



**GISERA** | Gas Industry Social and Environmental Research Alliance

# Project Order

## Short Project Title

Exposure assessment of identified chemicals used in CSG activities

## Long Project Title

Exposure assessment of identified chemicals used in the coal seam gas activities at a study site in the southern Surat Basin, Queensland.

## GISERA Project Number

H.3

## Start Date

06/02/2023

## End Date

31/07/2024

## Project Leader

Nai Tran-Dinh



Australian Government  
Department of Industry, Science,  
Energy and Resources



Supported by  
Government of  
South Australia



NORTHERN  
TERRITORY  
GOVERNMENT

## GISERA State/Territory

- |   |  |   |
|---|--|---|
| <input checked="" type="checkbox"/> <b>Queensland</b> | <input type="checkbox"/> New South Wales   | <input type="checkbox"/> Northern Territory |
| <input type="checkbox"/> South Australia              | <input type="checkbox"/> Western Australia | <input type="checkbox"/> Victoria           |
| <input type="checkbox"/> National scale project       |  |   |

## Basin(s)

- |  |  |   |
|--|--|---|
| <input type="checkbox"/> Adavale         | <input type="checkbox"/> Amadeus                 | <input type="checkbox"/> Beetaloo               |
| <input type="checkbox"/> Canning         | <input type="checkbox"/> Western Australia       | <input type="checkbox"/> Carnarvon              |
| <input type="checkbox"/> Clarence-Morton | <input type="checkbox"/> Cooper                  | <input type="checkbox"/> Eromanga               |
| <input type="checkbox"/> Galilee         | <input type="checkbox"/> Gippsland               | <input type="checkbox"/> Gloucester             |
| <input type="checkbox"/> Gunnedah        | <input type="checkbox"/> Maryborough             | <input type="checkbox"/> McArthur               |
| <input type="checkbox"/> North Bowen     | <input type="checkbox"/> Otway                   | <input type="checkbox"/> Perth                  |
| <input type="checkbox"/> South Nicholson | <input checked="" type="checkbox"/> <b>Surat</b> | <input type="checkbox"/> Other (please specify) |

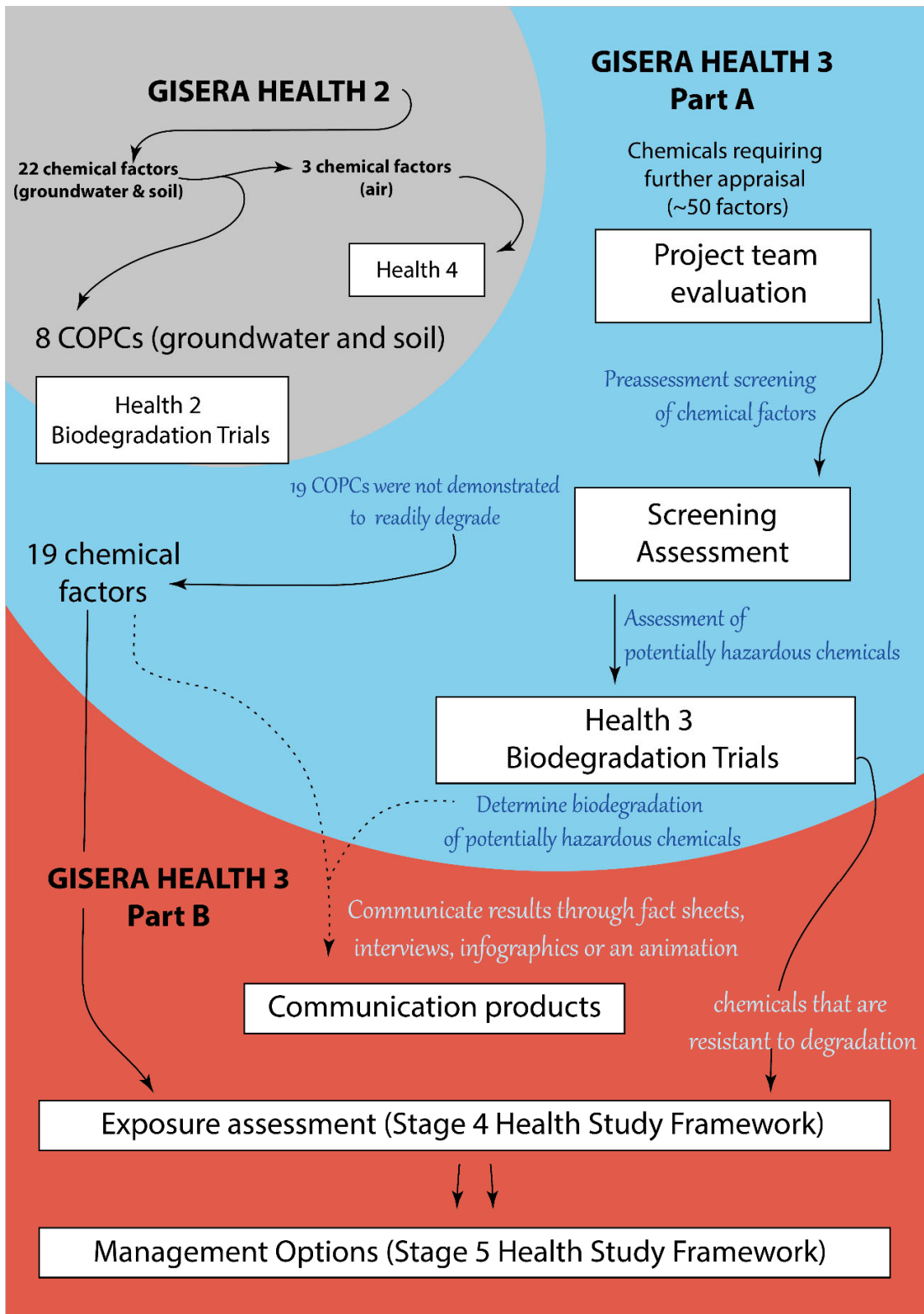
## GISERA Research Program

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Water Research                              | <input checked="" type="checkbox"/> <b>Health Research</b> | <input type="checkbox"/> Biodiversity Research                 |
| <input type="checkbox"/> Social & Economic Research                  | <input type="checkbox"/> Greenhouse Gas Research           | <input type="checkbox"/> Agricultural Land Management Research |
| <input type="checkbox"/> Land and Infrastructure Management Research | <input type="checkbox"/> Other (please specify)            |  |

