



Australia's National
Science Agency

GISERA | Gas Industry Social and Environmental Research Alliance

Progress report

Queensland CSG well integrity: cements, steels and microbial activity



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	Project management, stakeholder engagement and communication management	Duration of project		
2	Data collection and collation	1 Feb 2023	15 Oct 2023	Completed
3	Steels	1 Apr 2023	15 Oct 2023	Completed
4	Cements	1 Apr 2023	15 Oct 2023	Completed
5	Microbial aspects of well integrity	1 Feb 2023	30 Apr 2023	Completed
6	Final report compilation	1 Jul 2023	31 Dec 2023	Completed
7	Communications	1 Apr 2023	31 Dec 2023	Initial workshop held in Chinchilla on 2 August 2023. This project will be completed in April 2024.

Project schedule report

TASK 1: Project management, stakeholder engagement and communication management

BACKGROUND

This project will require engagement with industry and industry subcontractors to obtain information around materials (cements and steel) and operational choices. Furthermore, communication with the UQ Centre for Natural Gas and various government regulatory agencies, at the inception of the project, are key component of this task. This task also includes time for the project leader to manage the project and undertake administrative actions associated with project progress. Further, communications of GISERA research are an important component of outreach and dissemination of findings to diverse audiences, time to facilitate these activities are also included here

TASK OBJECTIVES

Engage with industry, industry partners, universities, and government agencies to obtain information for the project, manage project staff and deliverables, communicate project objectives, progress and findings to stakeholders through meetings, knowledge transfer session, factsheet and journal article, in collaboration with GISERA Communications officers.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

Communicate project objectives, progress and results to GISERA stakeholders according to standard GISERA project procedures which may include, but not limited to:

- 1) Obtain Ethics Committee approval for conducting workshops with community stakeholders
- 2) Complete milestone reports, undertake project team meetings
- 3) Engage with industry and industry subcontractors and record these interactions via the GISERA communications register.
- 4) Undertake Knowledge Transfer session(s) with Government/Gas Industry
- 5) Presentation of findings to Community members/groups
- 6) Preparation of article for GISERA newsletter and other media outlets e.g. The Conversation
- 7) Revision of project factsheet to include final results (a factsheet is developed at project commencement, and another will be done at completion)
- 8) Peer reviewed scientific manuscript ready for submission to relevant journal
- 9) Work with GISERA communications to organise Task 7.

PROGRESS REPORT

This task is due for completion at the duration of the project.

- Weekly project meetings continue to be held among the team members to discuss progress of activities
- Meetings with industry experts and contractors on casing and cements held, including with: Senex, Origin (APLNG), Santos, Haliburton, SLB (Schlumberger)
- Meeting held with Executive Petroleum Engineer (Wells Operations) – Resources Safety and Health Queensland
- Discussions on obtaining Ethics Committee approval for conducting workshops commenced.
- Interactions with the GISERA communication team continue and a fact sheet to introduce the project was prepared and available for viewing on the website.

TASK 2: Data collection and collation

BACKGROUND

Data on cements, their additives and steels used in well completions are held within well completion reports that are available online, from industry or from regulators.

TASK OBJECTIVES

This task will randomly subsample well completion reports from Queensland to obtain data on cement, cement additives and steels used in well construction. These data are required for Tasks 3 and 4.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

- 1) Data collated for cement and cement additives from a representative number of well-completion reports.
- 2) Data collated for steels from a representative number of well-completion reports.

3) These data are available on request.

PROGRESS REPORT

This milestone is complete.

Data collection task from well completion reports has been completed, information from 133 well completion reports, largely from wells drilled in the Bowen and Surat basins, have been obtained.

- 118 wells from the random selection of 200 made using python, collecting information from well completion reports,
- 6 wells with information supplied directly by QGC,
- 9 wells with information supplied directly by Origin.

The data have been included in an Excel database and used for detailed analyses of casing (steel) and cement composition information.

TASK 3: Steels

BACKGROUND

The use of steel in well infrastructure is a key part of well integrity. Data on the types of steel used are not readily available in a non-technical form that is accessible for the community. Further, differences between types of steel and reasons for their selection are not commonly understood.

TASK OBJECTIVES

Analyse the types of steel, historic changes (if present) and reasoning for use of particular steels in well applications. Discuss the pros and cons of this steel and its various resistances and vulnerabilities.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

- 1) A summary of steels used by industry through time (through analyses of the data provided from Task 2).
- 2) A description and discussion of the types of steels used by industry, including information on their various resistances and vulnerabilities.
- 3) A commentary on industry choices and decision making when it comes to use of steels in well completions.

PROGRESS REPORT

This milestone is complete.

Draft report on casing material used in the 133 have been completed. This includes the description of different casing types (i.e., standard casing grades used by Industry, API grades), corrosion behaviour and the chemical composition of different casing grades, analyses of casing types with respect to CSG fields, the depth range of different casing types for Surat and Bowen basins as well as casing types and sizes. This documentation will now be incorporated in the integrated project report.

