

Risk assessment report on hydraulic fracturing flowback wastewater at Santos Tanumbirini well site in the Beetaloo Sub-basin

Introduction

Santos QNT Pty Ltd (Santos) was granted approval by the Minister for Environment and Natural Resources (the Minister) for the McArthur Basin 2019-2020 Hydraulic Fracturing Program Exploration Permit 161 Environmental Management Plan (EMP) on 22 October 2019.

Hydraulic fracturing (HF) occurred in the Tanumbirini_1 well in November 2019 in five stages at different depths in the target Velkerri shale formation more than 2,600 m below ground level. Each stage took one day to complete. The wastewater is the fluid that was allowed to flowback from the well after pressure pumping the injected HF fluid (approximately 90% water and less than 1% HF chemicals) and 9% sand into hairline fractures created in the target shale reservoir, by the pumping operation. Flowback commenced in December 2019 and the wastewater, after passing through a hydrocarbon separator, was transferred to a 6.4 megalitre (ML) x five metre high enclosed steel storage tank in a bunded and low permeability hardstand containment area.

The management controls for wastewater in the EMP must be implemented on site in accordance with the Wastewater Management Plan, Spill Management Plan and the Code.

Public comments received on the Santos HF EMP raised concerns around the potential impact to water quality from HF chemicals and loss of wastewater containment, and potential impacts to land and water to fauna. To address these concerns, the Minister required an EMP approval condition to reassess the potential risks to avian fauna and soil based on the actual laboratory sampling and analyses of the wastewater, from flowback following HF operations stored on site.

In accordance with Regulation 11 of the Petroleum (Environment) Regulations 2016, the EMP was approved with conditions set out in the [approval notice](#)¹ including:

Condition 3: The Interest Holder must provide to DENR, within 60 days of flowback commencing, a report on the risk assessment of flowback water from the hydraulic fracturing phase. The risk assessment must be:

- prepared by a suitably qualified person²
- prepared in accordance with the monitoring wastewater chemistry analytes specified in Section C.3 of the Code of Practice: Onshore Petroleum Activities in the Northern Territory (Code).

¹ https://denr.nt.gov.au/__data/assets/pdf_file/0005/747779/ep161-santos-mcarthur-basin-hydraulic-fracturing-program-an-sor.pdf

² Defined in the Code as: A person who has professional qualifications, training or skills or experience relevant to the nominated subject matters or tasks and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature or conduct tasks in accordance with requirements.

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In compliance with Condition 3 of the approval notice, subject to an approved extension of time due to logistics in sampling and laboratory analysis, Santos submitted the attached report on hydraulic fracturing (HF) flowback fluid that provides a risk assessment of the enclosed storage tank wastewater from the EP161 Tanumbirini_1 petroleum well hydraulic fracturing operation ([the Report](#)³) conducted in November 2019.

Flowback wastewater monitoring

To support a risk assessment, wastewater samples were collected from the Tanumbirini enclosed wastewater storage tank 1 on 15 January 2020 and 12 February 2020. Samples were taken at 0.2 m and 4 m depth in the tank. Laboratory analyses of these wastewater samples was conducted for 110 inorganic, organic and radionuclide analytes specified in Section C.8 of the Code. Water sampling and handling practices are implemented in accordance with the procedure approved in the EMP to ensure data collected is representative and of an acceptable quality control to maintain reliability of data. The laboratory results are provided in Attachment 1 of the Report. Monitoring of flowback fluid volumes is shown in Figure 1.

