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Santos
We have the energy.

17 September 2014

Professor Mary O'Kane
Office of the NSW Chief Scientist & Engineer
GPO Box 5477
Sydney, NSW 2001

Dear Professor O'Kane,

I refer to the recent briefing with industry on Monday 1 September where the review of coal seam gas activities in NSW was discussed. During the briefing you raised some issues about particular aspects of our work. We have endeavoured to supply some additional information on those areas in this letter.

Water Extraction

The Narrabri Gas Project (NGP) will take water from coal seams within the "Gunnedah-Oxley" Basin, which is within the Namoi Catchment. This basin is a deep, poor quality groundwater source. Water use for the Basin is regulated by both the NSW Government through its water sharing plans, and by the Commonwealth Government, through the Murray Darling Basin Plan.

Any water extracted during the activities must be licenced as required under the NSW Government's water sharing plan and the Water Management Act. As is the case for all water users, Santos must purchase its allocation of water from the market.

The water sharing plan sets "long term extraction limits", for how much water can be sustainably taken from the ground water source in any year.

Santos' NGP will take on average 1.5GL of water per annum, over the life of the 25 year project. This is well within the annual maximum long-term extraction limit of around 205GL (Water Sharing Plan for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011, cl25(2)(a)).

To put our estimated use of 1.5GL per year in context:

- The average water used across all of the different water sources in any given year in the Namoi Catchment is approximately 400GL – most of this water is used by the agriculture industry. (NSW Office of Water (February 2014) – General Purpose Water Accounting Report 2012–2013 Namoi Catchment)

- A single representative or average farm in the Namoi Valley (1203 hectares) is typically licensed to take 2.35GL of good quality water every year from both groundwater and surface water, with an assumed average use of 1.285GL ("A Representative Irrigated Farming System in the Lower Namoi Valley of NSW" – NSW Dept of Industry and Investment and Cotton Catchment Communities CRC – January 2011 p 25).

- One hectare of cotton uses an average 5.5ML of good quality water per hectare per year – for a 500 hectare farm this equals 2.75GL of good quality water every year (Monitoring economic and social changes in NSW water sharing plan areas – irrigators' survey 2006 and 2010 p 67)

- In 2012 the Bayswater and Liddell power stations diverted over 84GL of water to produce the equivalent of 88,322 TJ of energy (Macquarie Generation Annual Report 2012 p 15). The proposed NGP is expected produce 200TJ of energy a day or 72,400 TJ a year, with an average water use of 1.5GL per annum.

Water Treatment

The coal seam water from the Narrabri Gas Project is about 1/3 to 1/2 as salty as seawater. The water drawn from the NGP can be generally categorised as being too salty for productive reuse without some form of treatment

We intend to treat the water by desalination. Sea water is treated via desalination to supplement drinking water supplies in most capital cities. The process Santos proposes to adopt is no different. The desalination process will produce two types of water, treated or beneficial water; and brine.

Based on the extensive experience from Santos' coal seam gas operations in Queensland, it is estimated more than 80% of the water extracted from the coal seam will be made available for beneficial use. The water, once treated, is very good quality. In Queensland, it is used for a range of high quality uses including farm irrigation and to replenish local water sources

For the NGP, Santos will similarly investigate the optimum beneficial re-use of the treated produced water. This previously unavailable water represents a significant opportunity for the local community. Options for reuse will be outlined in the forthcoming EIS for the Narrabri Gas Project.

The desalination process will generate a mixed salt as a by-product of the treatment of the produced water. The salt extracted in our project area contains high concentrations of bicarbonate which is commonly used in cooking and in a number of industrial processes such as glass manufacturing.

Santos has publicly stated that for the NGP, consideration will be given to the conversion of some of the salt for commercial purposes. This approach depends on a number of factors including transport costs, plant establishment costs, and long term availability of raw material.

Options for the salt will continue to be investigated during exploration and while we await approval for the Project. If a commercially viable option is unable to be identified, the alternative solution will be the transfer of salt to licenced waste treatment and containment facilities regulated by the NSW Environment Protection Authority.

It's estimated that for every 1 million litres of good quality water produced, 12 tonnes of salt will be created. The average salt production over the life of the Project would be 50 tonnes per day, which equates to approximately 20,000 tonnes per annum.
Disposing of concentrated salt is not an unusual issue. For example:

- In 2012 Bayswater and Liddell power stations released 35,500 tonnes of salt directly into the Hunter River under the Hunter Salinity Trading Scheme (Macquarie Generation Annual Report pg 15).

- The Murray Darling Basin Commission intercepts about half a million tonnes per annum or around 1,000 tonnes of salt each day prior to it entering the River Murray (Keeping Salt out of the Murray. Murray Darling Basin Commission Factsheet – March 2008). The last is relocated to evaporation ponds away from the river to concentrate and then is crystallised, harvested and sold for various commercial uses or allowed to seep into saline regional aquifers.