# 1. Project Summary

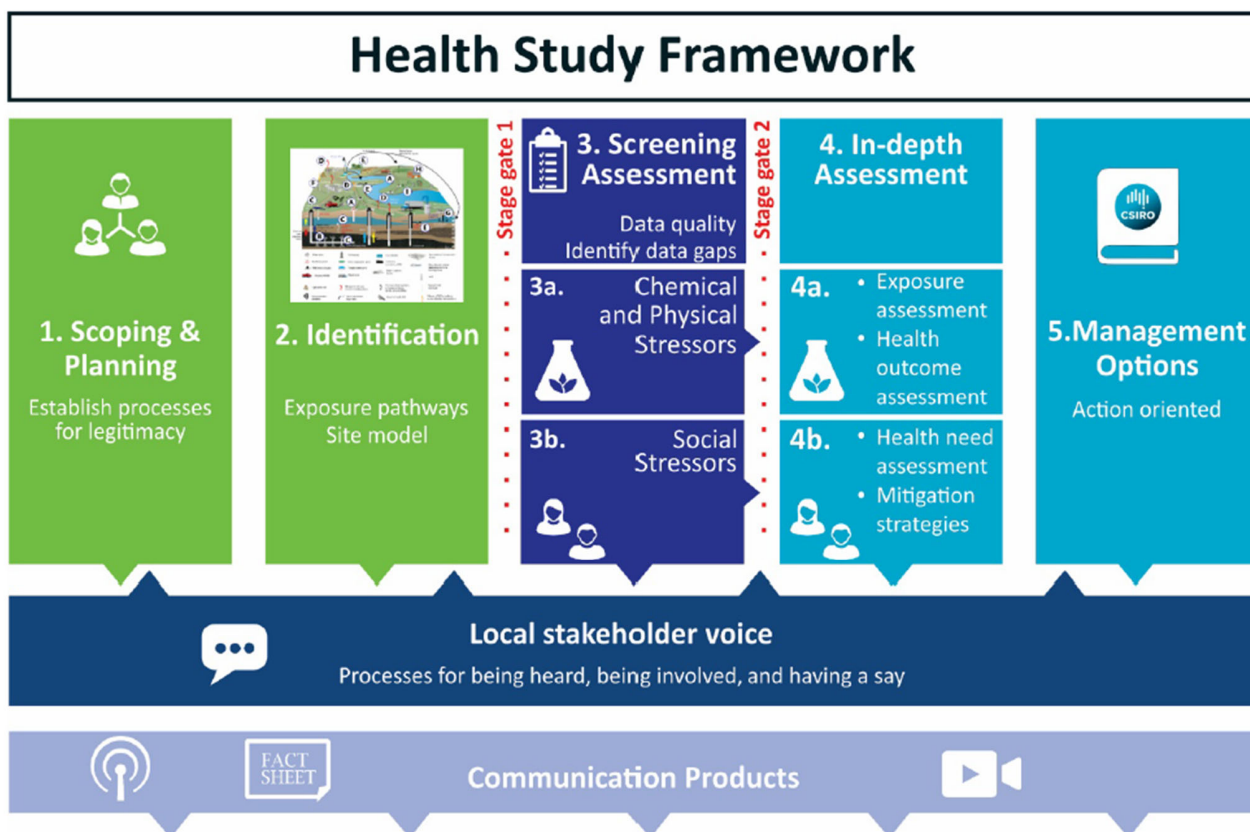
The CSIRO GISERA H.2 Project [Identification and screening for potential human health effects of coal seam gas \(CSG\) activity in the southern Surat Basin, Queensland](#) and the H.2 extension work identified 19 chemical factors requiring further assessment that were associated with a pathway through groundwater or soil; Tributyl Tetradecyl Phosphonium Chloride, Tetrakis (Hydroxymethyl) Phosphonium Sulphate, Nonylphenol ethoxylate, and a group of 16 fluorobenzoic acid tracers. In addition, the H.2 project identified a list of approximately 50 chemicals requiring further appraisal for potential health impacts related to CSG activities.

This project will assess the potential risks posed by the chemicals identified from H.2. The workflow for this project is outlined in Figure 1 and will broadly follow the GISERA Health Study Framework established in H.1 (Figure 2). In the first part of the Health 3 project (H.3 Part A), the ~50 additional chemicals identified in H.2 will initially be evaluated by the project team and those that warrant further investigation will be appraised through the Identification and Screening stages of the GISERA Health Study Framework (Figure 2). This appraisal will be carried out by an external contractor and will identify chemicals of potential concern (COPCs). Microbial degradation trials will be carried out on these COPCs to identify any chemicals that require in-depth assessment. The procedure in H.3 Part A will mirror the work carried out in H.2 extension work for identifying chemicals requiring in-depth assessment (Figure 1).



**Figure 1: Overview of Health 2 and Health 3 project workflows**

The 22 chemical factors (groundwater and soil) identified in GISERA Health 2 includes a group of 16 chemicals used in a small number of wells as tracers.



**Figure 2: Overview of Health Study Framework**

A communication product will be prepared to summarise the outcomes of both H.2 and H.3 Part A outlining the fate of COPCs in groundwater and soil within the study site. In addition, the product will communicate the COPCs that will be taken through the last two stages of the GISERA Health Study Framework.

Health 3 Part B will take all identified COPCs through the final two stages of the GISERA Study Framework (In-depth Assessment and Management Options stages) for the single Queensland study site used in H.2.

For the Queensland study site, the groundwater pathway associated COPCs will be further assessed as follows:

- A desktop exposure assessment for each COPC in the study site will be carried out, including information about the most recent use at which wells/surface water bodies. Assessments will be done by examining industry reports on the use of these COPCs in CSG extraction in the last 5 years (2018-2022), looking particularly at the timing and location of recent chemical usage. These assessments will focus on the COPCs that were identified as persistent from H.2 and H.3 Part A.

- Sampling campaign of specific wells/surface water bodies to determine the presence or absence of these COPCs. Where present, the concentration of COPCs will be determined.
- Potential management options for mitigation of COPCs found to be present in the exposure assessment will be discussed in the final report.

The project will be managed with the aim to address issues that are a priority to the local community and other stakeholders, and with the findings of the research as it progresses.

## 2. Project description

### Introduction

In response to community concerns about potential human health risks from CSG activities (OCSE, 2014), CSIRO's GISERA conducted the GISERA H.1 project—[Human Health effects of Coal Seam Gas—Designing a Study Framework](#) (Keywood et al., 2018) to develop a robust approach to conducting research into possible health effects associated with Coal Seam Gas (CSG) activities. The scoping, identification and screening stages of the Health Study Framework developed in that project were applied in the GISERA H.2 Project *Identification and screening for potential human health effects of coal seam gas activity in the southern Surat Basin, Queensland*. The H.2 project investigated a range of chemical factors associated with CSG activities including those found in additives used in drilling or hydraulic fracturing, produced water and air emissions and physical factors including noise, light and dust. The aim of the project was to identify factors that warranted further assessment.

