laboratory-scale and applying to whole reservoirs. A main aim of the work package is to investigate the remediation of leaky cement, and one novel approach is to use bioclogging as a permeability reducer. A central research question for the work package is 'how to maximise injection (rates) whilst minimising associated risks'.

Work Package 6- Jonathan Pearce (JP, UKRI-BGS)

WP6 ties together the lessons learned in WPs 2–5 and will result in recommendations on best practice for maintaining and re-establishing baseline conditions on surface and in the subsurface. It will also provide models and best practice guidelines for participatory monitoring. WP6 aims to contribute to the development of commercial CCS and the responsible exploitation of shale gas reserves in Europe and the dissemination of information on these geoenergy operations to non-technical audiences such as policymakers and European citizens.

JP introduced the review of WP6 activities, including multiple 'in-country' workshops (UK, Norway, Poland, Netherlands) (linking to task 6.3). A series of Responsible Research and Innovation (RRI) workshops have been held, as part of understanding public concerns with subsurface geo-energy technologiesRRI workshop participants summarized their attitudes and opinions in 5 'golden rules:

1. **Safety and Security** e.g. Ethical issues are not raised as much as safety issues, because ethics is included in good practices, and we do not do research on living organisms etc.
2. **Don't hurt** e. g. Another thing is to analyze and make a balance between the needs of society, our resources and capacities, as well as problems that we face.
3. **Prevention** e. g. The most problematic are the most groundbreaking, innovative solutions. The industry is also reluctant to do so because it involves unproven risks.
4. **Quality communication system** e. g. The key is a good interaction: the people concerned want to feel like a partner. They should be respected and receive information dosed according to their needs in an interactive way
5. **Think about the future in our work** e. g. Let us work so that we can use these results in our next project but also There must be a possibility to make mistakes in the research, to show the dead-end and to turn back from it. It is important to report these erroneous results.

It had been decided to try to hold the Australia fact-finding visit as a series of remote meetings. This is obviously logistically challenging when the time difference between Europe and Australia is taken into consideration, but the consensus is that the North America trip was a

great learning experience and a considerable benefit to the project as a whole, and the opportunity for learnings from Australia should be taken if possible. The meetings are likely to be in September 2020.

Item 5: Comments and thoughts from the SECURe Advisory Board

EH invited comments from the Advisory Board:

Don Lawton:

- will comment once presentations are circulated;
- Think about a pivot to hydrogen (blue or green); consider the CSA standard Z71-12.

ACTION: EH to circulate presentations via OpenText.

Marcella Dean:

- Recommended the consideration of fact sheets as principal project outputs, perhaps one themed for CCS and one for shale gas;
- Work package 2- is there scope to include results of geochemical reactions that may take place associated with geomechanical changes in the subsurface?
- Work package 3- What are the synergies in environmental baseline monitoring? Think about how best to communicate these to the non-expert;
- Work package 4- the research at natural gas seeps may allow for a comparison between monitoring technologies. Also, for task 4.3.1, may be worth stating clearly what is novel about the proposed approach;
- Work package 5- Can the research team say anything regarding the permanence of biofilms in the subsurface?
- Work package 6- Can any of the findings (particularly associated with Unconventional Hydrocarbons) be translated to understand the relevance to other energy technologies – e.g., hydrogen storage, geothermal? Concepts, frameworks for development, risk assessments.

Kevin Parks:

- In Canada (and elsewhere), hydrogen production and storage is relevant (there are also links to Unconventional Hydrocarbons), could this be a consideration of the project?
- KP thought it would be useful to map deliverables to the risks identified in work package 2;
- As part of the project legacy, the development of an ‘advanced read-me-file’ would allow readers to understand how deliverables have evolved and how they link the project together.

Ken Cronin:

- KC suggested in the light of Coronavirus, does this change how we value this research;
- Risk looks different across various stakeholder groups, and this will result in the presentation of findings requiring careful attention;

- Is there potential in work package 6 to look at newer energy technologies (e.g., wind, where 60% of proposals have been rejected at the planning stage in the UK, and hydrogen) as knowledge of coal technology is poorly recognised in many demographics [Simon Shackley said in response: There is secondary nostalgia in coal mining areas - witness the Durham Miners Gala. We are providing sufficient info on the technology to make it understandable. The survey company will get us the sample we want and we will go for a representative sample].

Tony Lemay:

- TM made the point that there were similarities in the topics of different work packages, e.g., modelling needs to incorporate uncertainty;
- Across the project we need to be clear what data is bespoke and what is used from 3rd parties;
- The North America mission should have indicated there is a balance between monitoring at a safe level and what is appropriate and cost-effective;
- Innovations could identify where there is common technology appropriate for different energy systems.

Item 6: Reflection on the day (Jonathan Pearce, UKRI-BGS)

JP closed the first day, summarising main points discussed and also looking forward to a fair and rapid transition to low-carbon technologies in a post-COVID-19 world, making the research carried out in the project more relevant.

Wednesday 17 June 2020

Item 7: Individual work package meetings

Separate MS Teams meetings were held for work packages 2-6. Where researchers were involved in more than one work package, they could leave and join meetings as required.

Item 8: Data management in the SECURe project: Mary Mowat, (MM, SECURe project data manager, BGS)

MM gave an overview of data management within the SECURe project. Given that the project is over 2 years through, there is a need to review whether datasets should be submitted for archiving- this is best not left to the final 3 months of the project. The main messages were of:

- FAIR (data should be findable, accessible, interoperable and reusable) and open access to data (acknowledging data could be held closed due to reasons of privacy, IPR and if open access to data may jeopardise the projects main objectives);
- The data management plan can be refreshed as necessary throughout the lifetime of the project;
- Importance of metadata;

- Requirement to archive data in recognised repositories (BGS can advise if partners are unsure of how to access a recognised data repository);
- Data management- email contact: secure.data@bgs.ac.uk
- Use Open Text Core for sharing data within the project

ACTION: ALL to feed revisions to the data management plan to MM via WP leads- see excel file embedded in MS Teams meeting link.

ACTION: All to Inform MM of archived datasets

ACTION: All to make sure MM is informed of new datasets over the remainder of the project

ACTION: All to send links to non-SECURe datasets that are referenced in deliverables.

Item 9: Innovation in SECURe (Rhian Kendall, UKRI-BGS)

Rhian led a session focussed on the development of innovative technologies and methods in the SECURe project, split into three parts:

- Innovation in SECURe- assessment of innovations (Rhian Kendall, UKRI-BGS).

RK summarised the approach innovation in the SECURe project, using the TRL framework to demonstrating progress. Although there are many innovative techniques being developed across the research program, 11 specific innovations were identified in the original proposal, and these are being tracked and publicised as the project progresses. To allow project partners and the Advisory Board visibility of a wide selection of these innovations, those working on a particular innovative technique were invited to give a short review of the innovation, progress to date and thoughts on further development of the techniques.

- Individual innovations in SECURe- 1-2 slides per innovation- were given (slides are in Appendix 3):
    - Synergies of environmental baseline strategies (UK & Canada sites) (BRGM);
    - Methodology optimisation for methane and higher hydrocarbons concentrations/isotopic ratio measurements in groundwater and soil gas (PGI);
    - Fracture leak rate prediction to validate flow sensors (UNOTT);
    - Noble gas downhole sensor (IFPEN);
    - Study possible failures of well cement (SINTEF);
    - Remediation of leakage using silicate gels (SINTEF);
    - Materials to optimize injectivity (SINTEF);
    - Gas source based monitoring microbial sensors (UKRI-BGS).
- Getting the message out (Jan Hennissen, UKRI-BGS). JH outlined the current plan to disseminate the outcomes of the development of innovations, via a webpage that clearly shows how the technologies and innovations have been progressed using the SECURe project funding. This will demonstrate the achievement of Milestone 9: development of exploitation plans for new tools and methods. These plans will summarise the technology, the development within SECURe, and anticipated future developments. Innovation management and IPR will also be noted in the plans.

Item 10: SECURe communications strategy: dissemination and exploitation (Philippa Parmiter, SCCS/UEDIN)

PP gave a review of the main communications activities undertaken in the project over the past year. Highlights included outputs associated with the mission to North America, and several blogs.

PP outlined the process to get new communications material up on the SECURe website, and asked for suggestions for webinar topics.

ACTION- All to let PP know, following discussions with WP leads, of potential topics suitable for webinars.

PP reminded project partners of the value of good publicity for papers/grey literature, book chapters and conference presentations, papers and posters, all of which can be publicised via SECURe. SECURe activities can also be promoted via social media to increase knowledge of the project.

PP asked for feedback from all project partners on who our stakeholders are as this will help inform how we engage with them on social or traditional media.

ACTION- All- referring to slide 8-11 of the communications presentation, please feed back on the project stakeholders

PP concluded with comments on the value of messaging in a changing world, both looking to a post-COVID world and also one where decarbonising is still a main driver, and asked if it changes the impact or emphasis of the SECURe research being carried out.

Item 11: Recommendations as the main project outcomes- Jonathan Pearce (UKRI-BGS)

JP led an interactive session looking at what the final project recommendations may look like. He invited initial thoughts presented from WP leads, collated from those researchers involved in individual work packages.

Item 12: Final address and thanks (Prof Michael Stephenson, Executive Chief Scientist, UKRI-BGS)

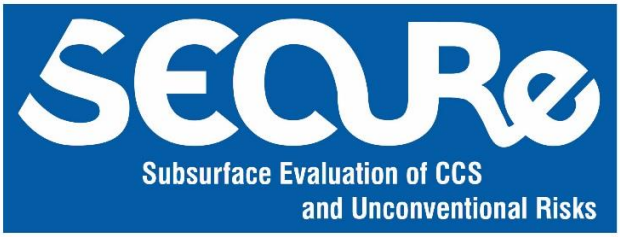
Prof. Stephenson gave a final address thanking researchers for their participation in the meeting and also contributions to the project. He outlined the importance of the subsurface in decarbonisation- for storage in, and exploitation of, pore space, and also recognised the importance of effective monitoring systems in achieving net zero- in terms of transition to gas inside and outside EC, supporting CCS and geothermal, and importantly reassuring the general public. He said that the project is making tangible and important progress in terms of the 5 technical work packages (assessing risk, understanding baseline environmental conditions and

what constitutes deviations from baselines, advancing technologies, mitigation strategies and in the development of good practices). He gave particular thanks for the contributions throughout the meeting of the Advisory Board, and closed the meeting by wish everyone well during the final year of the project.

