POSITION DESCRIPTION

Position Title: Research Fellow in Hydrochemistry and Gas Chemistry
Organisation Unit: Centre for Coal Seam Gas
Position Number: NEW
Classification: Research Academic Level B

THE UNIVERSITY OF QUEENSLAND

The University of Queensland (UQ) contributes positively to society by engaging in the creation, preservation, transfer and application of knowledge. UQ helps shape the future by bringing together and developing leaders in their fields to inspire the next generation and to advance ideas that benefit the world. UQ strives for the personal and professional success of its students, staff and alumni. For more than a century, we have educated and worked with outstanding people to deliver knowledge leadership for a better world.

UQ ranks in the world's top universities, as measured by several key independent ranking, including the Performance Ranking of Scientific Papers for World Universities (43), the US News Best Global Universities Rankings (52), QS World University Rankings (47), Academic Ranking of World Universities (55), and the Times Higher Education World University Rankings (60). UQ again topped the nation in the prestigious Nature Index and our Life Sciences subject field ranking in the Academic Ranking of World Universities was the highest in Australia at 20.

UQ has an outstanding reputation for the quality of its teachers, its educational programs and employment outcomes for its students. Our students remain at the heart of what we do. The UQ experience – the UQ Advantage – is distinguished by a research enriched curriculum, international collaborations, industry engagement and opportunities that nurture and develop future leaders. UQ has a strong focus on teaching excellence, winning more national teaching excellence awards than any other in the country and attracting the majority of Queensland’s highest academic achievers, as well as top interstate and overseas students.

UQ is one of Australia’s Group of Eight, a charter member of edX and a founding member of Universitas 21, an international consortium of leading research-intensive universities.

Our 50,000-plus strong student community includes more than 13,000 postgraduate scholars and more than 12,000 international students from 144 countries, adding to its proud 240,000-plus alumni. The University has about 7,000 academic and professional staff and a $1.8 billion annual operating budget. Its major campuses are at St Lucia, Gatton and Herston, in addition to teaching and research sites around Queensland and Brisbane city. The University has six Faculties and four University-level Institutes. The Institutes, funded by government and industry grants, philanthropy and commercialisation activities, have built scale and focus in research areas in neuroscience, biomolecular and biomedical sciences, sustainable minerals, bioengineering and nanotechnology, as well as social science research.
UQ has an outstanding track-record in commercialisation of our innovation with major technologies employed across the globe and integral to gross product sales of $11billion+ (see http://uniquest.com.au/our-track-record).

UQ has a rapidly growing record of attracting philanthropic support for its activities and this will be a strategic focus going forward.

Organisational Environment

Come and join an exciting multi-disciplinary research group that is working on solving some of the world’s trickiest energy and environmental problems. The University of Queensland Centre for Coal Seam Gas has initiated a project on Shallow Gas, which will advance Australia’s understanding of the occurrence, characteristics and migration of gas in the shallow subsurface. The acquisition of critical gas chemistry, hydrochemistry and isotope data from water bores and gas exploration and production wells, provides the Project with a highly cost effective means to increase the understanding of rock, fluid and gas properties and how formation water and methane as well as other gases behave within a multi-phase system with transient environmental conditions (temperature, pressure, salinity and biological activity). The project will take on the challenge of unravelling and identifying characteristics that can fingerprint different sources of methane (and other compounds) and track its evolution and mixing history in the subsurface environment. This will use a combination of field sampling, laboratory analysis and modelling techniques. Predictive models will then be ground-truthed against data sets for calibration and validation. Sensitivity analysis will reveal which variables are most important to prediction of gas behaviour in the shallow subsurface.

The position is hosted at the University of Queensland, consistently ranked in the top 50 universities globally and well recognised for its excellent research environment. The city of Brisbane is located in a sub-tropical climate on Australia’s north eastern coast with excellent public transport and a world renowned relaxed lifestyle. The leadership team has an international track record of delivering world class unconventional gas research projects.

Further information on the UQ Centre for Coal Seam Gas may be accessed via https://ccsg.centre.uq.edu.au

The position will be located in the University’s Engineering, Architecture, and Information Technology Faculty (EAIT). Information about the Faculty may be accessed on the Faculty’s web site at https://www.eait.uq.edu.au

Information for Prospective Staff

Information about life at UQ including staff benefits, relocation and UQ campuses is available at - http://www.uq.edu.au/current-staff/working-at-ug

The University of Queensland Enterprise Agreement outlines the position classification standards for Levels A to E.
DUTY STATEMENT

Primary Purpose of Position

To work in a multidisciplinary research team of geologists, engineers, geophysicists, hydrogeologists and modellers to better understand methane transport in the subsurface. You will be working with senior academics, other postdoctoral fellows and post graduate students to deliver high impact science outcomes. This position will provide the key technical scientific horsepower to improve our fundamental knowledge of gas movement in the shallow subsurface with an emphasis on:

- **Basin wide hydrodynamic influences on gas migration**
- **Basin wide Lateral and Vertical gas migration – susceptibility to hydrodynamic influences**
- **Basin wide fault and hydrodynamic influences on regional gas migration.**

Processes affecting gas migration include methane solubility, fractionation, potentiometric and buoyancy forces in the subsurface. Improving our understanding of methane behaviour in the subsurface has implications for predicting its location and characteristics. Within this context it is important to consider the various possible sources of methane and their characteristics, and the various modes of transport and the resulting geochemical signatures of each. These include:

- **Sources:**
  - Thermogenic deep Permian gas
  - Thermogenic gas desorbed from the Walloon Coal Measures
  - Biogenic gas desorbed from the Walloon Coal Measures
  - Biogenic gas desorbed from other minor coals
  - Biogenic gas generated in situ in shallower aquifers

- **Transport mode:**
  - Separate methane phase migration as bubbles in water saturated media (buoyancy and potential driving forces)
  - Methane saturated groundwater including diffusion and dispersion processes
  - Methane as a continuous phase in partially water saturated media (tendril migration including capillarity and relative permeability)
  - Effects of changes in formation pressure, temperature and chemistry

The research work will include significant consultation with experts in the School of Earth Sciences and School of Chemical Engineering, and will be conducted in partnership with technical experts in the Gas Industry and Government. Duties could also include providing support and coordination of PhD students working on theses related to the project.

Duties

Duties and responsibilities include, but are not limited to:

**Research**

- Develop and design appropriate research methodologies for characterising and modelling gas migration in the shallow subsurface.
- Develop and design appropriate research methodologies for gas sampling and analysis from both water and gas exploration and production wells.
• Apply cutting edge hydrogeological principles and techniques to conceptualize and simulate the effects of, density, reactive geochemistry, biological activity, faults, and intraformational baffles on the character and migration of gas in a dynamic groundwater environments.
• Develop a fingerprinting of methane in the shallow subsurface that can distinguish the source of the gas and the dominant transport processes.
• Contribute to an integrated analysis of shallow gas migration in the Surat Basin.
• Advise and direct PhD students working on components of the overall project
• Contribute to comprehensive and regular project and milestone reporting so that the achievements are effectively communicated.
• Prepare board papers, research reports and journal articles
• Deliver research presentations to various audiences

Service and Engagement
• As a motivated and enthusiastic individual you will work as an integral part of a diverse project team and contribute to the overall performance of the team,
• You will participate in the mentoring and supervision of PhD students that are working on the team
• You will liaise closely with the project Chief Investigator and with academics in Earth Sciences, Engineering and other UQ Schools/Institutes.
• Establish and maintain close working relationships with stakeholders within the community, gas industry companies and all levels of government, where relevant,
• Engage with fellow researchers in the University of Queensland faculties and collaborating research institutions,

Other
Ensure you are aware of and comply with legislation and University policy relevant to the duties undertaken, including but not exclusive to:

• the University's Code of Conduct
• requirements of the Queensland occupational health and safety (OH&S) legislation and related OH&S responsibilities and procedures developed by the University or Institute/School
• the adoption sustainable practices in all work activities and compliance with associated legislation and related University sustainability responsibilities and procedures
• requirements of the Education Services for Overseas Students Act 2000, the National Code 2007 and associated legislation, and related responsibilities and procedures developed by the University

Organisational Relationships
The position reports to the CSG Chair in Petroleum Hydrodynamics.
SELECTED CRITERIA

Essential

- The applicant should be an early career researcher and have obtained a PhD in hydrogeology, hydrochemistry or a related discipline.
- Detailed understanding of technical aspects of Hydrochemistry and Gas Chemistry including isotope chemistry, dissolution, fractionation, biological processes, and how each of these relate to hydrogeological processes.
- Detailed knowledge of hydrodynamic and inorganic geochemistry processes including aquifer drawdown or injection processes, recharge, discharge, evapotranspiration, gas dissolution, density driven processes and reactive transport processes.
- Detailed knowledge of groundwater sampling techniques, gas sampling techniques (dissolved and free phase gas) from both groundwater bores and gas exploration and development wells.
- Detailed knowledge of geochemical laboratory analysis, isotope analysis and gas analysis laboratory methodologies.
- Strong inter-personal communication skills and the ability to relate to stakeholders with competing interests and views,
- Well-developed written communication skills,
- Experience in designing and conducting research or related data gathering processes,
- Experience in collating, analysing and interpreting quantitative and qualitative research data or other similar information.
- Experience in hydrochemistry, gas chemistry and hydrogeology.
- Gas sampling (dissolved or free gas) techniques for groundwater and gas exploration and production wells.
- Laboratory analysis methodologies for hydro-chemical and gas chemistry characterisation.
- Experience in groundwater flow processes that may affect gas migration and distribution including density effects, diffusion, dispersion, dissolution, and reactive transport.
- Experience with isotope geochemistry (measurement and analysis and interpretation).
- Experience in designing and conducting research or related data gathering processes,
- Experience in collating, analysing and interpreting research data or other similar information,

Desirable

- Knowledge of the Surat Basin geology in Queensland
- Experience in groundwater modelling including the incorporation of a static geological model, dynamic flow modelling and reactive transport modelling, history matching, calibration and validation.
Ability to grow and develop personal research expertise, demonstrated by an emerging profile in research with an increasing degree of autonomy,

Knowledge of reservoir Groundwater Modelling software such as MODFLOW, MODFLOW USG, FEFLOW and TOUGH React (or equivalent) to be run in both steady state and transient modes.

Qualification Verification
An appointment to this position is subject to the verification of the highest academic qualification from the conferring institution.

The University of Queensland values diversity and inclusion.
Applications are particularly encouraged from Aboriginal and Torres Strait Islander peoples. For further information please contact our Australian Indigenous Employment Coordinator at: atsi_recruitment@uq.edu.au
Applications are also encouraged from women.
This role is a full-time position; however flexible working arrangements may be negotiated.