The H.2 project identified and appraised over 97 unique chemical factors from 140 drilling or hydraulic fracturing additives. 25 of these chemical factors were found to warrant further assessment as they were either appraised to be chemicals of potential concern (COPC) or there were knowledge gaps that meant a complete appraisal was not possible. The H.2 extension project demonstrated that potentially 19 of these chemical factors were persistent in biodegradation trials with soil and groundwater samples from the Queensland study site. The H.2 extension used 4-fluorobenzoic acid as a proxy for the group of 16 fluorobenzoic acid tracers. This project will progress the assessment on these 19 persistent chemical factors that are associated with groundwater and soil pathways, including Tributyl Tetradecyl Phosphonium Chloride, Tetrakis (Hydroxymethyl) Phosphonium Sulphate, Nonylphenol ethoxylates, and the fluorobenzoic acid tracers (Table 1) and further appraise a list of ~50 additional chemicals identified in H.2. This project will also assess Nonylphenol and the 15 other fluorobenzoic acid tracers that were used in the Queensland study site.

A companion CSIRO GISERA project will assess the other chemical which is associated with dust/atmospheric pathways (GISERA Health 4 project).

**Table 1: H.2 chemicals identified as requiring further assessment**

| <b>Chemical</b>                                   | <b>Abbreviation</b> | <b>CAS RN</b> |
|---|---------------------|---------------|
| <b>Tetrakis(hydroxymethyl)phosphonium sulfate</b> | THPS                | 55566-30-8    |
| <b>Nonylphenol ethoxylates</b>                    | NPE                 | 9016-45-9     |
| <b>Fluorobenzoic acid tracers<sup>^</sup></b>     | FBA                 |               |
| <b>Tributyltetradecylphosphonium chloride</b>     | TTPC                | 81741-28-8    |

CAS RN - Chemical Abstract Service Registration Number

<sup>^</sup> In the H.2 extension 4-fluorobenzoic acid was used as a proxy for the group of 16 fluorobenzoic acid tracers

## Prior Research

This project is a direct follow up project to GISERA H.2 (and the H.2 extension work) and further assesses the human health impacts of chemicals identified as either to be Chemicals of Potential Concern (COPC) or as chemicals with knowledge gaps that meant a complete appraisal was not possible.

- Tetrakis (Hydroxymethyl) Phosphonium Sulfate (THPS); CAS RN 55566-30-8. A broad-spectrum biocide and fungicide used in industrial water systems and in drilling and hydraulic fracturing fluids. It is highly soluble in water and readily oxidised under aerobic and neutral pH conditions (PubChem, CID 41478). Potential persistence under aerobic and low pH conditions, absence of information in available literature and insufficient information on elimination by biodegradation warrants further research on degradation behaviour by CSIRO.
- Nonylphenol ethoxylates; CAS RN 9016-45-9 and Nonylphenol CAS RN 25154-52-3 are both surfactants used in industrial cleaning, agriculture, plastics, textiles, paper, phenolic resins, plastics additives, detergents, emulsifiers, and pesticides (PubChem, CID 24773 and 67296). At the study site, it was a drilling additive (97 wells) and hydraulic fracturing additive (5 wells) prior to 2014. These are highly soluble but have low mobility in soils. They are considered as substances of very high concern and, despite discontinuity of their use after 2014, warrant further research on degradation behaviour by CSIRO.
- Fluorobenzoic acid tracers are commonly used as tracers in water systems and used in hydraulic fracturing. Limited information exists on toxicity and environmental fate of fluorobenzoic acid tracers and they may be highly mobile and persistent in the environment (PubChem, CID 9973). Toxicity data is lacking and no chronic studies exist, therefore further research on degradation behaviour is warranted by CSIRO.
- Tributyl tetradecyl phosphonium chloride (TTPC) is a common antimicrobial agent in industry and was used at the study site during hydraulic fracturing of 11 wells in 2019/2020. No data are available on environmental behaviour and fate of TTPC but has potential persistence to

organic matter (PubChem, CID 9889168). As such, it warrants further research on degradation behaviour by CSIRO.

The Geological and Bioregional Assessment Program (GBA) has assessed the potential impacts of unconventional gas developments on water and the environment in three onshore areas (Cooper Region, Isa Region and Beetaloo Region)<sup>1</sup>. These regions are geographically distant and climatically unanalogous to the GISERA Queensland study site, however, outcomes from this project may have value outside of the study site and will be communicated to the various proponents of the GBA (Task 11).

## Need & Scope

The GISERA H.2 project identified eight chemicals associated with groundwater or soil pathways that warranted further assessment; fluorobenzoic acid related tracers (FBA), glutaraldehyde (GA), methylchloroisoithiazolinone (CMIT), methylisothiazolinone (MIT), nonylphenol ethoxylates (NPE), polyacrylamide (PAM), Tributyl tetradecyl phosphonium chloride (TTPC) and tetrakis(hydroxymethyl) phosphonium sulphate (THPS). The H.2 extension work demonstrated that four of the chemicals readily degraded and the remaining four; TTPC, THPS, NPE and FBAs should be continued through the last two stages of the health study framework.

In parallel, the H.2 project identified a further list of ~50 chemicals and produced water chemistry data that require appraisal through the Health Study Framework.

This project further assesses the potential human health impacts of the identified chemicals within the GISERA H.2 project study area.

## Objective

The project's objectives are to:

### Health 3 Part A:

- Prescreen the list of ~50 chemicals identified as requiring further appraisal and identify high-risk chemicals.

---

<sup>1</sup> <https://bioregionalassessments.gov.au/gba>



- Screening Assessment of high-risk chemicals as part of the Health Study Framework.
- Microbial biodegradation trials of high-risk chemicals to identify persistent chemicals requiring further In-depth Assessment as part of the Health Study Framework.
- Communication of results from Health 3 Part A through fact sheets, interviews, infographics and/or animations.

#### **Health 3 Part B:**

- Desktop exposure assessment of COPCs (identified from Health 3 Part A) to determine timing and location of recent chemical usage.
- Undertake a comprehensive sampling campaign in the study area at specific wells/surface water bodies to determine the presence or absence of these COPCs. Where present, the concentration of COPCs will be determined.
- Potential management options for mitigation of COPCs found to be present in the exposure assessment will be discussed in the final report.