The General Assembly closed at 16.15, Wednesday 17 June 2020.

Appendix 1 Papers circulated prior to the meeting

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL



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To delegates to the SECURe General Assembly- Second annual meeting

Call for SECURe General Assembly first annual meeting, 16-17 June 2020.

Venue: Remote, connection details issues on outlook invite

Schedule: all times CET
Tuesday 16th June 2020, log-in from 13.45,
General Assembly starts 14.00, scheduled end 18.00

Wednesday 17th June, log-in from 10.00,
Work package meetings, data management, 10.15 – 12.15
General Assembly continues 14.45 – 17.00

Attached: draft agenda; detailed schedule for the meeting.

Yours sincerely

Ed Hough
Co-ordinator, SECURe

Co-ordination

Ed Hough (Meeting Chair) BGS
Karen Kirk BGS
Rhian Kendall BGS
Jan Hennissen BGS

WP leads

WP2: Jens Wollenweber TNO
WP3: Wolfram Kloppmann BRGM
WP4: Matteo Icardi UNOTT
WP5: Pierre Cerasi SINTEF
WP6: Jonathan Pearce BGS

Invitees:

Beneficiaries

Aleksandra	Lis	Adam Mickiewicz University in Poznan
Krzysztof	Maczka	Adam Mickiewicz University in Poznan
Katarzyna	Iwinska	Adam Mickiewicz University in Poznan
Michaela	Blessing	BRGM
Frederick	Gal	BRGM
Aochi	Hideo	BRGM
Thomas	Le Guenan	BRGM
Frederic	Martin	BRGM
Ben	Rhouma Sabirine	BRGM
Mike	Duijn	Erasmus Research & Business Support BV
Carsten M.	Nielsen	Geological Survey of Denmark and Greenland (GEUS)
Trine	Dahl-Jensen	Geological Survey of Denmark and Greenland (GEUS)
Rasmus	Jacobsen	Geological Survey of Denmark and Greenland (GEUS)
Tatiana	Goldberg	GFZ Potsdam
Cornelia	Schmidt-Hattenberger	GFZ Potsdam
Eunseon	Jang	GFZ-Potsdam
Andreas	Busch	Heriot-Watt University
Roberto	Rizzo	Heriot-Watt University
YIHUAI	ZHANG	Heriot-Watt University
Florence	Delprat-Jannaud	IFPEN
Sonia	Noirez	IFPEN
Pascal	Ricroch	IFPEN
Piotr	Letkowski	INIG - PIB
Wieslaw	Szott	INIG - PIB
Andrzej	Gołąbek	INIG - PIB
Lubas	Jan	INIG - PIB
Marcin	Warnecki	INIG - PIB
Mirosław	Wojnicki	INIG - PIB
Adam	Wójcicki	Polish Geological Institute - National Research Institute
Olga	Lipińska	Polish Geological Institute - National Research Institute
Joanna	Fajfer	Polish Geological Instiute-National Research Institute
Monika	Konieczyńska	Polish Geological Instiute-National Research Institute

Matt	Beeson	Risktec Solutions Ltd
Emma	Hurdle	Risktec Solutions Ltd
Indira	Mann	SCCS-University of Edinburgh
Philippa	Parmiter	SCCS-University of Edinburgh
Bastien	Dupuy	SINTEF
Laura	Edvardsen	SINTEF
Peder	Eliasson	SINTEF
Anu	Schei	SINTEF
Ali	Taghipour	SINTEF
Ingunn	Tiller	SINTEF
Malin	Torsaeter	SINTEF
Amir	Ghaderi	SINTEF Industry
Logan	Brunner	TNO - Netherlands Organisation for applied scientific research
Thibault	Candela	TNO - Netherlands Organisation for applied scientific research
Al	Moghadam	TNO - Netherlands Organisation for applied scientific research
Hanneke	Puts	TNO - Netherlands Organisation for applied scientific research
Samantha	Scholte	TNO - Netherlands Organisation for applied scientific research
Jan	ter Heege	TNO - Netherlands Organisation for applied scientific research
Marianne	van Unen	TNO - Netherlands Organisation for applied scientific research
Jurgen	Foeken	TNO - Netherlands Organisation for applied scientific research
Anthony	Credoz	TOTAL
Frederic	Perie	TOTAL
Mary	Mowat	UK Government- BEIS
Megan	Barnett	UKRI-BGS
Simon	Gregory	UKRI-BGS
Jan	Hennissen	UKRI-BGS
Edward	Hough	UKRI-BGS
Colm	Jordan	UKRI-BGS
Rhian	Kendall	UKRI-BGS
Karen	Kirk	UKRI-BGS
Melinda	Lewis	UKRI-BGS
Chris	Rochelle	UKRI-BGS
Pauline	Smedley	UKRI-BGS
Mike	Stephenson	UKRI-BGS
Helen	Taylor-Curen	UKRI-BGS
Ceri	Vincent	UKRI-BGS
Robert	Ward	UKRI-BGS
Jim	White	UKRI-BGS
Corin	Jack	University of Edinburgh
Simon	Shackley	University of Edinburgh
Bagus	Muljadi	University of Nottingham
Federico	Municchi	University of Nottingham
Veerle	Vandeginste	University of Nottingham

Advisory Board

Ken	Cronin	Advisory Board	UK Onshore Operators Group
Marcella	Dean	Advisory Board	Shell Global Solutions International B.V.
Patricia	Fosselard	Advisory Board	European Federatio of Bottled Waters
Alwyn	Hart	Advisory Board	Environment Agency
Don	Lawton	Advisory Board	Carbon Management Canada Inc
Tony	Lemay	Advisory Board	AER|Alberta Geological Survey
Noramalina	Mansor	Advisory Board	UK Government- BEIS
Kevin	Parks	Advisory Board	Deep Time
Katherine	Romanak	Advisory Board	BEG- Texas
Gerhard	van der Linde	Advisory Board	Golder Associates
Luke	Warren	Advisory Board	CCSA

Apologies

Pauline Smedley (UKRI-BGS)

Draft agenda SECURe General Assembly second annual meeting

Date 16-17 June 2020
Venue Remote, via MS Teams

Tuesday, June 16, 14-18:15								
Time	Duration	Agenda points					Participants	Link
13.45	15'	*Welcome and progressive login of participants*					All	Link 1
14.00	30'	Welcome address BRGM (5 mins). Project Overview (EH)						
14.30	1h30'	WP reports (WP 2 – 4), 15 mins each plus discussion						
16.00	15'	*Break*					*none*	
16.15	60'	WP reports (WP 5 – 6), 15 mins each plus discussion					All	Link 1
17.15	15'	*Break*					*none*	
17.30	30'	Advisory Board – feedback and comment						Link 1
18.00	15'	Synthesis and closure first day						Link 1
Wednesday, June 17, 10.00 – 17.00								
Time	Duration	Agenda points					Participants	Link
10.00	15'	*Welcome and progressive login of participants*					All	Link 1
10.15	1h30'		WP2 meeting	WP3 meeting	WP4 meeting	WP5 meeting	WP6 meeting	WP participants, possibility to join several WP meetings	Link 2-7
11.45		*Data management*					*All*	Link 1
12.15	2hr30’						*None*	
14.45	30'	SECURe innovation strategy					All	Link 1
15.15	30'	SECURe communication strategy					All	Link 1
15.45	15'	*Break*					*none*	
16.00	50'	Recommendations as main project outcome (WP6, facilitated by JP with short descriptions of key messages per WP).					All	Link 1
16.50	10’	Final address (BGS)					All	Link 1

SECURe- work packages

Number	Title	Lead Beneficiary	Start Month	End Month	Deliverables No.	Status
1	Ethics requirements	NERC	1	36	**1, 2, 3 ...**	Active
2	Risk assessment for leakage and induced seismicity: methodology and case studies	TNO	1	32	**4, 5, 6 ...**	Active
3	Environmental baseline and monitoring strategies	BRGM	1	36	**10, 11 ...**	Active
4	Advanced monitoring and sensor technologies	UNOTT	1	32	**19, 20 ...**	Active
5	Impact Mitigation and Remediation	SINTEF AS	1	32	**27, 28 ...**	Active
6	Development and Exchange of Best Practice to esnure SECURe impact	NERC	1	36	**35, 36 ...**	Active
7	Management and co-ordination	NERC	1	36	**45, 46 ...**	Active

SECURe deliverables

Deliverable/ Milestone Number	Deliverable Title	Lead Beneficiary- Author	WP/WP Lead	Management Board- approval	Submitted	Revised delivery- month	Revised delivery date
D1.1	POPD - Requirement No.1: Informed consent procedures	1 - UKRI (BGS) (Ed Hough)	WP1- Ed Hough	Jonathan Pearce	Yes	3	31/08/2018
D1.2	NEC - Requirement No.2: Confirmation of adherence to H2020 ethics policy	1 - UKRI (BGS) (Ed Hough)	WP1- Ed Hough	Jonathan Pearce	Yes	3	31/08/2018
D1.3	EPQ - Requirement No.3: Information about the possible harm to the environment caused by the research and measures that will be taken to mitigate the risks	1 - UKRI (BGS) (Ed Hough)	WP1- Ed Hough	Jonathan Pearce	Yes	1	30/06/2018
D2.1	Report on state of the art microseismicity techniques	2 - BRGM- Thomas le Guenan	WP2- Jens Wollenweber	Pierre Cerasi	Yes	10	31/03/2019
D2.2	Report on effects of long-term sequestration	4 - INIG- Wieslaw Szott/Piotr Wojnicki	WP2- Jens Wollenweber	Wolfram Kloppmann	Yes	24	31/05/2020
D2.3	Report on induced seismicity models	2 - BRGM- Thomas le Guenan	WP2- Jens Wollenweber	Pierre Cerasi	Yes	24	31/05/2020
D2.4	Report on geochemical models	3 - GEUS- Rasmus Jakobsen	WP2- Jens Wollenweber	Matteo Icardi		30	30/11/2020
D2.5	Report on risk factors in fluid and CO_2 migration	12 - TNO- Jens Wollenweber	WP2- Jens Wollenweber	Matteo Icardi		28	30/09/2020
D2.6	Guidelines for risk assessment for leakage and induced seismicity risks	12 - TNO- Jens Wollenweber	WP2- Jens Wollenweber	Jonathan Pearce		32	31/01/2021
D3.1	Report On addressing methods to establish baseline levels post operational activity	3-GEUS	WP3- Wolfram Kloppmann	Pierre Cerasi	Yes	14	31/07/2019