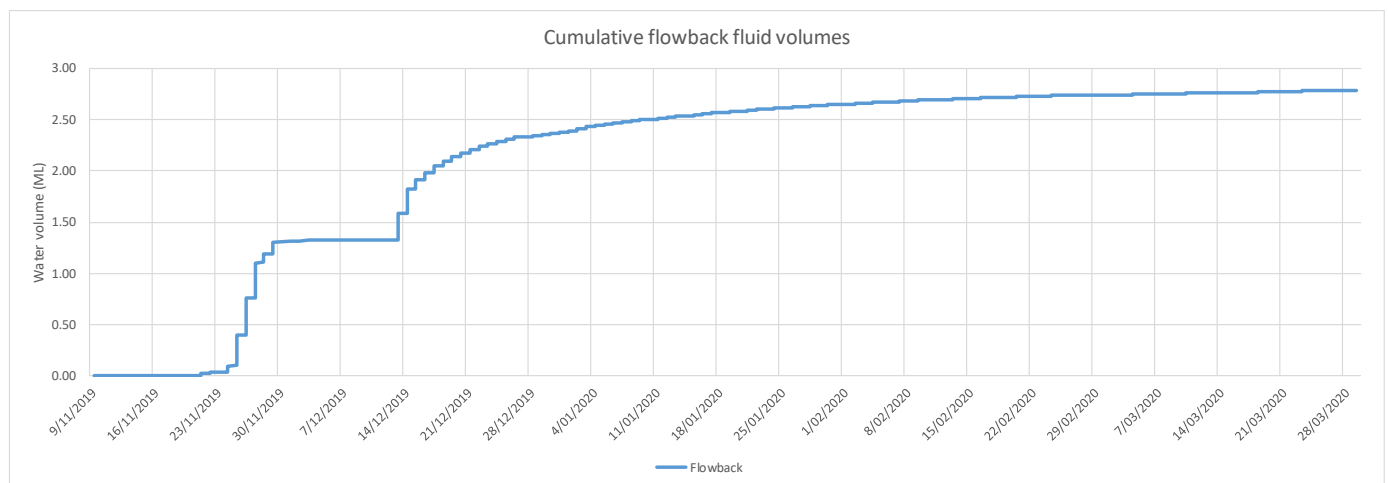


Figure 1: Recorded volume of cumulative flowback at Tanumbirini well site.

The total volume that was recovered in the flowback process, which extended over a period of about two months, was 3.2 ML which is about 40% of what was pumped into the impermeable shale in the HF Operation. This is similar to the average recovery rate reported in shale fields in North America⁴.

³ <https://denr.nt.gov.au/onshore-gas/onshore-gas-in-the-northern-territory/industry-compliance-and-reporting/flowback-fluid-monitoring-results>

⁴ Hayes, T. 2009. Sampling and Analysis of Water Streams Associated with the Development of Marcellus Shale Gas, Final Report, 31 December 2009.

Synopsis of Risk Assessment Report

The Report was prepared by a Board-Certified Toxicologist with a Ph.D. in Environmental Health Sciences and over 25 years of experience in the specialty chemical and consulting industries. Expertise includes chemical residue analysis for regional fate and transport models, providing toxicology testing management, and risk assessment support for new and existing products and raw materials.

The objectives of the Report included:

1. assessment of determining testing requirements for potential degradants from the approved HF chemicals that may be present in the Tanumbirini well wastewater flowback
2. update the quantitative risk assessment to avian receptors if wastewater was ingested
3. assess the potential ecological risks from a hypothetical release of wastewater to soil
4. provide laboratory results for the 110 HF wastewater chemistry analytes specified in Section C.3 of the Code.

Summary of results

Assessment of HF wastewater testing requirements

The assessment of testing requirements determined if potential degradants of the 63 HF Chemicals approved in the EMP, are included in the chemistry analytes specified in the Code, or required further analytical testing. Based on this assessment, the report concludes that there are no degradants of the HF chemicals that would require additional analytical testing beyond the chemistry analyte specified in the Code.

Risk to local birds drinking HF wastewater from the storage tank

The assessment consisted of screening to identify chemicals of concern measured in the wastewater that require further assessment in a quantitative ecotoxicological evaluation for birds potentially drinking the wastewater. The report concluded there were no unacceptable risks to birds from potential ingestion of chemicals in the wastewater over a one year period.

Risk to local soil contamination in the event of a storage tank release

DENR requested Santos to also assess the potential ecological risks from a hypothetical maximum release (8 ML release resulting from a tank failure) of wastewater to soil within the wastewater tank containment area. The soil exposure risk assessment concluded that no chemicals detected in the wastewater, at their maximum concentration, under a hypothetical maximum release scenario, would result in soil levels above soil screening criteria⁵ for the protection of terrestrial plants and animals.

⁵ NEPM 2011. Guideline on Investigation Levels for Soil and Groundwater. National Environment Protection (Assessment of Site Contamination) Measure April 2011 - relevant criteria sub-tables