## Methods

#### **Health 3 Part A:**

Prescreening of chemicals requiring further appraisal. The list of ~50 chemicals will be critically appraised by the project team through chemical toxicity reviews, evaluation of exposure potential, evaluation of persistence and bioaccumulation in soil environments, and known CSG usage (concentration of chemical used, recent usage, widespread usage) and other industrial usage. The chemicals will be triaged, and potentially hazardous chemicals will be identified for further investigation.

Screening Assessment of potentially hazardous chemicals as part of the Health Study Framework. This task will be carried out by an external contractor following the Health Study Framework and will identify any additional chemicals for further investigation. This assessment will follow environmental health risk assessment guidelines for human health risks (enHealth, 2012).

Microbial biodegradation trials of potentially hazardous chemicals. Sampling of water and soil from the Queensland study area will be carried out, followed by replicated microcosm degradation trials for the chemicals identified in the previous screening assessment. This process will mirror the work carried out in H.2 extension and will identify COPCs to be carried through the H.3 Part B.

Communication of results from H.2 and H.3 Part A via fact sheets, interviews, infographics and/or animations. These communication products will be used to clearly state the reasoning behind taking COPCs through the final two stages of the Health Study Framework (carried out in H.3 Part B).

### **Health 3 Part B:**

Desktop exposure assessment of COPCs. Industry and government reports will be used to determine timing and location of recent COPC usage. This information will be used to inform the subsequent exposure assessment campaign.

Sampling campaign in the study area. Groundwater and surface water offer potential pathways for movement of COPCs in the environment. As such, the exposure assessment campaign will focus on groundwater and surface water sampling at locations informed by the desktop exposure assessment i.e. sites proximal to locations where COPCs have been historically used by the CSG industry. Water samples will be analysed at an external NATA accredited laboratory. In addition to water, soils offer a means by which chemicals may enter ground or surface water pathways. In general, the degradative potential of soils and their ability to adsorb chemicals make this pathway less likely to contribute to human health impacts. As such, soil sampling during the exposure assessment will be limited to areas proximal to CSG activities and will be a less significant focus of the exposure assessment.

Potential management options for mitigation of COPCs. For those COPCs found to be present during the exposure assessment, management options will be developed that will focus on future usage of COPCs and use of alternative chemicals that considers industry costs and high-level environmental and social outcomes.

Desktop appraisal of water chemistry for produced CSG water will be conducted to determine whether any components exceed relevant water quality guidelines. Pathways for humans to be exposed to produced CSG water are expected to be limited, however this water is used for activities including dust suppression and drilling, and inadvertent releases (spills) have occurred. The appraisal will consider whether plausible pathways for human exposure exist. The results of the appraisal of water chemistry combined with plausible pathways will allow potential levels of exposure to be assessed.

Treated CSG water data will also be appraised. Treated water is used for a number of beneficial uses including the Chinchilla Beneficial Use Scheme and irrigation. There are strict quality standards as well as monitoring and reporting requirements for treated water.

For any COPC's identified through this exposure assessment, potential management options for their mitigation will be developed.

### 3. Project Inputs

#### Resources and collaborations

| Researcher                | Time Commitment (project as a whole) | Principle area of expertise                          | Years of experience | Organisation |
|---------------------------|--------------------------------------|--|---------------------|--------------|
| Nai Tran-Dinh             | 82                                   | Microbiology, molecular biology                      | 25+                 | CSIRO        |
| David Midgley             | 55                                   | Microbial ecology, bioinformatics                    | 25+                 | CSIRO        |
| Carla Mariani             | 22                                   | Molecular biology, chemistry                         | 5+                  | CSIRO        |
| Stephen Sestak            | 22                                   | Analytical chemistry                                 | 25+                 | CSIRO        |
| Richard Schinteie         | 15                                   | Microbiology, geology                                | 25+                 | CSIRO        |
| Emma Crooke               | 12                                   | Chemical engineering                                 | >15+                | CSIRO        |
| Cameron Huddleston-Holmes | 10                                   | Project management, CSG development, risk assessment | 20+                 | CSIRO        |

| Subcontractors (clause 9.5(a)(i))   | Time Commitment (project as a whole)         | Principle area of expertise   | Years of experience | Organisation |
|-------------------------------------|--|---|---------------------|--------------|
| Environmental Risk Sciences Pty Ltd | 30 days (Budget estimate of \$50K)           | Environmental risk assessment to carry out screening assessment of prescreened chemicals from Task 1) | 30+                 | EnRiskS      |
| ACS Laboratories (Australia)        | Quote based on service (not time allocation) | Chemical analyses from environmental samples  | n/a                 | ACS          |
| ALS                                 | Quote based on service (not time allocation) | Water and soil chemistry  | n/a                 | ALS          |

## Technical Reference Group

The project will establish a Technical Reference Group (TRG) aimed at seeking peer-to-peer technical advice on contextual matters and to discuss research needs as well as outputs as the project progresses. The TRG will include the project leader and a group of different stakeholders as appropriate which may include a range of subject matter experts from government and industry will be invited to participate in the technical reference group. The group will have strong levels of experiences on CSG development, CSG produced water, GHG gas emissions.

## Budget Summary

| Source of Cash Contributions    | 2022/23          | 2023/24          | 2024/25         | 2025/26    | % of Contribution | Total            |
|---------------------------------|------------------|------------------|-----------------|------------|-------------------|------------------|
| GISERA                          | \$104,766        | \$360,970        | \$12,458        | \$0        | 80%               | \$478,194        |
| - Federal Government            | \$86,432         | \$297,800        | \$10,278        | \$0        | 66%               | \$394,510        |
| - APLNG                         | \$12,441         | \$42,865         | \$1,479         | \$0        | 9.5%              | \$56,785         |
| - QGC                           | \$5,893          | \$20,305         | \$701           | \$0        | 4.5%              | \$26,898         |
| <b>Total Cash Contributions</b> | <b>\$104,766</b> | <b>\$360,970</b> | <b>\$12,458</b> | <b>\$0</b> | <b>80%</b>        | <b>\$478,194</b> |

| Source of In-Kind Contribution    | 2022/23         | 2023/24         | 2024/25        | 2025/26    | % of Contribution | Total            |
|-----------------------------------|-----------------|-----------------|----------------|------------|-------------------|------------------|
| CSIRO                             | \$26,191        | \$90,242        | \$3,115        | \$0        | 20%               | \$119,548        |
| <b>Total In-Kind Contribution</b> | <b>\$26,191</b> | <b>\$90,242</b> | <b>\$3,115</b> | <b>\$0</b> | <b>20%</b>        | <b>\$119,548</b> |

| TOTAL PROJECT BUDGET        | 2022/23          | 2023/24          | 2024/25         | 2025/26    | -        | TOTAL            |
|-----------------------------|------------------|------------------|-----------------|------------|----------|------------------|
| All contributions           | \$130,957        | \$451,212        | \$15,573        | \$0        | -        | \$597,742        |
| <b>TOTAL PROJECT BUDGET</b> | <b>\$130,957</b> | <b>\$451,212</b> | <b>\$15,573</b> | <b>\$0</b> | <b>-</b> | <b>\$597,742</b> |