Deliverable/ Milestone Number	Deliverable Title	Lead Beneficiary- Author	WP/WP Lead	Management Board- approval	Submitted	Revised delivery- month	Revised delivery date
D3.2	Report focusing on best practice methods to establish baseline levels post-operational activity	3 - GEUS	WP3- Wolfram Kloppmann	Pierre Cerasi	Yes	15	31/08/2019
D3.3	Report on synergies of environmental baseline strategies for CCS and shale gas plays	1 - UKRI (BGS)	WP3- Wolfram Kloppmann	Jonathan Pearce		27	31/08/2020
D3.4	Report on downhole monitoring as part of environmental baseline assessment for carbon storage and shale gas development	2 - BRGM	WP3- Wolfram Kloppmann	Wolfram Kloppmann		34	31/03/2021
D3.5	Report on state of the art and new developments for defining the seismic baseline for gas storage and exploitations	2 - BRGM	WP3- Wolfram Kloppmann	Jonathan Pearce		30	30/11/2020
D3.6	Report on integrated multi-tracer finger printing of gas and fluid migration upon CCS and hydraulic fracturing	1 - UKRI (BGS)	WP3- Wolfram Kloppmann	Matteo Icardi		34	31/03/2021
D3.7	Guidelines for common strategies in gas storage and exploitation baseline assessment and monitoring	15 - GFZ	WP3- Wolfram Kloppmann	Jonathan Pearce		34	31/03/2021
D3.8	Report on long-term post-operational monitoring of Ketzin (CCS) and Polish (shale gas) sites	5 - PIG-PIB	WP3- Wolfram Kloppmann	Jens Wollenweber		34	31/03/2021
D3.9	Integrated data platform for multisource multiscale sensor data	7 - UNOTT	WP3- Wolfram Kloppmann	Jonathan Pearce		36	31/05/2021
D4.1	Report on applicability of UAV technology for monitoring design of large sites and the impact of remote sensing on monitoring design. The effectiveness of hyperspectral monitoring in CCS/ Shale gas.	1- UKRI-BGS	WP4- Matteo Icardi	Jens Wollenweber		26	31.07/2020

Deliverable/ Milestone Number	Deliverable Title	Lead Beneficiary- Author	WP/WP Lead	Management Board- approval	Submitted	Revised delivery- month	Revised delivery date
D4.2	Best practice report on methods for monitoring of induced and triggered seismicity	3 - GEUS: Rasmus Jacobson, Trine Larsen	WP4- Matteo Icardi	Pierre Cerasi	Yes	24	31/05/2020
D4.3	Report on the potential for exploiting methane oxidiser genes for monitoring stray CH4 intruding into aquifers and assessment of the area that can be monitored	3 - GEUS: Tina Bundagaard	WP4- Matteo Icardi	Wolfram Kloppmann		32	29/01/2021
D4.4	Report on modelling and simulation	7 - UNOTT: Matteo Icardi	WP4- Matteo Icardi	Jonathan Pearce		28	30/09/2020
D4.5	Report on integrated local-global geomechanics	6 - SINTEF AS: Amir Ghaderi	WP4- Matteo Icardi	Wolfram Kloppmann		31	31/12/2020
D4.6	Report on the effectiveness of gas and microbial sensors	12 - TNO: Jurgen Foeken	WP4- Matteo Icardi	Jonathan Pearce		34	31/03/2021
D4.7	Guidelines for next generation measurement and monitoring of Shale Gas/CCS	3 - GEUS: Rasmus Jacobsen	WP4- Matteo Icardi	Pierre Cerasi		34	31/03/2021
D4.8	Report on noble gases sampling and analyses	10 - IFPEN: Armand Karimi	WP4- Matteo Icardi	Jens Wollenweber		34	31/03/2021
D5.1	Report on remediation strategies for tubings and cement sheaths	6 - SINTEF AS: Pierre Cerasi	WP5- Pierre Cerasi	Jens Wollenweber	Yes	14	31/07/2019
D5.2	Report on the experiment-based knowledge on acoustic emission characteristics of CCS and shale gas operations and suggestions on how to mitigate seismicity for both operations	6 - SINTEF AS: Pierre Cerasi	WP5- Pierre Cerasi	Jonathan Pearce	Yes	16	30/09/2019

Deliverable/ Milestone Number	Deliverable Title	Lead Beneficiary- Author	WP/WP Lead	Management Board- approval	Submitted	Revised delivery- month	Revised delivery date
D5.3	Report on remediation strategies for tubing and casings	3 - GEUS: Rasmus Jacobsen	WP5- Pierre Cerasi	Jens Wollenweber	Yes	16	30/09/2019
D5.4	Guideline with ranking of various squeeze sealant materials with respect to ease of placement	6 - SINTEF AS: Pierre Cerasi	WP5- Pierre Cerasi	Jens Wollenweber		29	30/10/2020
D5.5	Report on the small scale processes occurring during engineered precipitation and models to assist in the upscaling	6 - SINTEF AS: Pierre Cerasi	WP5- Pierre Cerasi	Matteo Icardi		30	30/11/2020
D5.6	Report on application of the optimisation workflow to a field case with available seismicity data	12 - TNO: Jan Ter Heege	WP5- Pierre Cerasi	Matteo Icardi		30	30/11/2020
D5.7	Recommendations on how to minimize damage to cement sheath and surrounding rock during hydraulic fracturing and CO_2 injection	6 - SINTEF AS: Pierre Cerasi	WP5- Pierre Cerasi	Wolfram Kloppmann		30	30/11/2020
D5.8	Report on kinetics of enhanced cementation reactions for CO_2 leakage remediation and fault healing processes	7 - UNOTT: Veerle Vandeginste	WP5- Pierre Cerasi	Jens Wollenweber		30	30/11/2020
D6.1	Overview report of ethical issues associated with CCS and with Shale Gas R&D	11 - UEDIN: Simon Shackley	WP6- Jonathan Pearce	Wolfram Kloppmann	Yes	6	30/11/2018

Deliverable/ Milestone Number	Deliverable Title	Lead Beneficiary- Author	WP/WP Lead	Management Board- approval	Submitted	Revised delivery- month	Revised delivery date
D6.2	Workshop on co-designing tailor made strategies for participatory monitoring including training on working with stakeholders	12 - TNO: Jhanneke Puts	WP6- Jonathan Pearce	Matteo Icardi	Yes	12	31/05/2019
D6.3	Best practice recommendations for implementing responsible research and innovation for CCS and shale gas R&D	11 - UEDIN: Simon Shackley	WP6- Jonathan Pearce	Matteo Icardi		28	30/09/2020
D6.4	Online e-resources for online training and school children in STEM, on environmental monitoring for shale gas and CO_2 storage	7 - UNOTT: Bagus Muljadi	WP6- Jonathan Pearce	Wolfram Kloppmann		25	30/06/2020
D6.5	Training software and dataset	3 - GEUS: Rasmus Jacobsen	WP6- Jonathan Pearce	Matteo Icardi	Yes	24	31/05/2020
D6.6	Best practice recommendations on participatory monitoring of the impacts of CCS and shale gas development projects in four selected sites	12 - TNO: Hanneke Puts	WP6- Jonathan Pearce	Pierre Cerasi		33	28/02/2021
D6.7	Summary of recommendations for environmental monitoring for geoenergy operations in Europe.	12 - TNO: Hanneke Puts	WP6- Jonathan Pearce	Matteo Icardi		36	31/05/2021
D6.8	Best practice recommendations for the environmental monitoring of CO_2 storage operations in Europe	1 - UKRI (BGS): Jonathan Pearce	WP6- Jonathan Pearce	ALL		36	31/05/2021

Deliverable/ Milestone Number	Deliverable Title	Lead Beneficiary- Author	WP/WP Lead	Management Board- approval	Submitted	Revised delivery- month	Revised delivery date
D7.1	Minutes of the SECURe launch meeting for the Management Board, General Assembly and Advisory Board; data management plan	1 - UKRI (BGS): Ed Hough	WP7- Ed Hough	Jonathan Pearce	Yes	2	31/07/2018
D7.2	Minutes of Management Board, General Assembly and Advisory Board meetings from the 1st annual meeting	1 - UKRI (BGS): Ed Hough	WP7- Ed Hough	ALL	Yes	14	31/07/2019
D7.3	First period reports to the EC	1 - UKRI (BGS) ALL (Ed Hough)	WP7- Ed Hough	ALL		19	31/12/2019
D7.4	Minutes of Management Board, General Assembly and Advisory Board meetings from the 2nd annual meeting	1 - UKRI (BGS) Ed Hough	WP7- Ed Hough	ALL		26	31/07/2020
D7.5	Minutes of Management Board, General Assembly and Advisory Board meetings from the final annual meeting	1 - UKRI (BGS): Ed Hough	WP7- Ed Hough	ALL		36	31/05/2021
D7.6	Final period reports to the EC	1 - UKRI (BGS) ALL (Ed Hough)	WP7- Ed Hough	ALL		36	31/05/2021
D7.7	Project Management Plan	1 - UKRI (BGS): Jan Hennissen	WP7- Ed Hough	ALL	Yes	3	31/08/2018
D7.8	Data Management Plan	1 - UKRI (BGS): Mary Mowat	WP7- Ed Hough	ALL	Yes	2	31/08/2018

Deliverable/ Milestone Number	Milestone	Lead Beneficiary- Author	WP/WP Lead	Management Board- approval	Submitted	Revised delivery- month	Revised delivery date
M1	Agreed metrics for Ethical and Responsible Research and Innovation	1- UKRI (BGS): Jonathan Pearce	WP6- Jonathan Pearce	n/a	Yes	6	31/11/2018
M10	Launch of International Platform of environmental monitoring for geoenergy projects	1- UKRI (BGS): Jonathan Pearce	WP6- Jonathan Pearce	n/a		34	31/03/2021
M11	Review of scientific outputs	1- UKRI (BGS)	WP7- Ed Hough	ALL		34	31/03/2021
M2	Collaboration with Third parties initiated	1- UKRI (BGS): Jonathan Pearce	WP6- Jonathan Pearce; also WP3- Wolfram Kloppmann	n/a	Yes	12	31/05/2019
M3	Defined strategies for participatory monitoring	1-UKRI (BGS): Hanneke Puts	WP6- Jonathan Pearce	n/a	Yes	12	31/05/2019
M4	Criteria for baseline monitoring defined	2- BRGM	WP3- Wolfram Kloppmann	n/a	Yes	18	30/11/2019
M5	Best available well-remediation technologies defined	6- SINTEF AS	WP5- Pierre Cerasi	n/a	Yes	18	30/11/2019
M6	Stage gate for SECURe continuation	1- UKRI (BGS)	WP7- Ed Hough	ALL	Yes	18	30/11/2019
M7	Risk assessment framework agreed	12- TNO	WP2- Jens Wollenweber	n/a	Yes	24	31/05/2020
M8	Ethics and integrity assessment of the SECURe R&D with recommendations	11- UEDIN: Simon Shackley	WP6- Jonathan Pearce	n/a	Pending	24	31/05/2020
M9	Advanced tool development plans	1- UKRI (BGS) and also 2- BRGM	WP7- Ed Hough	n/a		27	31/08/2020

