



Human health and CSG development: a framework to investigate possible health effects

This fact sheet outlines a framework designed to ensure that research into possible health effects associated with coal seam gas (CSG) activity is both scientifically robust and meets community expectations.



This fact sheet is an output of a study design project by CSIRO's Gas Industry Social and Environmental Research Alliance. The project developed a framework to investigate possible human health impacts associated with coal seam gas activity.

Background

- A 2014 report by the NSW Chief Scientist on managing environmental and human health risks from CSG activities identified potential risks to the environment (air, soil, water) and risks and uncertainties around human health from emissions arising from CSG activities. The report found risks can be managed through regulation, monitoring, and industry standards. Concerns about possible health effects continue to be voiced in communities with CSG development and more widely. This project was undertaken as a result of these ongoing concerns.

Key Points

- A Health Impact Assessment (HIA) framework has been used as the basis for a research framework to investigate possible chemical and physical hazards as well as social stressors associated with CSG development. The framework involves a staged series of steps with decision points along the way. Steps include:
 - mapping potential hazards and exposure pathways for each study site
 - gathering existing data, screening to check its quality and validity, and identifying gaps;
 - establishing a data and sample archive;
 - conducting further in-depth assessments of chemicals, exposures and other factors deemed important;
 - providing options to safeguard or improve health in CSG regions.
- The framework is designed to assure the quality and legitimacy of the research process. This includes establishing robust governance structures, gaining ongoing input from technical experts, obtaining research ethics approval, developing a communication plan and maintaining community involvement.
- The framework has been shared with stakeholders in communities, governments, health and scientific specialties, and industry to ensure that it is understood and technically robust.
- A literature review conducted as part of the project highlighted a lack of robust studies around the 'stressors' (e.g., chemicals) and health impacts associated with Australian CSG activities. Most available scientific knowledge and data does not translate to the Australian context of CSG regulation, geological conditions, and gas extraction methods. The literature review found that there is currently no conclusive evidence of health impacts associated with CSG activities.
- The project was informed by an expert workshop in May 2017. The workshop involved technical experts from government, academia, and industry, as well as community-based health professionals. Community perspectives to further inform the project have also been collected in Queensland and New South Wales.

The Framework

The study framework uses the core tenets of the HIA¹, an existing framework used widely in Australia to identify potential health impacts on a population from a proposed development. HIAs generally apply existing knowledge and evidence about health impacts to develop evidence-based options. The framework proposed here is aimed toward generating new, foundational evidence on the possible exposures of residents living in the vicinity of CSG activities in Australia and any associated health impacts.

The framework incorporates assessment of both chemical and physical hazards related to air, water, soil, noise, and light. Also addressed are 'social stressors', stresses associated with changes in a region due to CSG development.

The framework addresses these aspects through two parallel streams of research:

- a. Conducting exposure and health impact assessments for chemical and physical stressors, including management options for potential health impacts.
- b. Identifying CSG activities contributing to social stress and defining effective intervention and mitigation strategies to reduce exposure to these stressors, while maximizing benefits in the context of the community's overall resilience.

A series of staged steps are the essence of the framework, with consultation and decision points at each step:

1. A scoping and planning phase defines the overall structure for a study in a given location, including strategies for involving stakeholders, communicating findings, and meeting research ethics requirements. This phase establishes processes to support the quality and legitimacy of the research.
2. The identification and screening phases establish the potential sources of chemical and physical hazards (air, water, soil, noise, and light) and other stressors, such as psychosocial stressors. It also identifies if there are exposure pathways. These phases collect existing data, assess the data for quality and validity, and establish a data archive. Through these processes, gaps in knowledge are identified.
3. The further assessment phase involves in-depth assessments of exposures and risks as well as health outcome assessments. This phase addresses gaps in data in relation to relevant chemical and physical stressors. A 'health needs assessment' approach would be used to further investigate and mitigate social stressors.
4. The final options phase in the framework integrates findings, draws conclusions, and provides options, including identifying needs for ongoing monitoring.

