Question to Santos - Email of 2 September 2019

In the response to Arriscar's follow up questions regarding the likelihood of bushfire being caused by the development (ID#11), the likelihood of a loss of containment creating a fire is estimated at once in 70 years.

Our hazards team have asked if you can provide any clarification on how that figure is derived?

Santos Response

Bushfire frequency in the Pilliga is significantly greater than the 1/10 year frequency stated by Arriscar

From December 2013 to January 2018 at least 17 Pilliga bushfires have been recorded

- 1 bushfire - December 2013 bushfire Pilliga south, around 30km south of Santos operations, fire closed the Newell Highway ~16 December 2013.
- 1 bushfire - 6 January 2014 FCNSW advised that they has been suppressing a Pilliga bushfire and their staff would likely be busy for the next week.
- Several (at least 3) bushfires - 7 November 14 Santos advised FCNSW of a bushfire near to Bibblewindi west pilot, unrelated to Santos operations. On 11 November 2014 FCNSW advised that they had responded to 'several fires' in state forests in the past few weeks.
- 3 separate bushfires – at 9 March 2015
    - Dangar Road bushfire had burnt ~15,000 ha
    - Emu Road bushfire had burnt ~1,300 ha
    - Brigalow Road fire had burnt ~200ha
- 1 bushfire - 26 November 2015 Santos notifies FCNSW bushfire ~2.5km south of Santos' operations, FCNSW later confirmed the bushfire started in area of Whirlybrook Fire Trail. On 29 Nov 2015 fire under control 7,900ha burnt.
- 3 bushfires – 15 January 2016 south end of Pilliga region, closure of Newell Hwy, one fire ~8,000ha at this time, air tankers being used
- 1 bushfire - 17 February 2017 Santos advised RFS/FCNSW of smoke and upon further investigation found fire from the previous night's lightning storm, ~200m into the forest off X-line Road.
- 1 bushfire - 10 January 2018 Santos notified FCNSW of tree well alight from lightning strike, on Boundary Road to the south of X-line Road, ultimate extent 1ha.
- 3 bushfires – 11 January 2018 a lightning strike started a fire close to Timmallalie NP (south west of and distant from STO operations) that over the next 2 weeks burnt around 60,000ha. On 25 January 2018 two additional bushfires from lightning were under control.

More rapid bushfire identification and suppression because Santos and it contractors are present in the Pilliga forest

There are four bushfire events above that were identified and notified by Santos / Santos contactors, November 2014, November 2015, February 2017 and January 2018. If the NGP

is approved there will be an increased Santos presence in the forest, providing for ongoing detection of bushfires.

Regarding one ignition every 70 years

- The estimate is for fire starts/ignitions only and is therefore conservative. It does not consider the probability of these ignitions escalating and leaving the site boundaries, and then further escalating to cause a bushfire.
- We also know, although it is not possible to quantify statistically for this analysis, that the presence of Santos and its contractors in the Pilliga forest has resulted in (and will continue to result in) the earlier detection of bushfires (unrelated to Santos operations), and more rapid containment by the relevant government agencies.
- The calculation takes into consideration all 850 wells
- With reference to the EIS, semi quantitative estimate by combining the frequency of release (Table 4-20 in the NGP EIS Appendix S) and probability of ignition (Table 4-13 in the NGP EIS, Appendix S)
- Ignition probabilities were based on values provided in the Purple Book (TNO, 1999)
- A probability of immediate ignition of 0.09 was used for all release cases representing the ignition probability for release rates >100 kg/s (this is conservative as the smaller hole sizes have release rates less than 100 kg/s, Table 6-2 in the NGP EIS, Appendix S)
- Immediate ignition probabilities were used for delayed ignition consequence events (explosions) as a conservative basis
- The ignition frequency per annum for all infrastructure is 1.4E-02, which is an ignition every 70.91 years

Location	Description of consequences/impact	Release frequency (single asset) (from Table 4-20 NGP EIS Appendix S)	Ignition frequency (incl. 850 wells)
Wellheads	Jet fire from a 100 mm hole with jet fire heat radiation of 4.7 kW/m2 (representing second degree burns after 30 seconds exposure) extending 50 m downwind.	4.2E-08	3.6E-05
Wellheads	Fireball from a catastrophic failure of a vessel with a 4.7 kW/m2 effect distance of 18 m.	1.6E-05	1.4E-02
Gathering lines	Jet fire from a full bore rupture (FBR) at the centre of the pipeline with jet fire heat radiation of 4.7 kW/m2 (representing second degree burns after 30 seconds exposure), extending a distance of 190m downwind.	3.0E-07	3.0E-07
Bibblewindi compression facility	Jet fire from a 100 mm hole with jet fire heat radiation of 4.7 kW/m2 (representing second degree burns after 30 seconds exposure) extending 82 m downwind.	4.2E-08	4.2E-08
Bibblewindi compression facility	Fireball from a catastrophic failure of a 2m3 vessel with a 4.7 kW/m2 (representing second degree burns after 30 seconds exposure) effect distance of 44 m.	1.6E-05	1.6E-05
Bibblewindi compression facility	Explosion from a catastrophic failure of a high pressure 2m3 vessel with a 7 kPa overpressure (representing a 10% chance of injury) effect distance of 58 m. Maximum consequence of medical treatment injury assumed as there are no sensitive receptors in the impact zone.	1.6E-05	1.6E-05

Bibblewindi to Leewood Gas Line	Jet fire from a full bore rupture (FBR) at the centre of the pipeline with jet fire heat radiation of 4.7 kW/m2 (representing second degree burns after 30 seconds exposure), extending a distance of 350 m downwind.	3.0E-07	3.0E-07	
Leewood Central Compression Facility and Power	Jet fire from a 200 mm hole in a high pressure pipe with jet fire heat radiation of 4.7 kW/m2 (representing second degree burns after 30 seconds exposure) extending 1,146 m downwind.	3.6E-07	3.6E-07	
Leewood Central Compression Facility and Power	Fireball from a catastrophic failure of a 2m3 vessel with a 4.7 kW/m2 (representing second degree burns after 30 seconds exposure) effect distance of 130 m.	1.6E-05	1.6E-05	
Leewood Central Compression Facility and Power	Explosion from a catastrophic failure of a high pressure 2m3 vessel with a 7 kPa overpressure (representing a 10% chance of injury) effect distance of 125 m. Maximum consequence of medical treatment injury assumed as there are no sensitive receptors in the impact zone.	1.6E-05	1.6E-05	
			1.4E-02	frequency of ignitions per annum
			70.91	an ignition every 70.91 years