Detailed programme
Tuesday 16 June 2020

14.00 Welcome Address: Philippe Freyssinet, Directeur, Direction de la Stratégie, de la Recherche et de la Communication, BRGM

14.05 Project overview (Ed Hough, project co-ordinator, UKRI-BGS)

Standing items:

Agenda- AOB

WP1 (Ethics)

Refer to:

Deviations report from Reporting Period 1 report, and tables S1-S4

Deliverable and milestone schedule

Agenda

14.30 WP2 report (Jens Wollenweber, TNO)

WP3 report (Wolfram Kloppmann, BRGM)

WP4 report (Mateo Icardi, UNOTT)

16.00 Break

16.15 WP5 report (Pierre Cerasi, SINTEF)

WP6 report (Jonathan Pearce, UKRI-BGS)

17.15 Break

17.30 Comments and thoughts from the SECURe Advisory Board

18.00 Reflection on the day (Jonathan Pearce, UKRI-BGS)

18.15 Meeting close

Wednesday 17 June 2020

10.15 – 11.45 Individual work package meetings

11.45 – 12.15 Data management (Mary Mowat, UKRI-BGS)

12.15 – 14.45 Break

14.45 – 15.15 Innovation in SECURe- assessment of innovations (Rhian Kendall, UKRI-BGS)

Individual innovations in SECURe- 1-2 slides per innovation

Getting the message out (Jan Hennissen, UKRI-BGS)

15.15 – 15.45 SECURe communications strategy (Philippa Parmiter, SCCS-UEDIN)

15.45 – 16.00 Break

16.00 – 16.50 Recommendations as the main project outcomes- discussion session facilitated by Jonathan Pearce (UKRI-BGS), with input from WP leads and all beneficiaries; comment from Advisory Board

16.50 – 17.00 Final address and thanks (Mike Stephenson, Executive Chief Scientist, UKRI-BGS)

17.00 Meeting close

Deviations report from RP1 reporting

Deviations from Annex 1 and Annex 2 (if applicable)
On commencement of the project, it was identified that the task numbering on the project portal (and consequently the grant agreement) was in error, necessitating a project amendment to be completed (Initiated 17 December 2018, completed January 2019). The amendment also included:

- Termination of Erasmus University, Rotterdam and inclusion of Erasmus Research & Business Support BV;
- Amendment of work package, task and sub-task numbers to accommodate WP1 (Ethics)
- Minor amendments to the composition of participants contributing to different work packages, tasks, subtasks and deliverables; movement of some tasks between WPs
- Amendment to beneficiary TOTAL maximum EU contribution to €0

Further changes anticipated to the original project proposal (subject to agreement with EC) include:

- **Task 2.4.2** There is only a minor deviation in the proposed approach to Subtask 2.4.2 as the text in the DoA described contribution on statistical models and on mechanical models. There is more focus on statistical models as we would need much more details in order to make full mechanical models. Statistical models can however include mechanical parameters in order to create "hybrid" models. This choice does not prevent from attaining the initial objectives of the subtask
- **Subtask 4.3.1 and 4.3.2** we decided to collaborate on the Sleen site due to the high natural gas concentrations in the subsurface (further details in Section 5, below). These samples (table 4.3) will give an opportunity to identify differences in microbial communities between those exposed to geogenic gas (methane plus higher alkanes) and those exposed to biogenic methane (no higher alkenes).
- **Task 3.1.1. request to add field site Preston New Road (Lancashire, UK)** (this site was not listed in the original proposal). This will provide additional data to the subtasks 3.1.1 and 3.1.2, and will not alter or change the proposed activities.
- **Task 4.1.3 request to add Borehole test sites Tonder-5 (Denmark) and SIG Geo-01 Satigny, Switzerland** (no sites were specified in the original proposal and these two sites were not listed in the original proposal). Addition of these sites to the work programme will not alter or change the proposed activities
- **Task 4.3.1 request to change 'intentional leakage sites' to 'existing leakage sites' (highlighted below), and to add BRGM to list of partners in 4.3.1:**

  Subtask 4.3.1 Gas source based monitoring sensors [TNO, BRGM]

  This subtask will develop and extend existing field-based protocols for specialised characterisation that will enable an operator or regulator to attribute the source of leaking gas. Carbon and hydrogen isotopes have proved useful in characterising CO_2 and CH4 sources. We propose to apply process-based monitoring techniques that will determine the sources of CO_2 and CH4 in the shallow subsurface, whether local production (respiration, oxidation, dissolution) or leakage from the deep subsurface. This will include characterisation of CH4, higher hydrocarbons, O2 and N2 concentrations. We propose to employ a new technique that determines the isotopologues of both CO2 and CH4 as tracers for temperature and depth. This could prove efficient in cases where conventional isotopes do not unequivocally indicate the gas source. Furthermore, if leakage is occurring or is assumed (e.g., Weyburn or NE Pennsylvania) and baseline monitoring may not have taken place, we propose to recapture the past record by historical baseline monitoring. By applying ^{14}C isotopes on plant material and tree-ring records, which provide a natural sub- annual resolution archive we intend to back-monitor potential gas leakage. The new combination of methods will be applied at natural leakage sites as well as in ~~intentional~~ existing and potential leakage sites. The new tools will be

scrutinised against commercially available tools to optimise on the economic and technical level.

1 Tasks

All project tasks and sub-tasks are on schedule. Preparation and planning is underway for subtasks that have not yet been initiated.

2

3 Use of resources (not applicable for MSCA)

A change of the cost calculation of SINTEF AS budget for Direct Personnel Cost from 'Actual' to 'Unit' is required. The value of the budget remains unchanged. This was an error at the initial project formulation stage.

Budget transfers that were not anticipated in Annex 1 are summarised:

Transfer €53,060 from UKRI-BGS to UEDIN

This covers costs of developing the project website by UEDIN (budget originally held by UKRI-BGS). This comprises €37,370 (Personnel to Personnel costs) and €5,078 (From Other Direct to UEDIN Internally invoiced goods and Services) and €10,612 (Indirect costs).

Transfer €3566 from UKRI-BGS to TNO

This covers the cost of hosting the 'Towards tailor-made participatory monitoring' workshop for WP6, Den Haag, 4-5 March 2019 by TNO (budget originally held by BGS but logistically the workshop hosting was more cost-effective to be organised and paid for by TNO). This comprises €3566 (Other Direct).

€12,920 from TNO to GFZ

Researcher moved from TNO to GFZ; this transfer is to pay for the researcher's continued involvement in Subtask 4.3.1. This comprises €4,420 (Personnel) and €8,500 (Other Direct):

Direct costs:

EUR 3,200.00 Fieldwork costs (incl. consumables)
EUR 1,800.00 Travel costs for isotope measurements
EUR 1,000.00 Multi-element and mineral analyses (at GFZ)
EUR 2,500.00 Meetings and workshops

Staff costs:

EUR 4,420.00 0.5 person months

Transfer €6162 from UKRI-BGS to INIG

This covers the cost of the 11-12 June 2019 General Assembly meeting, Wroclaw, Poland, and following field visit to the Borezicin Acid Gas storage facility on 13 June 2019. This comprises €6,162 (Other Direct).

Internal changes to allocation of budget for (9) AMU

Transfer of €20,000 from Personnel to Other Direct to cover additional travel burden (including attendance at N America mission). Transfer of €10,000 from Personnel to Other Direct to cover costs of open access publication. Personnel costs are lower than anticipated due to the inclusion of two post-doctorial investigators to the project in place of more expensive research staff.

Explanation of Person months, budget requested and deliverables

Overall spend

Overall spend on the project is at 28%, with all planned deliverables and milestones complete for RP1 (Table S1), and all remaining deliverables and milestones on schedule and within allocated budgets, to be reported in RP2. Activities on the project are generally non-linear for many beneficiaries with respect to budget spend compared to schedule of deliverables and use of person months. The following explains instances where spend deviates markedly from a linear profile:
UKRI-BGS. A large proportion of budget (est. €122,032) is associated with a subcontract for laboratory analysis associated with WP3. This is in the process of being let and will be charged to RP2 of the project. Additionally, a large proportion of budget is associated with 4 field survey campaigns (groundwater, soil gas) in WP3 that are planned for Feb 2020 – April 2021, which will utilise personnel and other direct (travel and subsistence).
BRGM. There are two main reasons for the non-linear expenditures for BRGM. The two Postdoc fellows hired by BRGM for working on the transatlantic studies (Duke and Calgary Universities) will start on March 02, 2020 [M22] for 12 months, this is an important part of our person months. Also, the programmed analytical work for the different SECURe sites has only started at M18.
IFPEN. The activities of IFPEN are associated with WP4. This work has focussed to date on the identification of suitable field sites for down-hole sampler testing. Field sites have been identified and discussions with the PO underway to approve these sites for use in SECURe. Once this is agreed, field testing is planned for the Q1 and Q2 of 2020, and the anticipated contract (est €102,600).
TNO. Most activities of TNO are due to deliver in RP2, although there has been some amount of effort during RP1 in preparation for these. Effort during RP2 will also focus on integration of WP2 outputs that feed into the recommendations of WP6.