## 4. Communications Plan

| Stakeholder   | Objective   | Channel<br>(e.g. meetings/media/factsheets)  | Timeframe<br>(Before, during at completion) |
|---|---|--|---|
| Regional community stakeholders/wider public including land holders and traditional owners. | To communicate project objectives and key messages and findings from the research             | A fact sheet at commencement of the project which explains in plain English the objectives of the health projects, how they relate to each other and the H.2 project.  | At commencement of project                  |
|   |   | Project progress reported and outcomes (e.g., final papers, final factsheets) on GISERA website to ensure transparency for all stakeholders including regional communities.  | Ongoing                                     |
|   |   | Communicate H.2 and H.3 Part A project progress and findings to stakeholders through fact sheets, interviews, infographics and/or animations.  | Task 4                                      |
|   |   | Public release of final reports.<br>Plain English factsheet summarising the outcomes of the research.  | At project completion                       |
|   |   | Local government and/or community groups invited to community forum (virtual or face-to-face) to learn of and share their reflections on the findings of the overall suite of health studies. This may be conducted as a component of broader GISERA communication activities. | At project completion                       |
| Gas Industry & Government   | To communicate the final results of the project.  | Presentation of findings at joint Gas Industry/Government Knowledge Transfer Session   | At project completion                       |
| Scientific Community  | To provide scientific insight into the potential impacts of CSG activities in the study area. | Peer-reviewed scientific publication.<br>Dataset(s) available through CSIRO's data repository.<br><br>Project outcomes will be communicated to the various proponents of the GBA assessments in the Cooper, Isa and Beetaloo Regions.  | After completion of project                 |

In addition to project specific communications activities, CSIRO's GISERA has a broader communications strategy. This strategy incorporates activities such as webinars, roadshows, newsletters and development of other communications products.

## 5. Project Impact Pathway

| Activities   | Outputs  | Short term Outcomes  | Long term outcomes  | Impact  |
|--|--|--|---|---|
| <p>Health 3 Part A:</p> <ul style="list-style-type: none"> <li>Project team evaluation</li> <li>Screening assessment</li> <li>Biodegradation trials</li> </ul> | <p>Appraisal and assessment of chemical factors requiring in-depth assessment through the final two stages of the GISERA Health Study Framework.</p>   | <p>Database available to industry, community and other stakeholders for information regarding chemicals used by the CSG industry in the study site.</p>  | <ul style="list-style-type: none"> <li>For government regulators, information regarding hazardous chemicals and their concentrations in the study site.</li> <li>For industry, there may be opportunities to use data collected in this study to inform the use of alternative chemicals for CSG activities in the study site.</li> </ul> | <p>Provide a comprehensive understanding of chemicals used by the CSG industry in the Queensland study site which potentially have human health impacts.</p>  |
| <p>Health 3 Part B:</p> <ul style="list-style-type: none"> <li>Communication products</li> </ul>   | <p>GISERA Communications will develop a plain English fact sheet at completion of Health 3 Part A.</p> <p>Completed fact sheet(s) with summaries of the outcomes of H.2 and H.3 Part A outlining the fate of COPCs in groundwater and soil within the study site. In addition, the product will communicate the COPCs that will be taken through the last two stages of the GISERA Health Study Framework.</p> | <p>A clear and concise summary of GISERA Health portfolio projects, linking the outcomes from H.1, H.2, H.2 extension and H.3 Part A, as well as providing information about the work to be carried out in H.3 Part B.</p>                           |   | <p>Provide information to industry and government regulators on chemicals of heightened risk.</p> <p>Provide information to community and other stakeholders regarding chemical concentrations and exposure assessment data in the environment.</p> |
| <p>Health 3 Part B:</p> <ul style="list-style-type: none"> <li>Completion of GISERA Health Study Framework assessments</li> <li>Reporting</li> </ul>           | <p>Detailed information regarding COPC usage in the study site down to timing and location of recent use.</p> <p>A representative collection of soil and groundwater samples from the study site for chemical exposure assessments. Detailed reporting and analysis of exposure assessment, featuring human health impacts of COPCs in the study site.</p>   | <p>The exposure assessment results will provide actionable information regarding COPC prevalence and distribution in the study site.</p> <p>Potential management options for mitigation of COPCs found to be present in the exposure assessment.</p> |   |   |

## 6. Project Plan

### Project Schedule

| ID             | Activities / Task Title                                     | Task Leader    | Scheduled Start | Scheduled Finish | Predecessor |
|----------------|---|----------------|-----------------|------------------|-------------|
| <b>Task 1</b>  | Prescreening of ~50 chemicals for further assessment        | Stephen Sestak | 6/02/2023       | 28/02/2023       | None        |
| <b>Task 2</b>  | Screening assessment of high-risk chemicals                 | Nai Tran-Dinh  | 1/03/2023       | 30/04/2023       | Task 1      |
| <b>Task 3</b>  | Microbial degradation trial of screened high-risk chemicals | Nai Tran-Dinh  | 1/05/2023       | 31/08/2023       | Task 2      |
| <b>Task 4</b>  | Communication product                                       | GISERA Comms   | 1/09/2023       | 31/10/2023       | Task 1-3    |
| <b>Task 5</b>  | Desktop exposure assessment                                 | David Midgley  | 1/09/2023       | 30/09/2023       | Task 3      |
| <b>Task 6</b>  | Sampling logistics  | Nai Tran-Dinh  | 1/10/2023       | 31/10/2023       | Task 5      |
| <b>Task 7</b>  | Sampling campaign – exposure assessment                     | David Midgley  | 1/11/2023       | 28/02/2024       | Task 6      |
| <b>Task 8</b>  | Chemical analyses   | Nai Tran-Dinh  | 1/03/2024       | 31/03/2024       | Task 7      |
| <b>Task 9</b>  | Project reporting   | Nai Tran-Dinh  | 6/02/2023       | 31/07/2024       | Tasks 1-8   |
| <b>Task 10</b> | Communicate findings to stakeholders                        | Nai Tran-Dinh  | 6/02/2023       | 31/07/2024       | Tasks 1-9   |



## Task description

### **Task 1: Prescreening of ~50 chemicals for further assessment**

**OVERALL TIMEFRAME:** 1 month (6-28 February 2023)

**BACKGROUND:** Prescreening of chemicals to determine potentially hazardous chemicals to take forward.

**TASK OBJECTIVES:**

- Critical appraisal of the H.2 chemicals list (~50) by the project team through chemical toxicity reviews, evaluation of exposure potential, evaluation of persistence and bioaccumulation in soil environments, and known CSG usage (concentration of chemical used, recent usage, widespread usage) and other industrial usage. The chemicals will be triaged, and high-risk chemicals will be identified for further investigation.