¹HIA, Health Impact Assessment Guidelines 2017, enHealth, Department of Health, Australian Government. [http://www.health.gov.au/internet/main/publishing.nsf/Content/A12B57E41EC9F326CA257BF001F9E7D/\\$File/Health-Impact-Assessment-Guidelines.pdf](http://www.health.gov.au/internet/main/publishing.nsf/Content/A12B57E41EC9F326CA257BF001F9E7D/$File/Health-Impact-Assessment-Guidelines.pdf)

The study framework is designed around three key principles:

- a. All aspects of the study should be open and transparent, and outcomes publicly, within ethical guidelines;
- b. The study should seek community and stakeholder involvement throughout the process, from scoping to options; and
- c. The study should result in options to mitigate negative health impacts and promote positive impacts

Proposed stages of a health assessment study:	
FUNDING BODY COMMISSIONS PROJECT. PROJECT LEADER APPOINTED TO INITIATE SCOPING AND PLANNING	SCOPING AND PLANNING
	IDENTIFICATION
	<p>This phase establishes processes that underpin the legitimacy and quality of the research.</p> <p>Key focus areas:</p> <ul style="list-style-type: none"> To clearly define the scope and objectives of the research To establish the foundational project structure to ensure effective communication and involvement of stakeholders To develop processes to maintain transparency and independence To build capacity of all stakeholders to understand the technical and social issues
	<p>This phase identifies site-specific:</p> <ul style="list-style-type: none"> potential hazards exposure pathways health concerns of the community, confounding factors for chemical, physical and social stressors. <p>For chemical and physical stressors, this phase informs on the site-specific potential hazards related to chemicals in air, water and soil, as well as noise and light hazards, to undertake the screening and further assessment phases.</p> <p>For social stressors, the focus is to understand the community profile and to characterise the sources of stress. Inform strategies to mitigate social stressors and increase resilience in the community.</p>
	GOVERNANCE AND ETHICS REVIEW
	CHEMICAL AND PHYSICAL HAZARDS
	<ul style="list-style-type: none"> Establish appropriate project structure and terms of reference, for an: <ul style="list-style-type: none"> – Oversight Committee (or equivalent) – Joint Steering Committee (or equivalent) – Community Reference Group – Subject Matter Reference Group. Initiate ethics review
	<ul style="list-style-type: none"> Develop a Conceptual Site Model (CSM) to identify potential hazards and exposure pathways, plus other local confounding sources, of chemical and physical stress Use non-target analytical approaches, as required, to catalogue the key chemicals in environmental and human (e.g. blood) samples
SCOPE AND OBJECTIVES	
SOCIAL HAZARDS	
<ul style="list-style-type: none"> Involve community and other stakeholders to define: <ul style="list-style-type: none"> – Site selection – Specific research objectives – Deliverables and timeline Appoint Project team for Identification phase 	
<ul style="list-style-type: none"> Through community involvement and data collection, characterise: <ul style="list-style-type: none"> – sources of stress of concern – perceived impacts – health concerns Develop a community and population profile 	
STAKEHOLDER INVOLVEMENT AND COMMUNICATION PLAN	
<ul style="list-style-type: none"> Identify processes to integrate community perspectives with scientific knowledge into project Define how to communicate project outcomes and manage expectations, and options for communication products Establish risk management protocols and feedback procedures. 	

STAGE GATE 1

Important notes:

- Prioritisation may be required to work within a given budget. This may result, for example, in breaking a future study up into a suite of smaller studies to be undertaken as budgets permit.

- Although the framework is illustrated as sequential steps, some steps may be efficiently undertaken in parallel
- Project plans will need to adapt as new information becomes available

- Information and findings will be communicated throughout the project via explainers and fact sheets
- The project will work in collaboration with existing programs, studies and initiatives

Objective: To understand if chemical and physical stressors impact human health, and if so, how and to what extent?

