Australia's National
Science Agency

GISERA | Gas Industry Social and Environmental Research Alliance

Progress report

Beetaloo basin shale long-term competency after decommissioning

CSIRO | Australia Pacific LNG | QGC | origin | Santos | NSW Government | Australian Government Department of Industry, Science, Energy and Resources | Supported by Government of South Australia | Queensland Government | Northern Territory Government

Progress against project milestones

Progress against milestones/tasks are approved by the GISERA Director, acting with authority in accordance with the GISERA Alliance Agreement.

Progress against project milestones/tasks is indicated by two methods: Traffic light reports and descriptive Project schedule reports.

1. Traffic light reports in the Project Schedule Table below show progress using a simple colour code:

- **Green**:
  - Milestone fully met according to schedule.
  - Project is expected to continue to deliver according to plan.
  - Milestone payment is approved.
- **Amber**:
  - Milestone largely met according to schedule.
  - Project has experienced delays or difficulties that will be overcome by next milestone, enabling project to return to delivery according to plan by next milestone.
  - Milestone payment is withheld.
  - Milestone payment withheld for second of two successive amber lights; project review initiated and undertaken by GISERA Director.
- **Red**:
  - Milestone not met according to schedule.
  - Problems in meeting milestone are likely to impact subsequent project delivery, such that revisions to project timing, scope or budget must be considered.
  - Milestone payment is withheld.
  - Project review initiated by GISERA Director.

2. Progress Schedule Reports outline task objectives and outputs and describe, in the 'progress report' section, the means and extent to which progress towards tasks has been made.

Project schedule table

TASK NUMBER	TASK DESCRIPTION	SCHEDULED START	SCHEDULED FINISH	COMMENT
1	Literature review of the concept of shale barriers, experimental studies, and possible stimulation mechanisms	15th August 2022	15th October 2022	The literature review has been submitted into ePublish and is likely to be released February 2023.
2	Acquire the shale core samples from the Beetaloo basin and quantify the shale mineralogy and chemoporomechanical properties	15th September 2022	15th January 2023	This milestone will be completed February 2023.
3	Perform triaxial creep tests under different downhole conditions to characterize Beetaloo shale behaviour	15th November 2022	15th July 2023	
4	Results interpretations	15th May 2023	15th August 2023	
5	Develop a decommissioned well leakage simulator to bound potential contaminant flux over the long-term	15th March 2023	15th July 2023	
6	Define key long-term decommissioned well integrity concepts such as timescale, and contamination grade	15th June 2023	15th July 2023	
7	Update decommissioned well leakage simulator with Beetaloo shale properties	15th July 2023	15th October 2023	
8	Project reporting	15th May 2023	15th November 2023	
9	Communicate findings to stakeholders	Project duration		

Project schedule report

TASK 1: Literature Review

BACKGROUND

Stimulating and activating the shale can happen through temperature and pressure changes imposed on the shales and also utilizing some chemicals. Chemical activation might be more straightforward than imposing temperature changes in field applications. The chemical solutions are circulated through the annular space by casing perforations with a workstring and packer arrangement.

TASK OBJECTIVES

The main emphases of the literature review will be placed on:

1.1) Experimental input data collection includes downhole conditions, wellbore characteristics, nominating chemicals
1.2) Shale barriers validations using logging techniques with the intent to qualify the formed shale barrier.
1.3) Techniques and approaches to stimulate and activate shale in decommissioned wells
1.4) Theoretical and experimental lab investigations to confirm the design of the studies in task 3.2

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

An internal report summarizing the literature review on the concept of shale barriers, experimental studies, and possible activation mechanisms will be delivered. This internal report will be incorporated into the project's final report.

PROGRESS REPORT

The literature review was submitted to ePublish, one of the reviewers suggested revisions and restructuring, especially in the creep modellings section. The reviewer's comments and revisions have been implemented and the final draft has now been sent to the approver in ePublish and is likely to be released February 2023.

TASK 2: Evaluation of the Beetaloo shale mineralogy and chemoporomechanical properties

BACKGROUND

Shale mineralogy (mainly the amount of clay and also the proportion of other constituents, including Smectite, which acts as a bonding agent) plays a critical role in the performance of the shale to act as an appropriate barrier. In addition, the response of shale to different annular fluids chemistry influences the time-dependent creep behaviour. In order to study the swelling and shrinkage of the shale, the chemoporomechanical properties, including the determination of chemoporoelastic properties including hydraulic diffusivity (D_h) and ionic diffusivity (D_c) should be measured.

TASK OBJECTIVES

2.1) Acquiring the shale core samples from the Beetaloo basin

2.2) Determination of core mineralogy by X-ray diffraction (XRD). Main mineral constituents and organic-matter contents will be quantified prior to the experiments
2.3) Commissioning the MicroRX rig
2.4) Sample preparation
2.5) Preparing the fluids test and the chemical solutions
2.6) Measuring the chemoporoelastic properties

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

An internal report summarizing the results of XRD studies along with mineral quantifications, rig calibration, and chemoporoelastic properties will be incorporated into the project's final report.

PROGRESS REPORT

The samples from Shenandoah-1A well located at the Beetaloo basin were acquired and delivered to our CSIRO researcher at the CSIRO Waite campus in person in early December 2022 for XRD, XRF and CEC examinations. The MicroRX rig has been successfully commissioned, and specimens are being tested to measure chemoporoelastic properties. Due to the staff taking time off during December and early January, this milestone will now be completed February 2023.

Variations to Project Order

Changes to research Project Orders are approved by the GISERA Director, acting with authority, in accordance with the GISERA Alliance Agreement. Any variations above the GISERA Director's delegation require the approval of the relevant GISERA Research Advisory Committee.

The table below details variations to research Project Order.

Register of changes to Research Project Order

DATE	ISSUE	ACTION	AUTHORIZATION

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GISERA is a collaboration between CSIRO, Commonwealth and state governments and industry established to undertake publicly-reported independent research. The purpose of GISERA is to provide quality assured scientific research and information to communities living in gas development regions focusing on social and environmental topics including: groundwater and surface water, greenhouse gas emissions, biodiversity, land management, the marine environment, and socio-economic impacts. The governance structure for GISERA is designed to provide for and protect research independence and transparency of research.