

Predicting the risk of chemicals used in coal seam gas extraction

CSIRO has investigated ways to better understand and predict risks to human and environmental health of chemicals used in extracting coal seam gas.

The CSIRO report, *Human and environmental exposure conceptualisation: Soil to shallow groundwater pathways* assists our understanding and predictions of the fate of chemicals used in the hydraulic fracturing and drilling process to extract coal seam gas. It is one of five reports CSIRO has contributed to the Australian Government's *National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia*.

This report documents the conceptual modelling framework developed to predict environmental concentrations of hydraulic fracturing fluids in spills and leaks at the land surface, and their anticipated fate in soil; shallow groundwater; wetlands and streams.

The models can be used to determine environmental and human exposure to hydraulic fracturing chemicals present at the land surface.

Developing conceptual models of exposure pathways

The process of developing the conceptual models considered the likely pathways chemicals travel through soil and shallow groundwater.

The concentrations of chemicals ending up in the soils, wetlands, streams and drinking water wells were then calculated. Both short-term spills (days) and long-term (3-30 years) undetected but small sub-surface leaks from water holding ponds containing 'produced' were considered.

These models incorporate the best current understanding of the complex soil-shallow groundwater system to ensure that the relevant processes and pathways are included. On this basis computer models are subsequently developed, which can be used to undertake human health and environmental risk assessments. The models were deliberately designed to overestimate the risk.

National Assessment of Chemicals

This National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia is aimed at developing an improved understanding of the occupational, public health and environmental risks associated with chemicals either used in or mobilised by drilling and hydraulic fracturing for coal seam gas in Australia.

It has assessed and characterised the risks to human health and the environment from surface handling of chemicals used in coal seam gas extraction between 2010 and 2012.

The models developed in this report were used by other agencies in human health risk assessments for the Assessment.

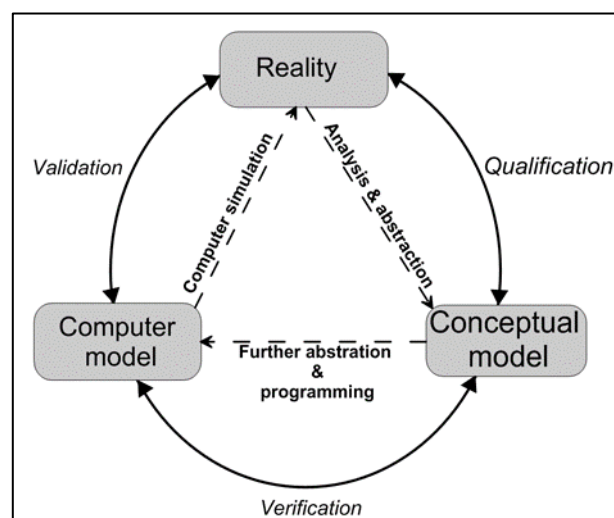


Figure 1 Conceptual models assist in the development of computer models to simulate what really happens in the environment.

Strengthening knowledge of the chemicals used in coal seam gas extraction

This research significantly strengthens the level of knowledge about chemicals used in coal seam gas extraction in Australia, and what risks they may pose to the public and the environment.

This information directly informs our understanding of which chemicals can continue to be used safely, and which chemicals are likely to require extra monitoring, industry management and regulatory consideration.

How are chemicals used in the extraction of coal seam gas?

- Chemicals are used during the drilling of a well and sometimes during hydraulic fracturing.
- Hydraulic fracturing for coal seam gas is the process of pumping water, proppant (e.g. sand) and chemical additives under high pressure into the underground coal layers to increase permeability of coal layers which improves the release of the trapped coal seam gas.
- The water and chemicals are then pumped back out of the well, leaving most of the sand and small amounts of the chemicals underground, allowing the gases in the coal seam to flow back up the well and be piped to processing facilities.
- Due to the varying geology of coal seams, hydraulic fracturing is only used in some coal seam gas operations.
- 'Flowback' and other associated or 'produced' waters are stored on the surface in water holding ponds for treatment and re-use (including reinjection) or removal and eventual discharge.

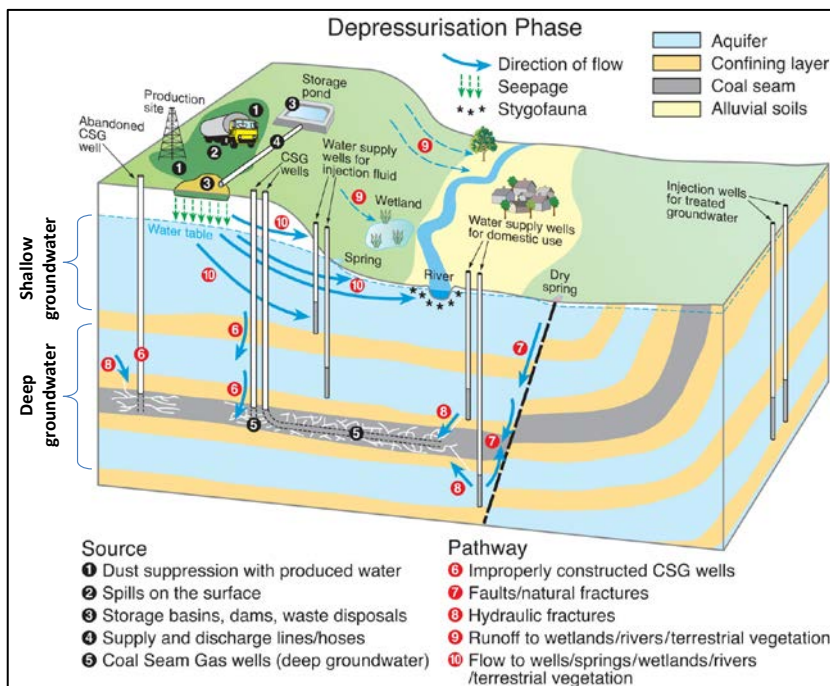


Figure 2 Possible contaminant sources at the coal seam gas site (1 to 5) and pathways (6 to 10) for transport of chemicals associated with the injection of hydraulic fracturing fluids.

Industry regulation

This research supports Australia's existing framework of regulations and industrial practices which protects people and the environment from adverse effects of industrial chemical use. For coal seam gas extraction, there is existing legislation, regulations, standards and industry codes of practice that cover chemical use, including workplace and public health and safety, environmental protection, and the transport, handling, storage and disposal of chemicals. CSIRO is actively engaged in a range of research relating to onshore unconventional gas activity to enhance our understanding of the opportunities and risks associated with this energy source.

Reference: Mallants D, Bekele E, Schmid W and Miotlinski K 2017, *Human and environmental exposure conceptualisation: Soil to shallow groundwater pathways*, Project report prepared by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) as part of the National Assessment of Chemicals Associated with Coal Seam Gas Extraction in Australia, Commonwealth of Australia, Canberra.

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