**TASK OUTPUTS AND SPECIFIC DELIVERABLES:** Brief technical report providing the list of high-risk chemicals to be taken forward in this project and methods of evaluation.

### **Task 2: Screening appraisal of potentially hazardous chemicals**

**OVERALL TIMEFRAME:** 2 months (1 March 2023 – 30 April 2023)

**BACKGROUND:** This task will be carried out by an external contractor following the Health Study Framework and will identify any additional chemicals for further investigation.

**TASK OBJECTIVES:**

- Desktop appraisal of potentially hazardous chemicals identified from Task 1.
- This appraisal will follow the GISERA Health Study Framework.

**TASK OUTPUTS AND SPECIFIC DELIVERABLES:** Report providing screening appraisal of high-risk chemicals through the Health Study Framework.

### **Task 3: Microbial degradation trial of screened potentially hazardous chemicals**

**OVERALL TIMEFRAME:** 4 months (1 May 2023 – 31 August 2023)

**BACKGROUND:** Chemicals identified to be potentially hazardous through the Screening Assessment (Task 2) will be used in microbial degradation trials to determine persistence in soil and groundwater samples from the Queensland study area.

**TASK OBJECTIVES:**

- Field sampling to obtain two bore water and two soil samples.
  - Sufficient samples for chemical testing and measurement of degradation of chemicals
- Detailed chemistry of two water and two soil samples to be done.
- Replicated microcosm biodegradation trials in soil and water samples for potentially hazardous chemicals Water microcosms will be incubated for 3 months and soil microcosms will be incubated for 1 month.
- Chemical analyses will be undertaken at the start and end of the biodegradation experiments to determine the extent of biodegradation of the chemical by microbes present in water and soil samples.

**TASK OUTPUTS AND SPECIFIC DELIVERABLES:** Brief technical report detailing microbial biodegradation trials of high-risk chemicals in soil and water samples collected from the Queensland study area. Potentially hazardous chemicals that are persistent in soil and water samples will be taken forward.

#### **Task 4: Communicate H.2 and H.3 Part A project progress and findings to stakeholders**

**OVERALL TIMEFRAME:** 2 months (1 September 2023 – 31 October 2023)

**BACKGROUND:** Communications of GISERA research are an important component of outreach and dissemination of findings to diverse audiences.

##### **TASK OBJECTIVES:**

- Communicate H.2 and H.3 Part A project progress and findings to stakeholders through fact sheets, interviews, meetings, infographics and/or animations. This task will be done in collaboration with GISERA Communications officers.

**TASK OUTPUTS AND SPECIFIC DELIVERABLES:** Communicate H.2 and H.3 Part A project progress and results to GISERA stakeholders.

### **Task 5: Desktop exposure assessment**

**OVERALL TIMEFRAME:** 1 month (1 September 2023 – 30 September 2023)

**BACKGROUND:** The desktop exposure assessment will include industry and government reports/data, and an analysis of relevant information for the COPCs identified in Tasks 1-3. This assessment will focus on data from the most recent use of these chemicals in the study area and will determine timing and location of recent COPC usage.

**TASK OBJECTIVES:**

- Provide information about the timing and location of recent COPC usage in the Queensland study area. This information will guide Tasks 6 and 7.

**TASK OUTPUTS AND SPECIFIC DELIVERABLES:** Brief technical report detailing the timing and location of recent COPC usage in the Queensland study area.

### **Task 6: Sampling logistics**

**OVERALL TIMEFRAME:** 1 month (1 October 2023 – 31 October 2023)

**BACKGROUND:** Results from the desktop exposure assessment (Task 5) will be used, along with consultation with this project's TRG and other industry contacts, to guide the sampling campaign to ensure that appropriate and representative water and soil samples are collected for the exposure assessment.

**TASK OBJECTIVES:**

- Identification of sites for water and soil sampling to ensure adequate representative samples for COPC exposure assessment.

**TASK OUTPUTS AND SPECIFIC DELIVERABLES:** This task will yield a series of documents describing the contacts, sampling sites, relevant permissions, sampling equipment and OH&S considerations for the exposure assessment (Task 7).

### **Task 7: Sampling campaign- exposure assessment**

**OVERALL TIMEFRAME:** 4 months (1 November 2023 – 28 February 2024)

**BACKGROUND:** Task 7 will involve two staff traveling to the Queensland study area with the purpose of collecting representative water and soil samples across the region for exposure assessment of COPCs.

**TASK OBJECTIVES:**

- To collect groundwater and soil samples from sites identified in Task 5 and 6, for the purpose of analysing COPC presence and concentration within the Queensland study site (Task 8).

**TASK OUTPUTS AND SPECIFIC DELIVERABLES:** Collection of water and soil samples for analyses for the presence and concentration of COPCs within the Queensland study area.

## **Task 8: Chemical analyses**

**OVERALL TIMEFRAME:** 1 month (1 March 2024 – 31 March 2024)

**BACKGROUND:** Chemical analyses for the presence or absence of the COPCs will be carried out by a NATA accredited external laboratory. Where present, the concentration of COPCs will be determined. All samples collected in Task 7 will undergo analyses for COPCs.

### **TASK OBJECTIVES:**

- Each water and soil sample from the exposure assessment (Task 7) will be analysed for the presence or absence of COPCs. Where present the concentration of COPCs will be determined.

**TASK OUTPUTS AND SPECIFIC DELIVERABLES:** Brief technical report detailing the presence or absence of the COPCs in the Queensland study area.

## **Task 9: Project reporting**

**OVERALL TIMEFRAME:** Full duration of the project

**BACKGROUND:** The final report for this project will bring together human health impact data from the CSG-related chemicals used across the Queensland study. It will identify the COPCs used by the CSG industry and the management options for their mitigation.

Critical evaluation of the results is needed to understand the experimental outcomes of this study.