Deviations in the average personnel costs per month

Justifications in exceptional deviations in the average personnel costs per month are as follows:
SINTEF AS (-30.80%): Deviation is due to the use of a greater proportion of lower-cost staff associated with the finalisation of the ECCSEL experimental cell during RP1. It is anticipated that now this is complete, the deviation will be rectified in RP2 as a greater proportion of higher-cost staff will be employed in the project activities.
UNOTT (-36.24%): Use of suitably qualified staff at the Assistant Professor level rather than the anticipated Full/Associate Professor level. This was necessary due to staff changes at UNOTT, and does not affect the integrity or quality of the research performed. Costs were also calculated in £GBP in 2017, since which there have been major currency fluctuations between £GBP and €EUR.
AMU (-54.10%): Once the grant was awarded (18 months from submission), changes in available staff at AMU resulted in the engagement of 3 lower cost (but suitably qualified) staff at Assistant Professor, Post-doctorial and PhD level. This does not affect the integrity or quality of the research performed. It is anticipated that the deviation will be rectified in RP2 as a greater proportion of higher-cost staff will be employed in the project activities.
UEDIN (-43.29%): There has been a delay in engaging with stakeholders due to various moratoria associated with Shale Gas in place locally (Scotland) and Nationally (UK-level). This has resulted in the use to date of lower-coat staff on the project than anticipated. As discussed during the RP1 face-to-face review meeting, the inclusion of additional low-carbon technologies will enable engagement with a wider spectrum of stakeholders, and will allow a greater proportion of higher-cost staff to be utilised during RP2 of the project.

Ratio of budget: person months: deliverables, by beneficiary

A review of person months claimed by beneficiary is compared to deliverables, which highlights the ratio of deliverables completed compared to the person months used by the beneficiary (Table S2).

AMU. AMU have to date claimed for 30.55 PM out of an anticipated 35.5 PM. This is partly explained by their use of a greater proportion of staff with a lower staff cost than anticipated during preparation of the project plan. AMU are required to input to some WP6 outcomes and have sufficient resource to meet these obligations, but are not the primary beneficiary associated with any deliverables.

For all other beneficiaries who are responsible for production of a formal deliverable, activities are on schedule and there is sufficient budget to meet obligations.

Ratio of person months: deliverables/milestones, by work package

A review of person months associated with each work package is compared to deliverables associated with the respective work package. This highlights the number of deliverables recorded compared to the person months used per work package.

WP2- The activities of WP2 are unevenly distributed throughout the project, with a greater proportion of effort foreseen in early stages of the project, feeding deliverables in M19-32 and integration of outcomes and recommendations into WP6.

WP6- The activities of WP6 are unevenly distributed throughout the project, with a greater proportion of effort foreseen in early stages of the project, feeding deliverables in M19-36.

For all work packages, there is sufficient budget and resource available within the project to meet obligations.

Record of person months per beneficiary per work package

A review of person months associated with each work package is compared to anticipated person months in the DoW. This highlights where spend deviates from that a linear profile (Table S4).

UKRI-BGS, WP5 Due to the use of a greater number of lower graded staff time than anticipated, and also weighting of activities towards RP1.

GEUS, WP5 Due to activity of GEUS planned primarily for RP2.

UNOTT WP2 Due to activity of UNOTT planned for RP2

UNOTT WP3 Due to activity of UNOTT planned primarily for RP2

TNO, WP5 Due to activity of TNO planned primarily for RP2

GFZ, WP4 Due to activity of GFZ planned for RP2

GFZ, WP6 Due to activity of GFZ planned for RP2

Table S1: Requested budget, RP1

	Benericiary	Budget total	Requested budget €	%
1	UKRI-BGS	1610478.49	382372.87	0.24
2	BRGM	1048312.5	198520.31	0.19
3	GEUS	492672.5	146411.23	0.30
4	INIG	436436.25	227525.74	0.52
5	PIG-PIB	466206.25	123916.85	0.27
6	SINTEF AS	1152625	351989.76	0.31
7	UNOTT	786758.75	234722.25	0.30
8	HWU	293738.75	96948.75	0.33
9	AMU	153125	66132.96	0.43
10	IFPEN	346931.25	28108.31	0.08
11	UEDIN	281675	102157.61	0.36
12	TNO	680020	174221.35	0.26
13	EUR	0	0	#DIV/0!
14	Risktec	312218.75	128452.2	0.41
15	GFZ	298472.5	111207.43	0.37
16	TOTAL	457500	0	0.00
17	ERBS	90937.5	21115	0.23

Table S2: Requested budget vs deliverables vs person months (by beneficiary)

								Budget, M1-18											
Partner		PM used, M1-18	PM total (DoA)	Expected use of PM at M18	%used in M1-18	Deviation from expected	Deviation as %	Personnel	Other Direct	Indirect	Internally invoiced	Subcontracts	Total	Total costs, DoA	%budget used	No deliverables, M1-18	Total number of deliverables	%deliverables completed, M1-18	Co-efficient, budget vs no deliverables
1	UKRI-BGS	38.66	147.5	73.75	26.21	35.09	24	196372	77674	68511	0	40420	382977	1610478	23.78	7	16	44	0.54355
2	BRGM	19.5	124.1	62.05	15.71	42.55	34	142973	15842	39704	0	0	198519	1048313	18.94	1	4	25	0.75748
3	GEUS	13.49	38	19	35.50	5.51	15	91855	25273	29282	0	0	146410	492672.5	29.72	3	8	38	0.792467
4	INIG	56.54	86.2	43.1	65.59	-13.44	-16	104745	45543	45505	31730	0	227523	436436.3	52.13	0	1	0	0
5	PIG-PIB	48.24	129.2	64.6	37.34	16.36	13	91653	7480	24783	0	0	123916	466206.3	26.58	0	1	0	0
6	SINTEF AS	23.2	49.2	24.6	47.15	1.4	3	240800	40791	70397	0	0	351988	1152625	30.54	2	6	33	0.916138
7	UNOTT	30.45	68.3	34.15	44.58	3.7	5	139786	47991	46944	0	0	234721	786758.8	29.83	0	4	0	0
8	HWU	11.97	34.5	17.25	34.70	5.28	15	57043	20515	19389	0	0	96947	293738.8	33.00	0	0	#DIV/0!	0
9	AMU	30.55	35.5	17.75	86.06	-12.8	-36	42069	10836	13226	0	0	66131	153125	43.19	0	0	#DIV/0!	0
10	IFPEN	1.82	17	8.5	10.71	6.68	39	18694	3792	5621	0	0	28107	346931.3	8.10	0	1	0	0
11	UEDIN	16.96	25.9	12.95	65.48	-4.01	-15	68291	7434	20431	5999	0	102155	281675	36.27	1	3	33	1.088009
12	TNO	21.7	76	38	28.55	16.3	21	121940	17436	34844	0	0	174220	680020	25.62	1	7	14	1.793388
~~13~~	~~EUR~~			0			#DIV/0!						~~0~~	~~0~~	#DIV/0!				#DIV/0!
14	Risktec	12.94	23	11.5	56.26	-1.44	-6	128452	7309	33940	0	0	169701	312218.8	54.35	0	0	#DIV/0!	0
15	GFZ	27.04	36	18	75.11	-9.04	-25	85875	3090	22241	0	0	111206	298472.5	37.26	0	1	0	0
16	TOTAL		6.7	3.35	0.00	3.35	50						0	457500	0.00	0	0	#DIV/0!	0
17	ERBS	2	7.5	3.75	26.67	1.75	23	15802	1090	4223			21115	90937.5	23.22	0	0	#DIV/0!	0

Table S3: Effort (PM) vs deliverables and milestones (per work package)

WP	Lead	PM, M1-18	PM, DoA	%M1-18	No Deliverables M1-18	Total No. deliverables	%Deliverables completed	Co-efficient, PM vs no. deliverables	Milestones M1-18	Milestones DoA	%Milestones completed	Co-efficient
1	BGS	0	0	0	3	3	100	0.00	0	0	#DIV/0!	#DIV/0!
2	TNO	99.92	224.8	44.45	1	6	17	2.67	1	1	100	0.44
3	BRGM	82.08	312	26.31	2	9	22	1.18	2	2	100	0.26
4	UNOTT	49.12	128.27	38.29	0	8	0	No deliverab	0	0	#DIV/0!	#DIV/0!
5	SINTEF AS	26.99	68.01	39.69	3	8	38	1.06	1	1	100	0.40
6	BGS	74.56	140.47	53.08	2	10	20	2.65	2	4	50	1.06
7	BGS	8.85	31.15	28.41	4	8	50	0.57	1	3	33.3333333	0.85

Table S4: Effort (PM) per beneficiary, per work package

Beneficiary		Effort in PM M1-18 according to financial statement	Effort in PM as per DoW	% effort spent	WP
1	UKRI-BGS	9.05	56.9	16	3
1	UKRI-BGS	7.7	35.47	22	4
1	UKRI-BGS	3.95	2.29	172	5
1	UKRI-BGS	9.11	21.77	42	6
1	UKRI-BGS	8.85	31.15	28	7
2	BRGM	3.82	16	24	2
2	BRGM	15.15	104.6	14	3
2	BRGM	0.53	3.5	15	6
3	GEUS	2.57	12	21	2
3	GEUS	1.26	3	42	3
3	GEUS	6.82	10	68	4
3	GEUS	0.54	8.5	6	5
3	GEUS	2.3	4.5	51	6
4	INIG	51.25	73.2	70	2
4	INIG	5.29	13	41	4
5	PIG-PIB	2.81	12	23	2
5	PIG-PIB	41.86	107.2	39	3
5	PIG-PIB	3.57	10	36	6
6	SINTEF AS	4.91	9	55	2
6	SINTEF AS	0.56	1	56	3
6	SINTEF AS	5.91	12	49	4
6	SINTEF AS	9.8	23.65	41	5
6	SINTEF AS	2.02	3.5	58	6
7	UNOTT	0	10	0	2
7	UNOTT	0.1	7	1	3
7	UNOTT	18.08	26	70	4
7	UNOTT	9.7	15.3	63	5
7	UNOTT	2.57	10	26	6
8	HWU	11.92	34.5	35	2
9	AMU	30	35.5	85	6
10	IFPEN	1.82	17	11	4
11	UEDIN	16.96	25.9	65	6
12	TNO	9.7	35.1	28	2
12	TNO	3.5	8.4	42	4
12	TNO	3	18.27	16	5
12	TNO	5.5	14.3	38	6
~~13~~	~~EUR~~			#DIV/0!	
14	RISKTEC	12.94	23	56	2
15	GFZ	14.1	29	49	3
15	GFZ	0	3	0	4
15	GFZ	0	4	0	6
16	TOTAL		3.3	0	3
16	TOTAL		3.4	0	4
17	ERBS	2	7.5	27	6