Beneficial Reuse

The treatment and reuse of the coal seam water for beneficial reuse is heavily regulated by both the NSW Government and the Commonwealth Government.

In our Queensland coal seam gas operations, Santos is currently using treated coal seam water for: irrigation of crops, release of water to creeks, and streams, injecting into aquifers and irrigation of trees. Before any water is discharged into the environment, environmental approval must be obtained, which includes a detailed assessment of the proposed receiving environment. Any approval will be conditional on Santos obtaining comprehensive baseline data, as well as ongoing monitoring and reporting.

If using the treated water from the Narrabri Gas Project for irrigation, Santos will be required to undertake a comprehensive baseline soil analysis before any irrigation occurs. This will include a range of agricultural tests including sodium absorption ratio, salt tolerance, and trace elements. As part of our operations, continued regular monitoring of soil conditions and infiltration of irrigation water will routinely occur to ensure any changes are within the approved limits.

Water Monitoring

As part of the development of the Narrabri Gas Project, Santos is implementing a comprehensive strategy to manage the water from the coal seams; this includes monitoring the surface and ground water in the areas where we operate. Santos is gathering comprehensive baseline data on the ground water and surface water systems across the areas of our operations.

Santos' existing water monitoring program includes ground water and surface monitoring across 300 monitoring locations across the Namoi Catchment area including outside the NGP area. The program is designed to improve the understanding of the natural variability in water levels, flow and chemistry across the region and includes the establishment of baseline conditions for streams, creeks, rivers and groundwater systems across the region. Water quality and level data from the program is available to the community via the Santos Water Portal.

The Water Portal is a Santos-led initiative to help landholders and communities access the most up-to-date monitoring information, along with long-term trends of water quality and water levels in areas where we operate. The Water Portal is not a regulatory requirement, but the company is leading the way in the provision of this data to the public.

This data is also required to be reported to the NSW Government at regular intervals. This data goes towards establishing the baseline conditions in the region, and will continue to be used to monitor our ongoing activities.

In addition, the NSW Government has recently announced a joint initiative between the Division of Resources and Energy and the Office of Water and a new framework to map, monitor and protect groundwater resources across NSW. Information can be found at http://www.resourcesandenergy.nsw.gov.au/landholders-and-community/coal-seam-gas/water-data-project.

Training and Employment

Santos prides itself on its rigorous approach to environmental, health and safety management, and its strong record of safe and sustainable operations.
The internal policies we have in place ensure our employees have the correct qualifications for their area of responsibility. In conjunction with ensuring Santos employees and contractors have appropriate qualifications and training to perform day to day operations safely, Santos has developed a comprehensive Environmental Health and Safety Management System (EHSMS) which employees and contractors are required to adhere to in all aspects of the working environment.

The management system consists of policies, standards, rules and work practices designed to ensure persons operate safely and lawfully, and our operations minimise impacts on the environment. As a minimum, this system complies with relevant legal and other requirements and is based on the ISO (International Organization for Standardization) 14001 and AS (Australian Standard) 4801 standards. It incorporates industry best practice and includes 17 management standards and more than 30 hazard standards.

One such management standard details the expectations and support mechanisms specifically relating to training and competency to ensure employees and contractors have the necessary skills, experience and competency to operate in a safe manner without harm to people, environment, plant or equipment. A copy of the full EHSMS guide is available on the Santos website.

Santos also undertakes auditing of its own operations to ensure compliance with its internal procedures.

Conclusion

Santos looks forward to the completion of your review of coal seam gas activities, which we believe will assist in the timely establishment of a viable and environmentally sustainable natural gas industry to provide much needed energy and other benefits to NSW.

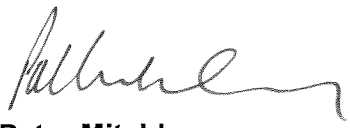
Over the last 3 years, the NSW Government has put in place substantial regulation covering the coal seam gas industry. This includes groundwater assessment requirements, agricultural land impact assessments, coal seam gas exclusion zones, water monitoring requirements, all activities being subject to an Environmental Protection Licence, to name just a few.

In addition, industry has proactively addressed issues such as committing to land access principles whereby we will respect the right for landowners to say yes or no to coal seam gas drilling on their land.

We understand the environment in which we are operating. We know from experience and research that our operations will have minimal but manageable impacts. Importantly, we share our information with landholders, local communities and the Government.

If you would like any further information regarding the issues raised above, or any other matter, please do not hesitate to contact Deena McMullen on +61 2 9276 1121.

Yours sincerely,



Peter Mitchley
General Manager, Energy NSW
Santos Ltd