Tasmanian Branch of IAH Australia

Submission to the Tasmanian Government's Review of Hydraulic Fracturing in Tasmania

December, 2014

Introduction

This paper has been drafted by the Tasmanian chapter of the International Association of Hydrogeologists (IAH). The IAH is a professional association encompassing those disciplines related to groundwater, its occurrence, utilisation, testing and management. IAH was established to foster closer ties, cooperation and information exchange related to the study of groundwater and operates as a truly international scientific and educational organisation. The IAH is a non-government and not for profit organisation and is supported by over 3,500 members representing over 135 countries. The Tasmanian branch of the IAH includes hydrogeologists from the public and private sector, and academia.

This submission provides preliminary comments in relation to the terms of reference (ToR) as set out on page 5 of the Review of Hydraulic Fracturing in Tasmania Issues paper (the Review). The ToR are a broad list of issues which have been discussed as part of the Review. The Review is very broad and as yet does not provide detail on the specifics of groundwater management in relation to hydraulic fracturing. This submission aims to outline potential groundwater-related issues and provide recommendations where possible. This submission draws upon issues currently faced in other Australians states and territories with unconventional gas and hydraulic fracturing projects underway (including coal seam gas). This submission also provides comment on the current Tasmanian regulatory framework and how groundwater fits within this in relation to unconventional gas and hydraulic fracturing activities.

A similar, more detailed review has recently been carried out by the IAH for the Northern Territory[1] and should be consulted. It is understood that this is a preliminary review and the IAH would welcome the opportunity to be involved in future, more detailed reviews.

This submission is set out according to each of the listed ToR headings.

[1] Northern Territory Branch of the International Association of Hydrogeologists, 2014. Submission to the Northern territory Governments Hydraulic Fracturing Inquiry

1. Consider the potential use in Tasmania of hydraulic fracturing, including technology and processes, scientific evidence, as well as best practise environmental and safety standards

- Include the collection of baseline data within the exploration and mining license, to include monitoring of all hydrogeological units within the study area. This should include all hydrogeological horizons/aquifers from immediately below the A review of the water quality parameters should be carried out and should include baseline monitoring of methane. Consideration should be given to improving the current state groundwater monitoring network of 120 bores monitored by DPIPWE's Water Assessment Branch. Currently the collected information (continuous standing water levels, pressure and temperatures) is used for development and implementation of the State's Water Management Plans. The current monitoring program is not sufficient to monitor hydraulic fracturing operations. Standard water analysis must be included (such as additional water quality parameters) in the monitoring program to identify the impacts of hydraulic fracturing operations to safe guard Tasmanian water resources and its current and future users.
- Include details of monitoring requirements for the proponents to capture cumulative impacts of conventional and unconventional mining and hydraulic fracturing, otherwise the government will need to institute a regional monitoring and analysis program to understand the cumulative impacts from multiple developments (including quarrying, open cut mining, underground and unconventional shale gas, and groundwater resource extraction)
- Review the current New South Wales legislation: The *NSW Code of Practice for Coal Seam Gas Fracture Stimulation Activities* [2], The *Code of Practice for Coal Seam Gas*
- *Well Integrity*[3] and the *Aquifer interference policy*[4] which provide detailed assessment and management frameworks for the monitoring and regulating of the coal seam gas (CSG) industry
- An improved state database of all well information is required and all groundwater well information should be publicly available so that independent regional studies can be undertaken. Groundwater data are very different to, and far more complex than, surface water data, which have been commonly handled in the past by DPIPWE. Groundwater data need to be interpreted in 3 dimensions with the geology, hydrogeological conceptual model and bore construction details especially (amongst other data). In order to achieve this, it is crucial for the State to finish development of the State groundwater database and link it with other databases that contain additional surface and ground water level or water quality data.
- Details of well integrity quality assurance measure, ongoing monitoring and long-term decommissioning and relinquishment plans for both exploration and production wells.
- Complete public disclosure of all well drilling and hydraulic fracturing additives and restriction to additives, and additive dosage levels, approved for potable aquifers.