TASK 4: Cements

BACKGROUND

The use of cements in well infrastructure are a key part of well integrity. Data on the types of cements used, their additives and the purpose(s) of these additives are not commonly available for the community in a non-technical form that is accessible. Further, operational decisions by industry and industry subcontractors are not well understood outside industry.

TASK OBJECTIVES

Analyse data from the well completion report survey (Task 2). Collate information on changes in industry practice over time (if present), use of particular additives or cement types.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

- 1) A summary of cements and cement additives used by industry through time (through analyses of the data provided from Task 2).
- 2) A description and discussion of the types of cements (and additives) used by industry, including information on its various resistances and vulnerabilities.
- 3) A commentary on industry choices and decision making when it comes to particular formulations of cement in well completions.

PROGRESS REPORT

This milestone is complete.

The cementing data obtained from the 133 well completion reports have been included in the database, and preliminary statistical analyses have been conducted and documented. Numerous inconsistencies in reporting procedure, including differences in nomenclature, were noticed in the well completion reports prepared by various operators, and these needed to be QCd within our database. The cement composition data have been analysed with respect to changes in industry practices over time, and the additives according to their specific functionality. The data have also been represented through plots that demonstrate their functionality, variations according to basin as wells the operating company. This information will now be incorporated in the integrated project report.

TASK 5: Microbial aspects of well integrity

BACKGROUND

There are community concerns about well integrity being affected by microbial activity. In particular, the distribution, and function of bacteria that produce corrosive compounds (H₂S or acids) are poorly understood in subsurface environments.

TASK OBJECTIVES

Review available literature on subsurface microbiology in association with hydrocarbons in onshore settings in Australia.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

A literature review of subsurface microbiology in Australia as it relates to microbes that may have deleterious effects on well integrity. This report will include all available published data on subsurface microbiology in Australia in association with hydrocarbon resources, specifically: the type of organisms in these environments, their function, constraints and ecology.

PROGRESS REPORT

This milestone is complete, a summary of activities that we've undertaken:

- We have compiled all known prokaryotic (bacterial and archaeal) species that have been detected in SE Qld aquifers. It should be noted that microbial data from the aquifers of SE Qld is largely lacking. What we do know about this environment is largely due to research on the microbes associated the resource (Surat and Bowen Basins) and most, but not all, the work has been done by CSIRO (and our team). There are some other contributors, particularly in the Bowen, from UQ. Our list is based on culture-based work, and culture-independent work (both 16S amplicon and metagenomic, shotgun sequence data). To do this we used both the literature and online repositories of genetic information (e.g. GenBank, IMG).
- We have used PICRUSt, a software package, to predict functional genes and metabolisms from our dataset.
- We have then created a second, sub-listing of species known to have sulfur-active or acid-producing metabolisms.
- Early data indicate a large proportion of taxa in the aquifers (~10-20%) possess the capacity to produce acids (including, but not limited to H₂S) **IF** the right conditions occur.
- Conditions that are important include: availability of phosphorus (which is a major constraint on microbial activity in the subsurface) and suitable oxidised sulfur species for reduction. The former of which, at least, is somewhat scarce in the subsurface.
- Work to integrate these data into a form for the final report is ongoing in the write up task.

Task 6: Final report compilation

BACKGROUND

Requires data from Tasks 1-5

TASK OBJECTIVES:

Integrate data and analyses from Tasks 1-5 into a comprehensive report. Liaise with GISERA communications to explore opportunities (in Task 1) to communicate study highlights to various stakeholders.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

- 1) Preparation of a final report outlining the scope, methodology, scenarios, assumptions, data analyses, findings and any suggestions/options for future research; incorporate broad feedback from the community forum.
- 2) Following CSIRO ePublish review, the report will be submitted to the GISERA Director for final approval.

3) Liaise with GISERA Communications Team to complete (Task 7).

PROGRESS REPORT

This milestone is complete.

The following two reports are components of the CSIRO GISERA project 'Review of cements, steels and microbial activity for Qld CSG wells':

- Report titled '*Queensland CSG well integrity: cements, steels and microbial activity*' - the scope of this report is tasks 2, 3 and 4 of the project, which cover data collection and collation, summarising and analysing data on the material used in well casing, and summarising and analysing data on the cements and cement additives used in well cement.
- Report titled '*Potential microbial interactions with cements and steels*' - addresses task 5 of the project, which covers a summary and analysis of the available data on subsurface microbial communities in Queensland aquifers in areas of coal seam gas activity.

Both reports have been finalised, peer reviewed and are submitted to the GISERA Director for final approval.



Public release is expected in late March/early April 2024.

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	AUTHORISATION
19/09/23	Milestones delayed due to complexities in extracting data from well completion reports.	Milestone 2 & 3 extended from June 2023 to 15 October 2023.	
19/09/23	Milestones delayed due to complexities in extracting data from well completion reports.	Milestone 4 extended from July 2023 to 15 October 2023.	

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Contact us

1300 363 400
+61 3 9545 2176
csiro.au/contact
csiro.au

For further information

1300 363 400
gisera.csiro.au

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.