Screening plan
Define scope, resources required and timeline. Appoint project team(s)

Yes

Chemical assessment needed?

CHEMICAL AND PHYSICAL STRESSORS

SCREENING

EXPOSURE SCREENING ASSESSMENT

This phase involves assessment and validation of *existing* data for:

- chemical levels in air, soil, water and people (e.g. blood),
- measures of physical stressors (light, noise)
- health symptom and outcome data.

- Collate existing exposure data for all relevant media
- Analyse health data for relevance and identify patterns
- Check data sets for quality: are data reproducible, reliable and representative?
- Identify data gaps and collect new data as necessary to understand key exposure and health factors for the region

Communicate findings and seek feedback

STAGE GATE 2

Further assessment plan
Define scope, resources required and timeline. Appoint project team(s)

Need more data

Intervention strategy needed?

Yes

Objective: To support increased resilience and adaptive capacity in the community and, where possible, mitigate stressors

SOCIAL STRESSORS

SCREENING

SOCIAL STRESSOR SCREENING ASSESSMENT

Assess and validate existing and new data related to social risk factors and 'precursors' that may contribute to adverse health outcomes at the individual, family, or population level to:

- Determine population statistics and identify vulnerable and susceptible populations
- Gauge social stress and resilience
- Identify symptom patterns
- Quality check data sets
- Identify confounding factors

Compare data for the site to equivalent non-CSG areas. Use ABS, State health agency, PBS/MBS, socioeconomic indicators

Communicate findings and seek feedback

STAGE GATE 2

Plan further assessment

Define scope, resources required and timeline. Appoint project team/s

The framework includes two Stage Gates (1 and 2), which represent decision points on whether to continue to the next stage or to finalise the study. The decision point considers the information and outcomes of the study to that point.

FURTHER ASSESSMENT

IN-DEPTH EXPOSURE AND RISK ASSESSMENT

This phase develops detailed exposure maps targeting priority chemicals/stressors identified during screening:

- Measure exposure through environmental or bio-monitoring
- Model spatial distribution of stressors; validate models with monitoring data
- Assess availability, reliability and relevance of health based guidance values (HBGVs)
- Compare exposure maps to robust guideline values
- Initiate a program to collect data and environmental/bio samples and retain in a publicly available repository/archive

Communicate findings and seek feedback

HEALTH OUTCOME ASSESSMENT

The aim of this phase is to undertake a full health outcome assessment:

- Use suitable epidemiological and other approaches (e.g. cluster, longitudinal, cross sectional or case control study/studies) to measure incidence or prevalence of health effects and compare to patterns of exposure established in the in-depth assessment
- Initiate a systematic program to collect longitudinal health data and retain in a publicly available repository/archive

Communicate findings and seek feedback

INTEGRATE OUTCOMES FROM EXPOSURE AND HEALTH ASSESSMENTS

OPTIONS

Make decisions to reach a set of final options for acting on the screening and/or health assessment's findings:

- Develop a draft set of concise and action-orientated options, including for ongoing monitoring of the site after completion of the project and implementation of the options
- Develop audience-specific communication products to disseminate fully interpreted results and draft options to the wider stakeholder group and public for feedback
- Write a final options report for implementation and action

FURTHER ASSESSMENT

IN-DEPTH ASSESSMENT OF SOURCES OF SOCIAL STRESS

Identify underlying sources or contributors to social stress and initiatives for mitigating stressors

NEEDS ASSESSMENT

Identify social stress status and needs: Collect further quantitative data as required, e.g. key health and population statistics.

Map existing services: Involve community, industry and service providers to characterise existing activities and services and their limitations, e.g. through interviews. Collate key data about services offered in the area, e.g. from GPs, allied health, hospitals, NGOs and other community providers.