Appendix 2 Minutes of the June 2020 Management Board meeting

Management Board meeting: June 2 2020, 13.00 GMT (14.00 CET)

Venue Remote
Present: Chair: Ed Hough, (BGS)
WP2: Jens Wollenweber (TNO)
WP3: Wolfram Kloppmann (BRGM)
WP4: Matteo Icardi (UNOTT)
WP5: Pierre Cerasi (SINTEF)
WP6: Jonathan Pearce (BGS)
BGS: Karen Kirk (BGS), Jan Hennissen (BGS)

Item	Lead
Outstanding actions- see below	EH/all
Standing items Update on project status Management and co-ordination Subcontracts Non-work package deliverables Risk Register Ethics (WP1) Data management Innovation Project management plan	EH
Preparations for Second annual General Assembly 16-17 June 2020, Orleans	WK/all
Work package updates and impact of Coronavirus on project delivery	All

Actions from previous meetings (EH)

- ACTION: JP confirm with MM datasets submitted for archiving. Few GB is fine hundreds of GB may be an issue now due to remote working.
- CCS to be combined with shale gas techniques in this project. ACTION: a statement is required about this on the website. JP forward the statement to PP.
- ACTION: PP to contact MI for further questions regarding this story. **ACTION: Needs a follow-up**

- ACTION: ALL let EH/PP know suggestions for one webinar topic and summary of content from WP 2 & 5 and one webinar topic and summary of content on WP 3 & 4. Aim to deliver seminar in September. Length: 30 mins to an hour. WP leads to circulate a proposal/schedule for an hour of content. **Action: Reminder: please follow-up with PP.**
- Meeting to be had with WK to set up GA (only five weeks away). Meeting was held today with WK, JH and EH.
- **ACTION: Reminder: Please inform EH if changes to risk register need doing.**
- **Reminder: Action: data manager (Mary Mowat) needs to be informed about upcoming delivery of large and small datasets.**
- **ACTION: Reminder, PMP; will have to be kept up to date with the changing deliveries**

Forthcoming deliverables and milestones:

Deliverable/ Milestone Number	Deliverable Title	Lead Beneficiary- Author	WP/WP Lead	Lead task(s)	Management Board-approval	Co-ordinator-approval and upload	Revise delivery-month	Revised delivery date
D2.2	Report on effects of long-term sequestration	4 - INIG- Wi	WP2- Jens Wollenweber	2.1.2	Wolfram Kloppmanr	BGS-Ed Ho	24	31/05/2020
D6.5	Training software and dataset	3 - GEUS: Ra	WP6- Jonathan Pearce	6.4.2	Matteo Icardi	BGS-Ed Ho	24	31/05/2020
M8	Ethics and integrity assessment of the SECURe R&D with recommendations	11- UEDIN:	WP6- Jonathan Pearce	6.2.4	n/a	BGS-Ed Ho	24	31/05/2020
D6.4	Online e-resources for online training and school children in STEM, on environmental monitoring for shale gas and CO2 storage	7 - UNOTT:	WP6- Jonathan Pearce	6.4.2	Wolfram Kloppmanr	BGS-Ed Ho	25	30/06/2020
D7.4	Minutes of Management Board, General Assembly and Advisory Board meetings from the 2nd annual meeting	1 - UKRI (BG	WP7- Ed Hough	7	ALL	BGS-Ed Ho	26	31/07/2020
D4.1	Report on applicability of UAV technology for monitoring design of large sites and the impact of remote sensing on monitoring design. The effectiveness of hyperspectral monitoring in CCS/Shale gas.	1 - UKRI (BG	WP4- Matteo Icardi	4.1.1	Jens Wollenweber	BGS-Ed Ho	26	31/07/2020
D3.3	Report on synergies of environmental baseline strategies for CCS and shale gas plays	1 - UKRI (BG	WP3- Wolfram Kloppmann	3.2	Jonathan Pearce	BGS-Ed Ho	27	31/08/2020
M9	Advanced tool development plans	1- UKRI (BGS) and also 2- BRGM	WP7- Ed Hough	7	n/a	BGS-Ed Ho	27	31/08/2020

Standing items

- Update on project status: Project Officer indicated that costs associated with meetings that were postponed due to Coronavirus would be eligible, but that reasons should be collated; late costs in the project can be justified even if conference occurs after deliverables if it can be shown that the outcomes feed into the composition of the final project recommendations.
- Management and co-ordination:
    a. looking at deliverables: OK for July–October. Even with updated time scales November is still busy. Six deliverables. 4 deliverables in WP5, PC confirmed that they are still good to go ahead.
    b. Deliverable at end of December; heads up for D4.5. MI confirmed they will keep into account early end of year closures
    c. 7 deliverables in M34: these need to be carefully managed because there is little contingency in additional time in the final few months of the project, and also we

need to maximise the value of late deliverables in the collation of final project recommendations.

d. Overall spread of revised dates for deliverables looks manageable, but need to be actively managed. **ACTION: please inform coordinator if deliverables are delayed.**

e. The project officer also communicated that it is preferable to have a high quality deliverable that is slightly late than a temporary uploaded deliverable that needs amending in the future.

f. End of May reports were delivered in time. EH thanked INIG, BRGM and GEUS for early circulation of deliverables.

- Subcontracts
  a. Still number of subcontracts to be let. They are reliant on field work.
- Non-work package deliverables
  a. Opening up program to North America, S. Korea and Asia. JP: we can invite people to the mission to be held online; many other researchers are eligible to participate from CCS. Shale: EH contacts from North America are easy to find, for other countries it may be more difficult. PC and WK confirmed they may be able to contact Argentinian researchers. JP: we can send out two emails: invitation for talk from researchers we know, a second email as a save the date which may also include invite for talks if so required. Progressing this point is associated with the organisation of the project conference in December.
- Risk Register
  a. Please have a look at opentext for risk register and send any additions to Ed Hough: https://core.opentext.eu/app/#/files?1299230535410785154
- Ethics (WP1)
  a. No change on ethics: environmental and dataset risks. Please send any updates or mitigation measures for potential environmental harm associated with the project to Ed Hough.
- Data management. This will be discussed at the General Assembly meeting- no datasets yet uploaded to the website.
- Innovation: BGS has been holding innovation interviews. Only one innovation interview left: Colm Jordan (BGS). There is a roadmap now to achieve Milestone M9, which will be progressed over the coming weeks by Rhian Kendall at BGS.
- Project management plan: is being updated according to changes for deliverables due to COVID-19.

Preparations for Second annual General Assembly 16-17 June 2020, Orleans

- Meeting between EH, JH and WK was held on 02/06. A draft of the program was proposed. This comprises two days : afternoon of 16/06 and all day (with 3h break over lunch) on 17/06.
  ACTION: comment on agenda today (02/06).
- WK stressed the need for circulating the agenda today (02/06) in order for people to plan, prepare talks.
  ACTION: ideas for questions for the advisory board which can be circulated ahead of time.
- EH went over the agenda and requested input from the WP leads.
  - WK: 3h lunch on the second day is due to the fact of the differing time zones and if we want to include some of the Advisory Board/project affiliates from North America, we need to do this after 4pm.

- JP: the slot to tie everything together can be divided into two: one part discussing how the research of each WP or even task can result in best recommendations and a second part on overall coordination. EH: is it worth having each WP leads to come with a slide. WK: it may not be a good idea to go over all the WPs again because it will be a reiteration of what was done before? KK: maybe give participants time to come up with recommendations for the bit of research they have done. Write them down, rank them and categorise them… Interactivity can be ensured through technology of Microsoft Teams.
- MI: will there be time for interaction between the WPs to encourage cross WP discussion. WK: in the initial draft of the agenda, we had a time slot for the cross WP discussions, these were taken out because it would lengthen the meeting significantly. If people want to jump to other WP meetings, this can be done through the links. PC: this will not be possible of course for the WP leads.
- EH: if no comments come in, this copy will be send around as a draft. WK: make it clear this is Paris time.

Work package updates and impact of Coronavirus on project delivery

- **WP2 (JW):**
  - Clear idea of deliverables for September. We will need to postpone until December. EH: ACTION: JW to confirm delay of deliverable 2.5 for end of September (now anticipated at end November due to issues with laboratory access)
- **WP3 (WK):**
  - Postdocs cannot go to Duke and Calgary as planned due to travel restrictions. They are hired and are working on the project with transatlantic partners, but a full placement at Duke and Calgary cannot be guaranteed now.
- **WP4 (MI):**
  - Nothing new to report. Longer WP meeting will be held before GA. All delays have now been discussed in the WP.
- **WP5 (PC):**
  - Nothing new. Also a WP meeting will be held ahead of GA which will be used to present WP5 actions to other WPs. May be difficult if there are no cross WP meetings.
- **WP6 (JP):**
  - WP meeting yesterday. UEDIN are progressing with the questionnaire. They are inviting tenders for consultations with public to the level of individual postcodes documenting past experiences with geo-energy.
  - Mission to Australia will be online event. Planning with Helen Taylor (BGS).
  - M8: to discuss with SS from UEDIN.

ACTION: JP to progress M8 with UEDIN.

AOB

There being no other business, the meeting closed at 14.00 GMT.