### **TASK OBJECTIVES:**

- Preparation of final report bringing together the information from all project tasks, including scope, methods, results, findings, analyses and management options for COPCs used in the Queensland study area.
- Reporting results and analyses from Tasks 1-8.
- Providing management options for mitigation of COPCs with the Queensland study area.

### **TASK OUTPUTS AND SPECIFIC DELIVERABLES:**

Final report encompassing all the tasks outlined above and integration with the related projects.

## **Task 10: Communicate findings to stakeholders**

**OVERALL TIMEFRAME:** Full duration of project

**BACKGROUND:** Communications of GISERA research are an important component of outreach and dissemination of findings to diverse audiences.

**TASK OBJECTIVES:** 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) Knowledge Transfer session with Government/Gas Industry
- 2) Presentation of findings to Community members/groups
- 3) Preparation of article for GISERA newsletter and other media outlets as advised by GISERA's communication team
- 4) Two project factsheets: A factsheet, hosted on the GISERA website, will be developed at commencement of project, and another that will include peer-reviewed results and implications will be developed at completion of project.
- 5) Peer reviewed scientific manuscript ready for submission to relevant journal

# Project Gantt Chart

| Task | Task Description  | 2022/23 |        |        |        |        | 2023/24 |        |        |        |        |        |        |        |        |        |        |        |        |  |
|------|---|---------|--------|--------|--------|--------|---------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--|
|      |   | Feb 23  | Mar 23 | Apr 23 | May 23 | Jun 23 | Jul 23  | Aug 23 | Sep 23 | Oct 23 | Nov 23 | Dec 23 | Jan 24 | Feb 24 | Mar 24 | Apr 24 | May 24 | Jun 24 | Jul 24 |  |
| 1    | Prescreening of ~50 chemicals for further assessment                    | █       |        |        |        |        |         |        |        |        |        |        |        |        |        |        |        |        |        |  |
| 2    | Screening assessment of potentially hazardous chemicals                 |         | █      | █      |        |        |         |        |        |        |        |        |        |        |        |        |        |        |        |  |
| 3    | Microbial degradation trial of screened potentially hazardous chemicals |         |        |        | █      | █      | █       | █      |        |        |        |        |        |        |        |        |        |        |        |  |
| 4    | Communication product   |         |        |        |        |        |         |        | █      | █      |        |        |        |        |        |        |        |        |        |  |
| 5    | Desktop exposure assessment   |         |        |        |        |        |         |        | █      |        |        |        |        |        |        |        |        |        |        |  |
| 6    | Sampling logistics  |         |        |        |        |        |         |        |        | █      |        |        |        |        |        |        |        |        |        |  |
| 7    | Sampling campaign – exposure assessment                                 |         |        |        |        |        |         |        |        |        | █      | █      | █      | █      |        |        |        |        |        |  |
| 8    | Chemical analyses   |         |        |        |        |        |         |        |        |        |        |        |        |        | █      |        |        |        |        |  |
| 9    | Project reporting   | █       | █      | █      | █      | █      | █       | █      | █      | █      | █      | █      | █      | █      | █      | █      | █      | █      | █      |  |
| 10   | Communicate findings to stakeholders                                    | █       | █      | █      | █      | █      | █       | █      | █      | █      | █      | █      | █      | █      | █      | █      | █      | █      | █      |  |

## 7. Budget Summary

| Expenditure              | 2022/23          | 2023/24          | 2024/25         | 2025/26    | Total            |
|--------------------------|------------------|------------------|-----------------|------------|------------------|
| Labour                   | \$72,617         | \$217,872        | \$15,573        | \$0        | \$306,062        |
| Operating                | \$2,500          | \$11,500         | \$0             | \$0        | \$14,000         |
| Subcontractors           | \$55,840         | \$221,840        | \$0             | \$0        | \$277,680        |
| <b>Total Expenditure</b> | <b>\$130,957</b> | <b>\$451,212</b> | <b>\$15,573</b> | <b>\$0</b> | <b>\$597,742</b> |

| Expenditure per task     | 2022/23          | 2023/24          | 2024/25         | 2025/26    | Total            |
|--------------------------|------------------|------------------|-----------------|------------|------------------|
| Task 1                   | \$35,372         | \$0              | \$0             | \$0        | \$35,372         |
| Task 2                   | \$63,331         | \$0              | \$0             | \$0        | \$63,331         |
| Task 3                   | \$19,451         | \$40,946         | \$0             | \$0        | \$60,397         |
| Task 4                   | \$0              | \$35,716         | \$0             | \$0        | \$35,716         |
| Task 5                   | \$0              | \$36,800         | \$0             | \$0        | \$36,800         |
| Task 6                   | \$0              | \$26,969         | \$0             | \$0        | \$26,969         |
| Task 7                   | \$0              | \$42,805         | \$0             | \$0        | \$42,805         |
| Task 8                   | \$0              | \$195,388        | \$0             | \$0        | \$195,388        |
| Task 9                   | \$9,856          | \$63,355         | \$12,392        | \$0        | \$85,603         |
| Task 10                  | \$2,947          | \$9,233          | \$3,181         | \$0        | \$15,361         |
| <b>Total Expenditure</b> | <b>\$130,957</b> | <b>\$451,212</b> | <b>\$15,573</b> | <b>\$0</b> | <b>\$597,742</b> |

| Source of Cash Contributions    | 2022/23          | 2023/24          | 2024/25         | 2025/26    | Total            |
|---------------------------------|------------------|------------------|-----------------|------------|------------------|
| Federal Govt (66%)              | \$86,432         | \$297,800        | \$10,278        | \$0        | \$394,510        |
| APLNG (9.5%)                    | \$12,441         | \$42,865         | \$1,479         | \$0        | \$56,785         |
| QGC (4.5%)                      | \$5,893          | \$20,305         | \$701           | \$0        | \$26,898         |
| <b>Total Cash Contributions</b> | <b>\$104,766</b> | <b>\$360,970</b> | <b>\$12,458</b> | <b>\$0</b> | <b>\$478,194</b> |

| In-Kind Contributions              | 2022/23         | 2023/24         | 2024/25        | 2025/26    | Total            |
|------------------------------------|-----------------|-----------------|----------------|------------|------------------|
| CSIRO (20%)                        | \$26,191        | \$90,242        | \$3,115        | \$0        | \$119,548        |
| <b>Total In-Kind Contributions</b> | <b>\$26,191</b> | <b>\$90,242</b> | <b>\$3,115</b> | <b>\$0</b> | <b>\$119,548</b> |

