Why we think the Tallawarra B plume exceeds 6.1 m/s at 700 feet, and hence why we think the Tallawarra B plume is not safe for aviation.

Supplementary Plume Rise Assessment for the Tallawarra B Power Station Aviation Impact Assessment

Prepared for:

EnergyAustralia

July 2021

Final

Prepared by:

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6. CONCLUSIONS

"This supplementary plume rise assessment has conducted CFD modelling of the detailed design of TPS with PDD.

The CFD modelling results show that:

- The plume average vertical velocity at 1,000 ft (AMSL) is 3.9 m/s compared to the CASA CPV requirement of 6.1 m/s.
- The plume radius at 1,000 ft (AMSL) is 118 m.
- The plume average vertical velocity at 700 ft (AMSL) is 4.9 m/s compared to the CASA CPV requirement of 6.1 m/s.
- The plume radius at 700 ft (AMSL) is 72 m.

Cross sectional analysis of the plume at 1,000 ft (AMSL) has been undertaken to calculate the time it would take an aircraft to pass through the section of the TBPS plume where the instantaneous vertical velocity is greater than 6.1 m/s, when travelling at various speeds (60 – 120 knots). Travel times range from 1.4 to 2.8 seconds. At 700 ft, the plume cross-section is smaller than at 1,000 ft and so travel times are proportionately shorter"

Stacey Agnew

TALLAWARRA B POWER STATION CFD PLUME MODELLING – GE-MODIFIED PDD DESIGN

SUMMARY REPORT

for Katestone
13TH AUGUST 2021

Ref 2001

Executive Summary

"At an elevation of 200 m (about 650 ft) the peak plume rise velocity is 11.9 ±0.4 m/s for the worst-case combined meteorological conditions (maximum of the three analysed cases). Depending on the plume area definition and the wind scenario, the average velocity at 200 m elevation is between 8.2 m/s and 3.5 m/s. **This wide variation suggests that average velocity over an arbitrarily selected area may not be useful in assessing performance, and another measure should be sought."**

"The analysis of the different wind scenarios showed that, depending on the ambient temperature, the individual vertical plume jets can either attach to each other or stay separate. Once the jets are combined to a single vertical jet (lower ambient temperature) the maximum plume rise velocity can reach a value of up to 12.3 m/s."

Table 1. Summary of equivalent top hat profile values for different heights.

Plume definition	Unit	650 ft	700 ft	1000 ft
Max. plume rise velocity from CFD	m/s	11.9 ±0.4	11.7±0.4	10.5±0.4

3.1 Plume Velocity and Temperature Against Height – 'Initial' Wind Case

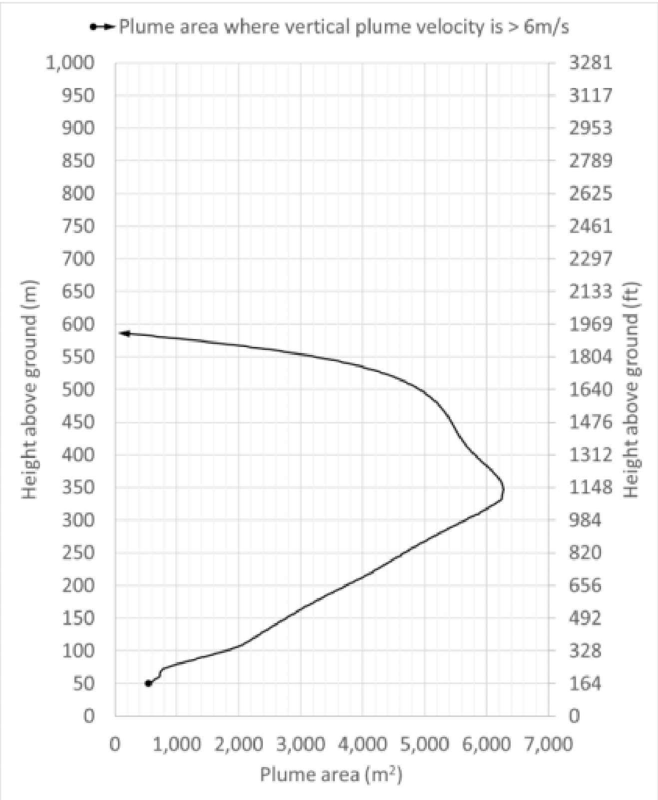

Figure 8. Plume area (area where vertical plume velocity is > 6 m/s) – 'Initial' wind case

This graph says that under initial wind case conditions, the plume exceeds 6.1 m/s up to approx 1900 feet

3.4 Plume Behavior Sensitivity on Different Wind Conditions

“Compared to the ‘initial’ wind condition, the calm wind case has lower wind speeds but ambient average temperature that is higher by about 7.2 °C.”