[2] NSW Code of Practice for Coal Seam Gas Fracture Stimulation Activities. NSW Trade & Investment 2012
[3] NSW Code of Practice for Coal Seam Gas Well Integrity. NSW Trade & Investment 2012
[4] NSW Aquifer Interference Policy . DPI - NSW Office of Water, September 2012

- The production, presentation and management of publically available data, records and report.
- Upfront and publically available management plans for the decommissioning of flowing or failed wells.
- The Tasmanian government should invest in a skilled workforce and capacity building to adequately manage and review permit applications and data provided by the proponents, and the on-going environmental risks and impacts of the hydraulic fracturing industry. At present the state has limited hydrogeological skills in unconventional gas projects, complex hydrogeological modelling and hydrogeochemical assessment. This situation occurred in QLD where there were insufficient personnel to adequately review the influx of hydrogeological impact assessments and monitoring data, as a result of which significant environmental risks and impacts were overlooked and, conversely, other projects were delayed or shut down partly due to misattribution of impacts to the projects.
- Shales are typically low permeability hydrogeological units and act as aquitards or aquicludes. This can limit vertical groundwater flow through primary porosity. However where transmissive faults, fractures and lithological heterogeneities occur, permeability can be high. Understanding and modelling of fractured rock aquifers is complex and will require a suitably experienced person in regulation. QLD have established the *Office of Groundwater Impact Assessment* within the Department of Natural Resources and Mines, to provide independent review and in-house capability. This should be established in Tasmania, albeit on a smaller scale.

2. To examine the potential impacts of hydraulic fracturing in Tasmania, in particular potential impacts on: Agriculture, groundwater and the broader Tasmanian environment

- **Well integrity failure and decommissioned wells:** Deterioration and failure of improperly constructed or decommissioned wells will, over time, results in long-term release of oil and/or gas and potentially poor quality (saline) water into the environment. Pathways in the well annulus may develop that would allow oil, gas and poor quality formation or hydraulic fracturing fluids to move vertically across geologic formations and contaminate groundwater. Substances dissolved in the fluid may include those that occur naturally in the shale formations and others injected during the hydraulic fracturing process. There is also potential for upwardly migrating gas to represent an explosion hazard if not properly vented away from buildings and drinking water wells. The risk of annular pathways developing increases over time as chemical, mechanical and thermal stresses causes deterioration of well structure and components. Failure occurs where wells are improperly abandoned, with issues such as formation of cracks in the cement casing or packers, corrosion of steel production casing, faulty valves and leaking temporary plugs or surface caps. Impacts can many years to appear, often after the commercial extraction has finished and the operators have moved on. It is recommended that funds adequate to match reclamation should be generated directly from the revenue stream, during the most lucrative years of the gas production. These funds should be held by the Tasmanian Government to assure against any long terms liabilities from unconventional gas extraction.
- Undertake well performance audits over the life of the well. The literature to date describe varying failure rates, however the overall fact is that wells do fail. A study in Alberta Canada (Watson and Bachu, 2009)[5] found that injection wells were 2 to 3 times more likely to fail than conventional production wells. It is recommended that a system of identifying experienced unconventional gas well drillers be developed and a system of regulating the completion of wells be adopted into the management of production and injection wells.
- The key concerns in management of recovered fluids include: unregulated release to surface and groundwater resources; leakage from on-site storage ponds, improper pit construction, maintenance and decommissioning, disposal of large volumes of brine, incomplete treatment, spills on site and waste water treatment activities (ACOLA, 2013)[6].
- Methane contamination has been highlighted as an issue in other states and countries. - Methane emissions from all existing wells should be included as part of baselines studies and over the term of the project.
- There are potential contamination issues surrounding uncontained flowback as spent hydraulic fracturing fluid can impact on surface waters, wetlands, groundwater dependant ecosystems (GDEs) and other aquatic ecosystems.

[5] Watson, T. L and Bachu, S., 2009, evaluation of the Potential for Gas and CO2 Leakage Along Wellbores. SPE Drill and Compl 24 (1): 115-126. SPE-106817-PA: http://www.spe.org/ejournals.jsp/journalapp.jsp?pageType=preview&jid=EDC&mid=SPE-106817-PA

[6] ACOLA Australian Council of Learned Academics, 2013. Engineering Geology: Unconventional Gas Production. A Study of Shale Gas in Australia. www.acola.org.au.