Appendix 3 Slides used in the General Assembly Innovation discussion (Item 9)

WP3 Environmental baseline and monitoring strategies: Innovation

Innovation	D's	Sites	TRLs	Progress
Synergies of environmental baseline strategies	D3.3	UK, F, CAN	~6→9	- Integration of multi-scale multi-disciplinary methods on French natural analogues (F Subalpine Chains sites), on UK sites (Preston Road, Vale of Pickering) - Individual innovative method development: bacteriological, clumped isotopes, radiocarbon on vegetation, multispectral/hyperspectral methods at different scales, drone measurements, degassing of outcropping shales..
Integrated multi-tracer fingerprinting of gas and fluid migration	D3.6	UK, F, DEN,	~7→9	- Multi-tracer methods applied to gas and groundwater fingerprints on UK sites (Lancashire, V of P), F sites (FSC sites), D sites (Vendsyssel). - Multi-isotopic methods (C, H, O isotopes on alkanes, CO2,...), B, Li, S, O, H, C,... applied on groundwater, integration in field studies - Development of a multi-level method (routine measurement→ trigger alerts → in depth investigation
Methodology optimisation for methane and higher hydrocarbons concentrations/isotopic ratio measurements in groundwater and soil gas		P, F, UK		- Development of soil gas, dissolved gas and gas seep detection methods: soil gas sampling (P), handheld laser spectroscopy, gas seep detection by drones, degassing methods with measurement of concentrations/isotopes on pore gas…

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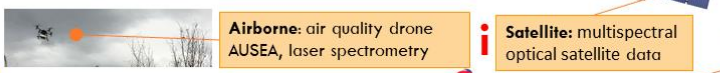
WP3 Progress highlights : French alpine natural analogues

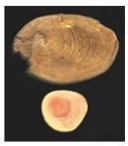


Airborne: air quality drone AUSEA, laser spectrometry

Satellite: multispectral optical satellite data

On site/lab: New isotope measurements Δ_{18}

On site/lab: ^{14}C-^{13}C anomalies on Vegetation



On site: Spectroradiometer hyperspectral measurements on soil/vegetation

On site/lab microbiology: molecular (DNA) and culture-based techniques

On site: Accumulation chamber CH_4-CO_2 flux benchmarking

WP3 + WP4

Lab: Degassing of shale cuttings/cores CH_4-CO_2 contents, fingerprints

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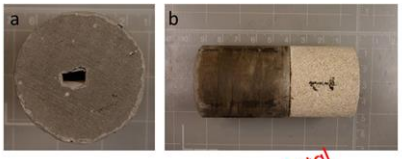
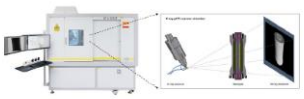
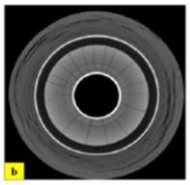
10 Remediation of leakage using silicate gels (linked to D5.2)

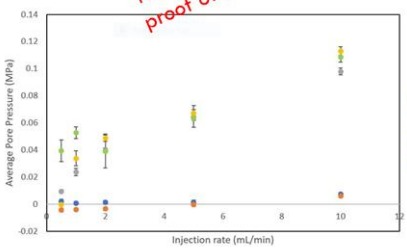
- Innovation related to testing methodology
  - Tests placement
  - Tests permeability reduction
  - Tests ability to remediate realistic fracture networks at in-situ conditions
- Concept only tested so far in sandstone setting where slow/weak remediation was possible
  - Quicker reaction required for SECURe for large fractures; this requires high concentration of silicate gels
- High concentration and quick solidification may present practical problems on well site







TRL 3: experimental proof of concept



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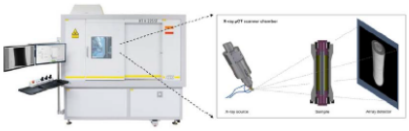
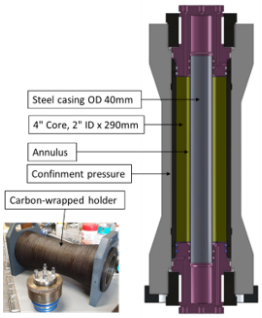
9 Study possible failures of well cement (linked to D5.1)

- Innovation related to testing methodology
  - Main research question: are we able to fracture cement in a field relevant way?
  - Trying to mimic what would happen in a field setting when cement fails. Main issue in the field: cement cannot be reached
  - Mini wellbore simulator used to fracture cement and surrounding rock by pressurizing casing
  - Fracture network permeability measured
  - Sealant efficiency tested by injecting in fractures and measuring permeability again





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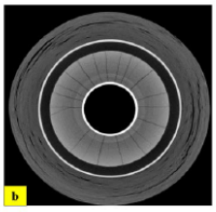

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Methodology optimisation for methane and higher hydrocarbons concentrations/~~isotopic ratio~~* measurements in groundwater and soil gas (linked to D3.6) PGI-NRI

Explaining innovation
What do you want to come up with? What is the final product?

The goal is to implement the methodology for CH_4 measurements in soil gas and groundwater as a routine, credible tool to be applied for standard tasks of geological and hydrogeological survey in Poland as well for other projects undertaken by the PGI.

Device (*for soil gas sampling*):
a simple 'piece of steel pipe' but *reliable, *failure-free, *easy to use, *functional in different soil types, *affordable, *replicable (at least a few sets are needed to be available for different field teams), *for country-scale monitoring purposes

Protocol (*for soil gas & groundwater sampling*):
validated sampling procedure with determined credibility, assuring the representativeness of sample

**we will probably cut this ambition due to time constraints caused by the lockdown*

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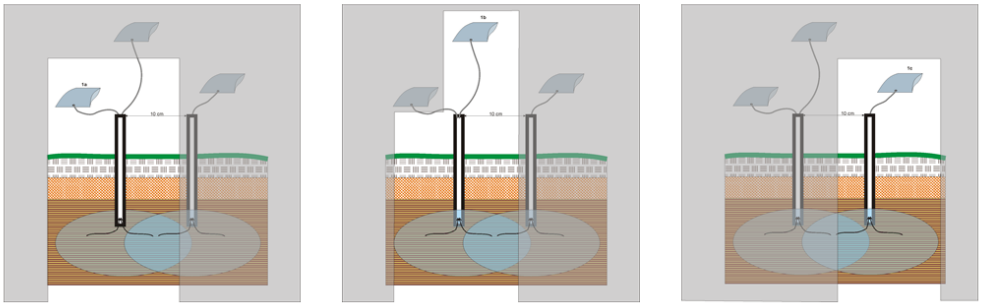
Planned tasks for validation:
- sample content vs storage time
- frequency of septum piercing vs sealing properties
- atmospheric air intake possibility instead of soil gas
- removing atmospheric air from sampler
- double samples variability



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Microbial monitoring (BGS, GEUS, Total)

Why microbial based sensors?

- Low cost
- Low technical equipment and expertise required
- Integrated signal for intermittent leaks
- Not susceptible to gas loss

Achieved so far

- Refinement of protocols including
  - volumes filtered
  - Carbon source used
- Data interrogation – calculation of species richness

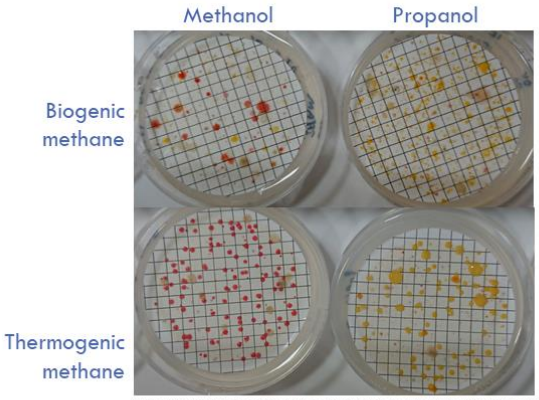
By end of project

- Comparison with isotopic data where available
- Integrate with DNA data to improve confidence

Beyond project

- Refinement of sampling protocol
  - include replicates
  - Reduce time
- Automated cell counting of images

	ratio richness MeOH/PrOH	total samples	true	false	% true
biogenic	<1	15	11	4	73.3
thermogenic	>1	23	16	7	69.6



The differences in microbial community grown with different carbon sources indicate the methane source

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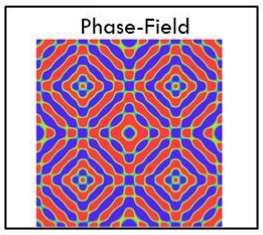
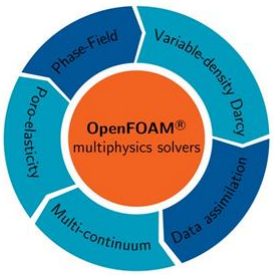
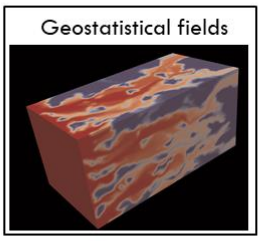
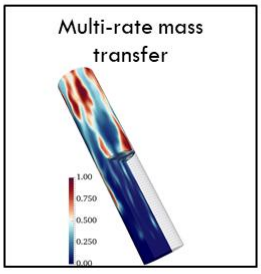
Fracture Leak Rate Prediction to validate flow sensors

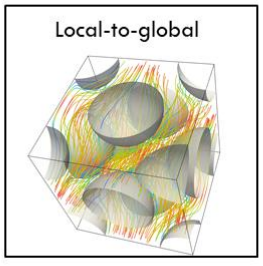
WP 4.2 – Open source library











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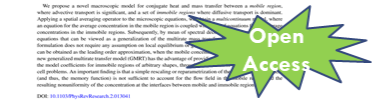
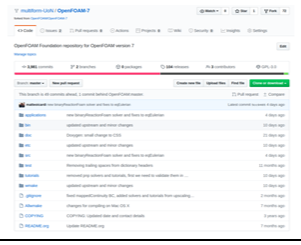
Fracture Leak Rate Prediction to validate flow sensors

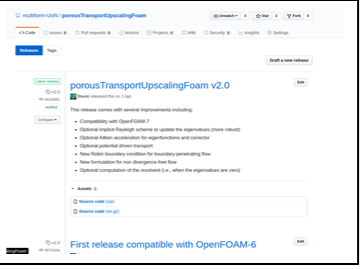
Two publications in 2020





Self-contained repository including the full OpenFOAM-7 package and all the software developed in WP-4.2

Dedicated repositories with up-to-date code release



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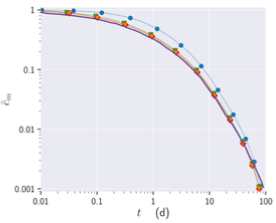
Fracture Leak Rate Prediction to validate flow sensors

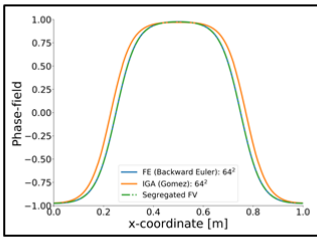
WP 4.2 – TRL

Comparison of our multi-rate library against data from literature

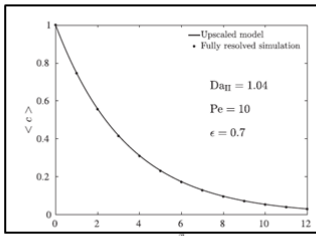


Almost all the modules in the library reached TRL 4

(technology validated in laboratory)