Identify initiatives: Canvas stakeholders to identify measures to increase wellbeing and barriers to such initiatives: 'Options Analysis'

Synthesize insights into a picture of current and emerging mental health needs, service opportunities, and service bottlenecks/constraints.

Identify action priorities

Communicate findings and seek feedback

MITIGATION STRATEGY

Identify mitigation opportunities:
• Assess strategies to minimise impact, e.g. changing industry practices

Involve stakeholders: Formulate and obtain commitment to proposed mitigation actions

Monitor: Identify agreed measures to monitor stress

DEVELOP COORDINATED MITIGATION AND INTERVENTION STRATEGY

OPTIONS

Make decisions to reach a set of final options and report findings to project governance bodies.

Develop audience-specific communication to share fully interpreted results and draft options to government, industry, community, and service providers for feedback.

Options would be around, for example:

- Provision of mental health support, financial support, childcare, other relevant services
- Finding people/ families in need via identified criteria – e.g., via social service agencies, police, GPs, financial institutions
- Modifying behaviours, activities, equipment by industry to mitigate causes of social stress

Expert input and community perspectives

The framework is designed around three key principles identified in an expert workshop conducted for the project, and through discussions with community stakeholders:

- All aspects of the study should be open and transparent and outcomes must be publicly available, working within ethical approval guidelines;
- The study should seek community and stakeholder involvement throughout the process, from scoping to options;
- The study should result in providing options to mitigate negative health impacts and promote positive benefits to the community and individual health.

The expert workshop acknowledged the issue of social stress in CSG communities. These concerns were echoed by community stakeholders. The framework is not designed to quantify social stressors associated specifically with CSG (or other singular) activities. Rather, it is to identify those aspects of CSG activity that contribute to the overall stress experienced by individuals or community and develop mitigation strategies to reduce exposure to these stressors. This approach is instead of undertaking highly complex, detailed, and potentially inconclusive assessments in search of specific sources or impacts of mental health outcomes.

Confounding factors: It is widely recognised that in any Australian CSG region there may be confounding factors to be considered when conducting an investigation using the proposed framework. Confounding factors are extraneous factors that can make defining single associations between an exposure and an outcome challenging. These factors include the presence of other industries in a region that may be alternative sources of chemical, physical and social stressors. Confounding factors can also include pre-existing sources of chemical contamination before CSG development commenced, and other non-CSG related, social stressors such as drought effects on agricultural businesses and farmers. Ensuring that confounding factors are identified, documented and accounted for in the study design are part of the identification phase of the framework.

Some chemical stressors may be specific to a particular industry, such as pesticides and agriculture. For other stressors, which may come from both CSG activities and other industries, such as dust, the study approach may involve designing monitoring strategies to isolate industry-specific sources. Where that is not possible, the total exposure of the community to all sources will be determined and appropriately communicated.

In relation to confounding factors, strategies for interpretation and communication of results will be an important aspect of the communication and community involvement strategies defined in the Scoping phase.

Research team

The team included research staff from:

- CSIRO's Gas Industry Social and Environmental Research Alliance (GISERA)
- Queensland Alliance for Environmental Health Sciences (QAEHS) of The University of Queensland
- Queensland University of Technology
- The University of Queensland's Centre for Coal Seam Gas, and;
- University of Newcastle's Hunter Research Foundation Centre.

Funding contributors include GISERA and QAEHS.

Next steps

The framework provides a study design that can be used to develop future studies of potential human health impacts of activities within Australia's CSG producing regions. The framework sets out a process for scoping future studies in terms of the research objectives and the location. The staged nature of the framework, along with the separate chemical and physical hazards and social stressor streams allows future research to be conducted as discrete studies that engage the appropriate expertise and provide results in a timely manner. Prioritisation may also be required to work within available funding.

More detail on the individual framework steps and research study methodologies are included in a comprehensive report to be made publicly available on the GISERA website at www.gisera.csiro.au/project/human-health-effects-of-coal-seam-gas/

Contacts

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