“For the ‘initial’ wind condition, the released horizontal jets get bend upwards due to the density deficit and the resulting high buoyancy force. Similar to the Coanda effect, the now vertical jets tend to attach to each other, so that a single vertical plume jet is formed. The plume temperature in the core of the formed single jet is still high enough to further accelerate the plume rise velocity to a maximum value of 11.5 m/s (at 700 ft).”

“This ‘combined’ wind case confirms that the ambient air temperature has a meaningful influence on the plume behavior in general and the individual jets in particular. The buoyancy force at lower ambient temperatures is higher so that the individual jets bend upwards at an earlier stage. Therefore, the horizontal separation of the jets is lower and they are closer to each other once they are vertical. Similar to the simulation with the ‘initial’ wind case, the individual jets tend to attach to each other, so that a single vertical plume jet is formed again. The lower wind speed around the jets further helps to attach the individual jets, as the flow around and between the jets is lower (lack of air between the jets). Moreover, lower wind speeds reduce plume cooling, disturbance of the plume shape and natural convection as well as reduce the plume displacement in general. This leads to a slimmer and more vertical stretched single jet where the core temperature is slightly higher and more maintained. In turn, this leads to higher buoyancy forces and plume rise velocity, with a peak value of 12 m/s (+/- 0.4 m/s) at 590 ft.”

Stacey Agnew Fig 19

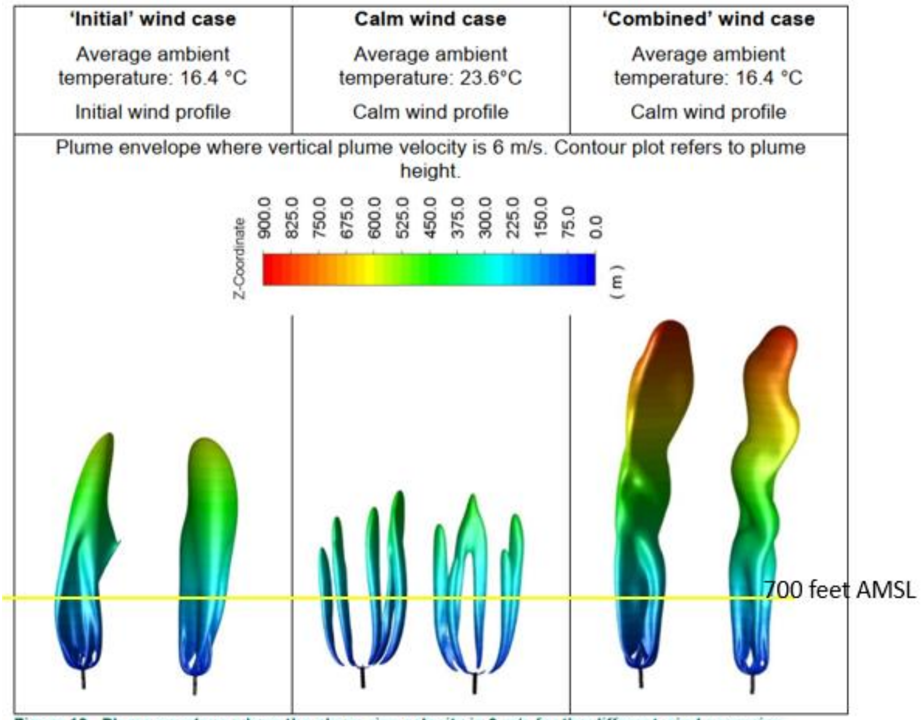

Figure 19. Plume envelope where the plume rise velocity is 6 m/s for the different wind scenarios. Colouring of the envelope depicts the plume height.