Finite volume phase-field model agrees with finite element



Verification of the upscaling methodology and software

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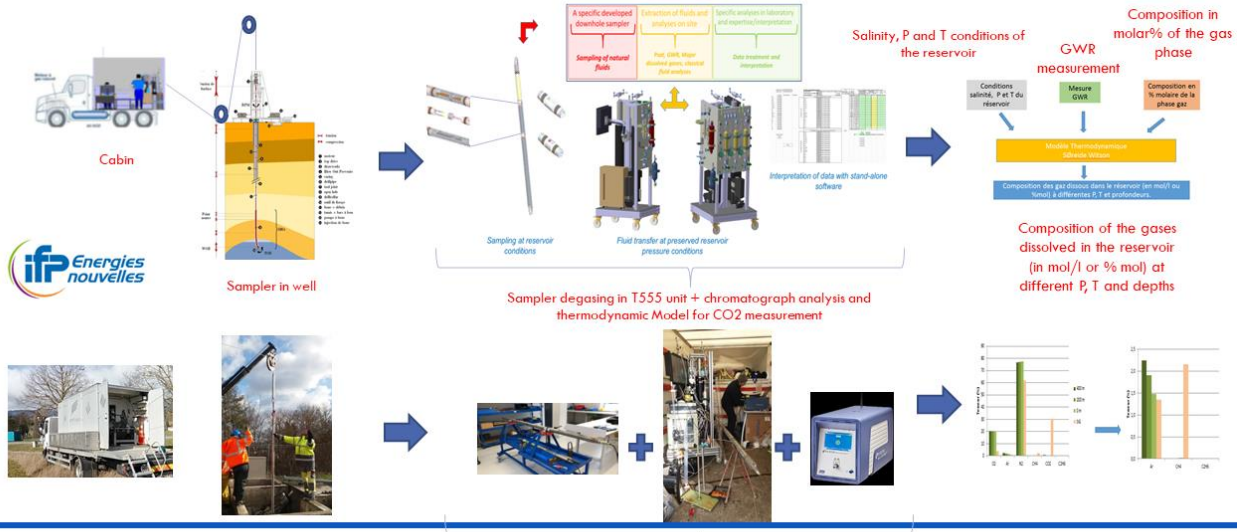
Fracture Leak Rate Prediction to validate flow sensors

WP 4.2 – What is next?

- Using real datasets. Links with WP-3 could advance the **TRL beyond level 4**.
- Potential collaboration with IMFT in the field of porous electrode modelling.

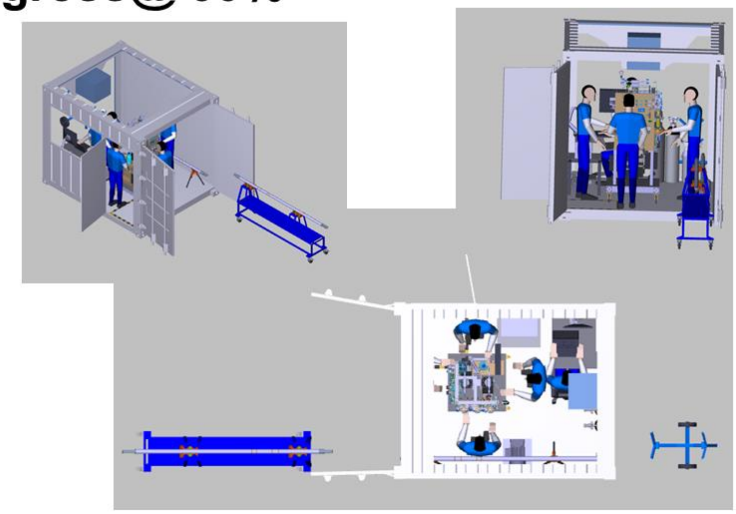
WP4.1.3 : Noble gases sampling and analyses

Scheme : SAMPLING From Theory to Practice



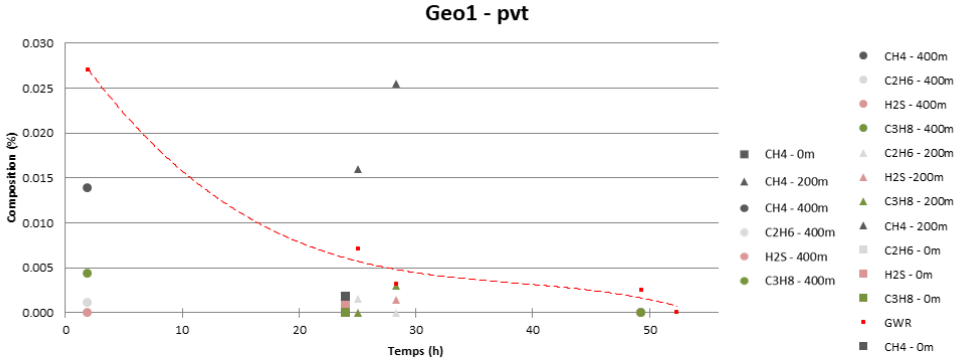
Cabin DESIGN : Construction Progress@ 60%

- Fully Equiped :
  - ☐ 1 desk,
  - ☐ 1 Computer,
  - ☐ 1 Unit T555,
  - ☐ 1 Chromatograph,
  - ☐ 1 Sampler,
  - ☐ 1 Sampler support,
  - ☐ 1 container,
  - ☐ 1 HVAC system,
  - ☐ 1 pump,
  - ☐ 2 N2 bottles
  - ☐ Safety H2s Masks,
  - ☐ Safety Covid Masks,



Results

- Composition of dissolved gases



→ Composition of traces which vary according to GWR

→ SIG-1 Comment « Odor (sensor) : H2S » : Here H_2S is measured between 3 & 8 ppm

OUTPUT

- **WHAT DOES MY RESEARCH MEAN FOR INDUSTRY OR REGULATORS ?**
  - Use of a cabin to help characterize the follow up of gases and to monitor in situ the (majors +noble) gas concentration and the dissolved (majors +noble) gas in water by « on site » measurements in the reservoir.
- **HOW CAN MY RESULTS IMPROVE CO2 STORAGE OPERATIONS ?**
  - Characterization of reservoirs and upper aquifers : Baseline
  - To monitor the CO2 plume + noble gas in the reservoir,
  - To monitor eventual leakage of CO2 + noble gas in aquifers,
- **WHAT SHOULD BE IMPLEMENTED DIFFERENTLY AS A RESULT OF MY RESEARCH ?**
  - Results are at preliminary stage, therefore needs consolidation.
  - On process improvement will help to :
    - Analyse the fluids in 'Low GWR' conditions
    - reducing time for local Psat measurements and gas composition measurement and GWR measurment
    - In case of future clients requirements (Water analysis in-situ instead of actual laboratory work (PH, dissolved gas)
- **IMPROVEMENT MIGHT ARISE FROM GREATER UNDERSTANDING OF PROCESSES, NEW METHODOLOGIES, IMPROVED TECHNOLOGIES, NEW KNOWLEDGE ?**
  - Further digitalization allowing data vizualisation in « real time » and security access for our clients abroad.

9 Study possible failures of well cement (linked to D5.1)

- Innovation related to testing methodology
  - Main research question: are we able to fracture cement in a field relevant way?
  - Trying to mimic what would happen in a field setting when cement fails. Main issue in the field: cement cannot be reached
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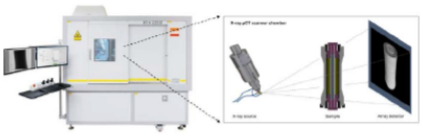

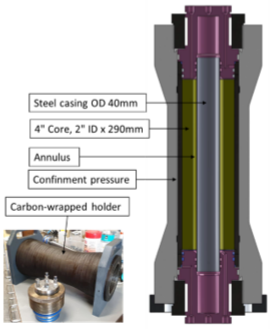

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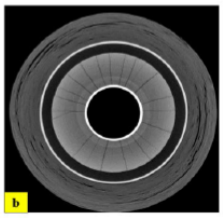

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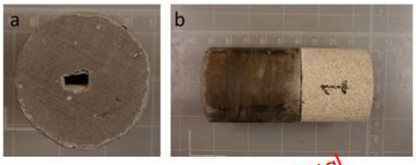
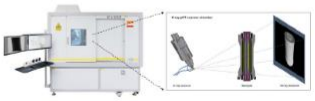
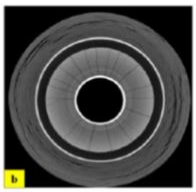
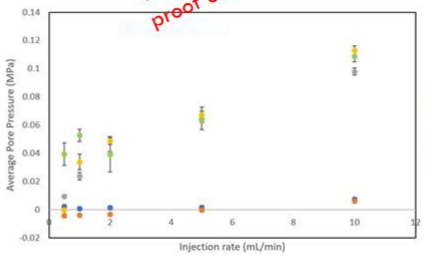






TRL 3: experimental proof of concept



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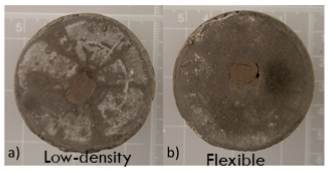
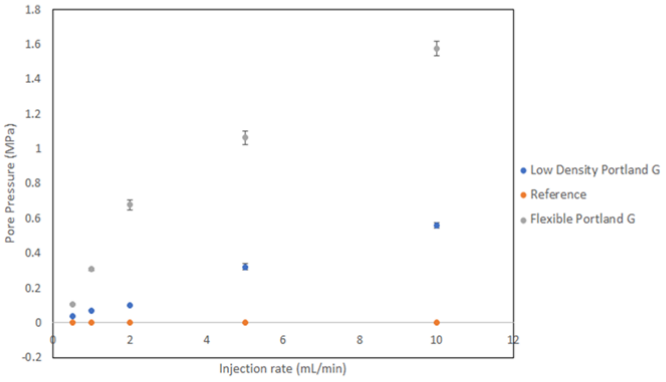
Materials to optimize injectivity (linked to 5.3)

- 2 simple existing modified Portland G cement formulations analyzed
  - see how they perform as fracture-filling remediation material
- Low density and flexible cement chosen.
- Flexible cement prepared by adding bentonite and sodium metasilicate
  - both at 1 % BWOC
  - W/C (water to cement) ratio of 0.6
- Low-density formulation prepared by increasing W/C ratio from 0.44 to 0.5.





Sample	Length [mm]	Diameter [mm]	Peak axial stress [MPa]	Young's Modulus [GPa]
Flexible Portland G 1	52.41	25.15	11.18	3.60
Flexible Portland G 2	53.43	25.08	10.88	3.49
Low-density Portland G 1	51.58	25.26	19.13	6.49
Low-density Portland G 2	51.89	25.30	18.84	6.11

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