- Cross contamination through pressurised bores. Pressurisation of the well casing can cause leakage of poor quality water in to surrounding aquifers. This risk can be reduced by using water quality consistent with surrounding aquifers but this may then compete with other water users or receiving environments. This requires careful well and fracturing design, construction and operation, as well as detailed multi-aquifer monitoring throughout the life of the project, including sufficient baseline data to enable separation of natural trends form the operational data. All proposed programs should be independently audited and reviewed by independent experts.
- Pressurisation of the fractured formation can induce outward flow of poor quality water in to surrounding aquifers. Conversely, drawdown in the production phase or from pumping of source water wells can induce inward flow of poor quality water into the aquifer.
- Shale gas targets are typically very deep in Australia (up to 3000 m deep), however in the Review, the Woody Island Formation is mentioned which comes close to the surface in places and may be in direct contact with other widely used shallow aquifers. This will require detailed controls and regulated groundwater – surface water monitoring programs to protect. Furthermore, deep pressurised wells can fail at any elevation, hence all overlying aquifers are at some risk and should be assessed and monitored.
- A requirement for water resource allocation for the water used for hydraulic fracturing should be included in the assessment phase. Volumes required for shale gas extraction can be high. In Tasmania, with the exception of the Wesley Vale Groundwater Management Area (GMA), groundwater extraction is not currently regulated in Tasmania, therefore the impacts to groundwater resources, and as a knock on effect surface resources, could be compromised. Additional review and regulation is required.
- Due to the potential high water demand for hydraulic fracturing, high-value aquifers should be defined across the state and these should be excluded from fracturing, with the exception of local hydraulic fracturing to improve water supply well performance.
- Re-use and recycling of produce water should be the first source of water used by hydraulic fracturing proponents before any additional water allocations from natural water resources will be considered.

3. To consider developments and experiences in the regulation of hydraulic fracturing nationally and internationally

- Undertake stakeholder consultation to gain an understanding of the relevant issues facing the shale gas and hydraulic fracturing industry. Include those who have experience from other states/territories

- Include external peer technical review of the Review of hydraulic fracturing in Tasmania

4. To examine the robustness and operation of the current laws governing exploration licences and any future extraction licenses in Tasmania and consider whether any changes are required to improve protections for land users and industry engagement with landholders and local community.

- With the exception of the Wesley Vale Groundwater Management Area groundwater extraction is not currently regulated in Tasmania. Unconventional gas mining should trigger the need for a Water Management plan and groundwater management area to be declared so that adequate assessment of water resource protection and management can be implemented.
- The current legislative framework discussed in the terms of reference (MECOP) does not currently provide a detailed groundwater assessment framework or avenue for regulation - for example how would the government ensure that the wells are installed according to best practise or "good oil field practice" as stated in the Assessment process. If in-house expertise is not available, provision must be made for the use of independent auditors.
- The Review states that most other Australian jurisdictions do not have specific legislation regarding unconventional gas fracturing. At present, New South Wales, Queensland and Northern Territory have or are in the process of developing legislation or regulations to protect the environment. For example NSW has the following: the *Code of practice for fracture simulation*, the C*ode of practise for well integrity*, and the *Aquifer interference policy*. There are also coal seam gas exclusion zones, banning of BTEX in fracturing, and establishment of an *Office of Coal Seam Gas*. The Queensland Government has established the Office of Groundwater Impact Assessment (OGIA) and has restricted the use of BTEX chemicals in hydraulic fracturing. Under the regulations BTEX cannot be added to hydraulic fracturing fluids as has been done in the Tasmanian Review.
- The Review states that the MRDA is supported by EMPCA and LUPAA, however it does not appear that unconventional gas mining/production is listed under any of the headings currently listed as a Schedule 2 Activity. Unconventional gas needs to be added as a Schedule 2 Activity. Additional specifications for groundwater assessment in relation to unconventional gas mining should be developed and included as part of EMPCA.
- Requirements for experienced well drillers with the necessary experience/qualifications in controlling well blow outs and experience in drilling for potable water supplies.
- Prohibition of all exploration and mining in groundwater recharge areas and aquifers of water resource importance as well as those with groundwater dependant ecosystems, or at least a very high level of scrutiny.
- Develop detailed bore decommissioning guidelines due to the high contamination risk posed through vertical groundwater movement.

5. To consider any other relevant matters including economic costs and benefits

- Include financial mechanisms to manage the risk of well failure and other environmental impacts- funds adequate to match the reclamation should be generated directly from the revenue stream during the most lucrative years of gas production. These funds should be held by the Tasmanian government to assure against any long-term liabilities from unconventional gas extraction.
- Given that the impacts may take decades or longer to appear, sufficient funding must be in place to cover reasonably foreseeable impacts in perpetuity.