Tallawarra B Power Station CFD Plume Modelling
GE – Modified PDD Summary Report
13th August 2021

Stacey Agnew

The above figures show that:

- All 3 cases modelled exceed 6 m/s at 700 feet
- The colour of each picture shows the altitude to which each case modelled exceeds 6 m/s. To be safe for aviation, there should be no colour showing above the 700 feet mark (the yellow horizontal line)
- In the “combined” wind case, the plume is shown to exceed 6 m/s up to 2700 feet. This may penetrate the PANS OPS surface. We don’t know because the work has not been done for this conditionally approved installation. RNAV 34 missed approach is likely to be affected.

Stacey Agnew Fig 20

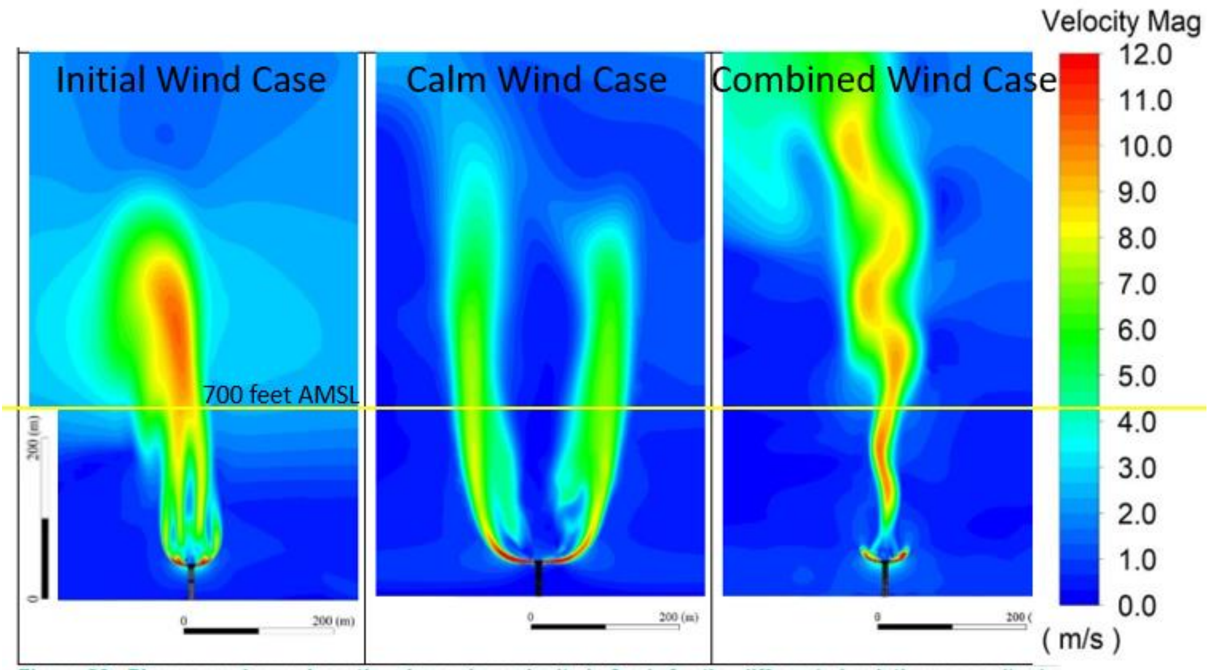

Figure 20. Plume envelope where the plume rise velocity is 6 m/s for the different simulation cases (top) and contour plot of absolute velocity in plane through the stack (bottom) for the different wind scenarios.

Tallawarra B Power Station CFD Plume Modelling
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From Stacey Agnew Figure 20 above:

- The yellow horizontal line shows 700 feet AMSL
- To be safe for aviation, CASA says the plume velocity at and above 700 feet AMSL must be less than 6.1 m/s
- 6.1 m/s is coloured green in the figures
- Yellow and red show plume velocities of 8 to 12 m/s
- There should be no yellow or red above the yellow horizontal line for the plume to be safe for aviation
- All three case show the plume exceeds 6.1 m/s at 700 feet AMSL