



Australian Government



Geological and Bioregional Assessment Program

Fact sheet 24

Water quality risk assessment from use, handling, and storage of chemicals and flowback at onshore gas operations in the Beetaloo Sub-basin

Onshore gas developments, as with many other industry developments, are recognised as having inherent risks that can have impacts on the environment, especially water resources, without appropriate and effective controls and management strategies and actions. Community and government consultation in the initial stages of the GBA Program identified potential impacts on water quality from the use, handling, and storage of chemicals and flowback during shale gas developments in the Northern Territory (NT) as an area of high concern.

We performed a qualitative risk assessment of possible events that might impact water quality from the use, handling, and storage of chemicals and flowback waters at the Tanumbirini-1 and Kyalla-117 shale gas wells in the Beetaloo Sub-basin, NT (Figure 1).

Results

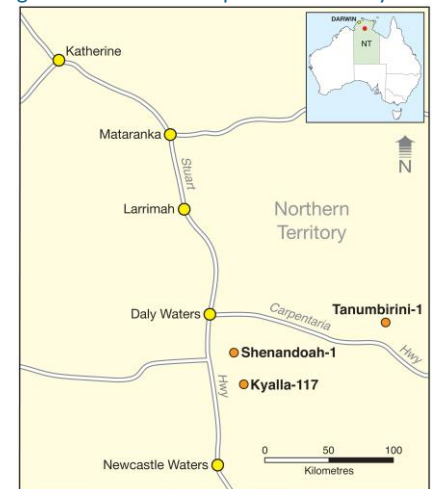
A total of 42 individual chemicals were used for hydraulic fracturing at the Tanumbirini-1 and Kyalla-117 shale gas wells. These chemicals included acids, buffers, biocides, cross-linking agents, friction reducers, surfactants, gelling agents, and breakers. A mixture of geogenic chemicals (i.e. inorganics, organics, and radionuclides) were mobilised from target shale formations into flowback and present in storage tank wastewaters. Screening risk quotients found up to 88% of the down well chemicals were present at concentrations of potential concern or potentially high concern for freshwater organisms. The concentrations of geogenic chemicals in flowback with time and in storage tanks wastewaters were dynamic. Some geogenic chemicals were above the default ANZECC/ARMCANZ (2000) guideline values for freshwater organisms, including salinity, ammonia, boron, copper, cadmium, mercury, nickel, and zinc. Most organic compounds in flowback and storage tank wastewaters were unidentified.

While there is an inherent risk to water quality from the use, handling, and storage of chemicals and flowback waters at shale gas developments in the Beetaloo Sub-basin, gas companies are required to implement a range of risk controls, mitigation, and management strategies and actions to protect surface water and groundwater quality and dependent ecosystems in accordance with the Code of Practice: Onshore Petroleum Activities in the Northern Territory (2019).

If an accidental release should occur at a well, impacts on water quality and dependent ecosystems will be dependent on the fate and behaviour of hydraulic fracturing chemicals during handling, down wells, and storage (for example, loss to surfaces and formations, degradation), and reactions and processes in the environment (natural attenuation processes) that will likely modify their fate and bioavailability (for example, dilution, complexation, adsorption, degradation).

Figure 1 Shale gas wells in the Beetaloo Sub-basin

Tanumbirini-1 and Kyalla-117 shale gas wells were sampled. Shenandoah-1 shale gas well was not sampled in this study



There were no short- or long-term impacts observed to groundwater/bore quality post-hydraulic fracturing compared to control bores and regional water quality. Further, independent groundwater monitoring (target and non-targeted chemicals and contaminants) will provide confidence and acceptance in onshore gas developments in the Beetaloo Sub-basin as well numbers increase and well decommissioning is undertaken.

What is needed

- Government enforcement of legislative and regulatory requirements, and practices and actions approved by the NT Minister in environmental management plans (e.g. monitoring, reporting) to protect water resources.
- Open and transparent reporting of incidents (e.g. spill, leaks) and management actions to prevent recurrence.
- Chemical assessments for new chemicals and open reporting on chemicals and wastes as outlined in the Code of Practice: Onshore Petroleum Activities in the Northern Territory (2019).
- Independent groundwater monitoring program to provide confidence and acceptance in onshore gas developments in the Beetaloo Sub-basin as well numbers increase and well decommissioning is undertaken.
- Use high-resolution analytical techniques to fingerprint and quantify chemicals and contaminants of concern in waters and complex saline wastewaters for robust chemical assessments and targeted monitoring programs.
- On-going assessment of the environmental risks and management of wastes and wastewaters from on-shore gas activities in the Beetaloo Sub-basin.

The GBA Program

The \$35.4 million Geological and Bioregional Assessment (GBA) Program is assessing the potential impacts of shale and tight gas development on water and the environment to inform regulatory frameworks and appropriate management approaches. The geological and environmental knowledge, data and tools produced by the GBA Program will assist governments, industry, land users and the community by informing decision-making and enabling the coordinated management of potential impacts.

How to cite

- Geological and Bioregional Assessment Program (2021) Fact sheet 24: Water quality risk assessment from use, handling, and storage of chemicals and flowback at onshore gas operations in the Beetaloo Sub-basin. Fact sheet for the Geological and Bioregional Assessment Program.

Find out more

- Journal paper: Kirby JK, Golding L, Mallants D, Apte SC, Williams M, King J and Johnston C (2021). Qualitative assessment of events that might impact water quality from chemicals and flowback at onshore shale gas well. Submitted to Environmental Assessment and Management.
- Apte SC, Kirby JK, William M, King J, Hayward J, Johnston C, Schatz J and Jarolimek C (2021). Assessing the potential impacts of hydraulic fracturing on water quality at well sites in the Northern Territory, Australia.
- Journal paper: Mallants D, Kirby JK, Golding L Apte S and Williams M (2021). Assessment of attenuation potential affecting fate and transport of chemicals accidentally released into soils at on-shore gas developments. Submitted to Science of the Total Environment.
- Journal paper: Golding L, Kumar A, Adams M, Binet M, Gregg A, King J, McKnight K, Nidumolu B, Spadaro D and Kirby JK (2021). The influence of salinity on the chronic toxicity of shale gas wastewaters to freshwater organisms in a risk assessment context. Submitted to Environmental Science and Technology.

Datasets that support this work are available at data.gov.au:

- Geological and Bioregional Assessment Program (2020) [Direct toxicity assessment of flowback waters from Beetaloo Sub-basin](#) [tabular].

More information is available at bioregionalassessments.gov.au/gba.