|                               | Total funding over all years | Percentage of Total Budget |
|-------------------------------|------------------------------|----------------------------|
| Federal Government investment | \$394,510                    | 66%                        |
| APLNG investment              | \$56,785                     | 9.5%                       |
| QGC investment                | \$26,898                     | 4.5%                       |
| CSIRO investment              | \$119,548                    | 20%                        |
| <b>Total Expenditure</b>      | <b>\$597,742</b>             | <b>100%</b>                |



| <b>Task</b>    | <b>Milestone Number</b> | <b>Milestone Description</b>  | <b>Funded by</b> | <b>Start Date (mm-yy)</b> | <b>Delivery Date (mm-yy)</b> | <b>Fiscal Year Completed</b> | <b>Payment \$ (excluding CSIRO contribution)</b> |
|----------------|-------------------------|---|------------------|---------------------------|------------------------------|------------------------------|--|
| <b>Task 1</b>  | 1.1                     | Prescreening of ~50 chemicals for further assessment                    | GISERA           | Feb-23                    | Feb-23                       | 2022/23                      | \$28,298   |
| <b>Task 2</b>  | 2.1                     | Screening assessment of potentially hazardous chemicals                 | GISERA           | Mar-23                    | Apr-23                       | 2022/23                      | \$50,665   |
| <b>Task 3</b>  | 3.1                     | Microbial degradation trial of screened potentially hazardous chemicals | GISERA           | May-23                    | Aug-23                       | 2023/24                      | \$48,318   |
| <b>Task 4</b>  | 4.1                     | Communication product   | GISERA           | Sep-23                    | Oct-23                       | 2023/24                      | \$28,573   |
| <b>Task 5</b>  | 5.1                     | Desktop exposure assessment   | GISERA           | Sep-23                    | Sep-23                       | 2023/24                      | \$29,440   |
| <b>Task 6</b>  | 6.1                     | Sampling logistics  | GISERA           | Oct-23                    | Oct-23                       | 2023/24                      | \$21,575   |
| <b>Task 7</b>  | 7.1                     | Sampling campaign – exposure assessment                                 | GISERA           | Nov-23                    | Feb-24                       | 2023/24                      | \$34,244   |
| <b>Task 8</b>  | 8.1                     | Chemical analyses   | GISERA           | Mar-24                    | Mar-24                       | 2023/24                      | \$156,310  |
| <b>Task 9</b>  | 9.1                     | Project reporting   | GISERA           | Feb-23                    | Jul-24                       | 2023/24                      | \$68,482   |
| <b>Task 10</b> | 10.1                    | Communicate findings to stakeholders                                    | GISERA           | Feb-23                    | Jul-24                       | 2023/24                      | \$12,289   |

## 8. Intellectual Property and Confidentiality

|   |                                       |                                     |                                     |              |
|---|---------------------------------------|-------------------------------------|-------------------------------------|--------------|
| <b>Background IP</b><br>(clause 11.1, 11.2)                       | <b>Party</b>                          | <b>Description of Background IP</b> | <b>Restrictions on use (if any)</b> | <b>Value</b> |
|   |                                       |                                     |                                     | \$           |
|   |                                       |                                     |                                     | \$           |
| <b>Ownership of Non-Derivative IP</b><br>(clause 12.3)            | CSIRO                                 |                                     |                                     |              |
| <b>Confidentiality of Project Results</b><br>(clause 15.6)        | Project Results are not confidential. |                                     |                                     |              |
| <b>Additional Commercialisation requirements</b><br>(clause 13.1) | Not Applicable                        |                                     |                                     |              |
| <b>Distribution of Commercialisation Income</b><br>(clause 13.4)  | Not applicable                        |                                     |                                     |              |
| <b>Commercialisation Interest</b><br>(clause 13.1)                | <b>Party</b>                          |                                     | <b>Commercialisation Interest</b>   |              |
|   | CSIRO                                 |                                     | N/A                                 |              |
|   | APLNG                                 |                                     | N/A                                 |              |
|   | QGC                                   |                                     | N/A                                 |              |

## 9. References

EnHealth (2012). Environmental Health Risk Assessment. Guidelines for assessing human health risks from environmental hazards. <http://www.eh.org.au/documents/item/916>.

Keywood M, Grant S, Walton A, Aylward L, Rifkin W, Witt K, Kumar A and Williams M. (2018) Human Health Effects of Coal Seam Gas Activity – A Study Design Framework. Final report to the Gas Industry Social and Environmental Research Alliance (GISERA). January 2018. CSIRO, Canberra. <https://gisera.csiro.au/wp-content/uploads/2018/03/Health-1-Final-Report.pdf>.

OCSE (2014). Independent Review of Coal Seam Gas Activities in NSW Managing environmental and human health risks from CSG activities. Report from the NSW Government Office of the Chief Scientist and Engineer. [http://www.chiefscientist.nsw.gov.au/\\_data/assets/pdf\\_file/0006/56922/140930-Final-Managing-Environmental-and-Human-Health-Risks.pdf](http://www.chiefscientist.nsw.gov.au/_data/assets/pdf_file/0006/56922/140930-Final-Managing-Environmental-and-Human-Health-Risks.pdf).

National Center for Biotechnology Information (2022). PubChem Compound Summary for CID 9973, 4-Fluorobenzoic acid. Retrieved from <https://pubchem.ncbi.nlm.nih.gov/compound/4-Fluorobenzoic-acid>.

National Center for Biotechnology Information (2022). PubChem Compound Summary for CID 24773, 2-[2-(4-Nonylphenoxy)ethoxy]ethanol. Retrieved from [https://pubchem.ncbi.nlm.nih.gov/compound/2-2-4-Nonylphenoxy\\_ethoxy\\_ethanol](https://pubchem.ncbi.nlm.nih.gov/compound/2-2-4-Nonylphenoxy_ethoxy_ethanol).

National Center for Biotechnology Information (2022). PubChem Compound Summary for CID 41478, Tetrakis(hydroxymethyl)phosphonium sulfate. Retrieved from [https://pubchem.ncbi.nlm.nih.gov/compound/Tetrakis\\_hydroxymethyl\\_phosphonium-sulfate](https://pubchem.ncbi.nlm.nih.gov/compound/Tetrakis_hydroxymethyl_phosphonium-sulfate).

National Center for Biotechnology Information (2022). PubChem Compound Summary for CID 67296, 2-Nonylphenol. Retrieved from <https://pubchem.ncbi.nlm.nih.gov/compound/2-Nonylphenol>.

National Center for Biotechnology Information (2022). PubChem Compound Summary for CID 9889168, Tributyltetradecylphosphonium chloride. Retrieved from <https://pubchem.ncbi.nlm.nih.gov/compound/Tributyltetradecylphosphonium-chloride>.