

Network Standard

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NS192

Title:

Blasting near substations and power lines

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Scope

This standard sets acceptable limits and controls that need to be put in place to prevent damage to Ausgrid assets resulting from mine and quarry blasting.

Reference Documents

All work covered in this document shall conform to all relevant Legislation, Standards, Codes of Practice and Network Standards. Current Network Standards and Technical Guides are available on BALIN and Ausgrid's Internet site at www.ausgrid.com.au.

Ausgrid Documents

NS001 Glossary of Terms

Electrical Safety Rules

Electricity Network Safety Management System Manual

Other Standards and Documents

AS 2187.2: Explosives – Storage and Use – Use of Explosives

Acts and Regulations

Electricity Supply (General) Regulation 2014 (NSW)

Electricity Supply (Safety and Network Management) Regulation 2014 (NSW)

Work Health and Safety Act 2011 (NSW)

Work Health and Safety Regulation 2017 (NSW)

Clause Standard Requirements**1 General**

- 1.1 The controls outlined in this standard shall be put in place to minimise the likelihood of damage to Ausgrid's assets in the vicinity of sites where blasting occurs (e.g. quarries and mines).
- 1.2 This standard shall apply to blasting near any Ausgrid asset located within a distance that is the greater of:
- 1km from the site boundary of where blasting occurs (e.g. quarries and mines).
 - A distance where predictive analysis indicates that ground vibrations may exceed 50% of the acceptable PPV limits in this standard.
 - A distance where predictive analysis indicates that air blast overpressure may exceed 115dBL.
- 1.3 Mine/Quarry operators that perform blasting near Ausgrid assets shall enter into an agreement with Ausgrid, and this is typically a requirement of the Development Approval process. This agreement shall cover the impacts associated with blasting activities and the necessary controls in accordance with the requirements of this standard.

2 Notification of Blasting

- 2.1 The mine/quarry operator shall provide written notification to Ausgrid of all blasting activities that may have an impact upon Ausgrid's assets. This notification shall be submitted to Ausgrid at least two (2) weeks prior to each blasting event.
- 2.2 The required notification period shall be increased to at least four (4) weeks where the agreed Peak Particle Velocity (PPV) limits, airblast overpressure or controls for flyrock are to be approached (within 80%) or exceeded for Ausgrid's assets.

3 Monitoring

- 3.1 At least one PPV logger shall be installed at each substation site or overhead power line that may be affected by mine blasting to monitor blasting vibrations. The PPV measuring equipment, installation method, measuring technique and monitoring records shall comply with the requirements of AS 2187.2.
- 3.2 Each ground vibration transducer shall be effectively coupled and in good contact with the ground, in accordance with AS 2187.2.
- 3.3 Additional on-site PPV monitoring may also be required at identified locations for specific structures, components and sensitive electrical equipment.
- 3.4 All ground vibration transducers shall be installed as permanent installations at locations that are unlikely to require future repositioning. The aim is to ensure a continuity of the baseline data that is collected for the substation.
- 3.5 The PPV measuring equipment shall be fully calibrated and shall have a minimum sampling rate of 4000 Hz. The frequency range of the measuring equipment shall be at least 2 Hz to 250 Hz (-3 dB roll off), with a tolerance of 10% over this frequency range. The measuring equipment transducers shall be triaxial, and the axes shall be aligned with the major equipment directions (e.g. the busbars) within the substation.
- 3.6 The selection of appropriate PPV measuring equipment (geophone or accelerometer) for a site shall be based on the critical vibration frequencies that need to be assessed, the expected signal content of the blast vibration spectra over various distances, and the corresponding capabilities of the measuring equipment to accurately capture the data.

For substation sites, accelerometers are the preferred PPV measuring equipment due to the very detailed response spectrum data required.

- 3.7 On-site PPV monitoring shall be downloaded at regular intervals for analysis. Additional downloads may be required following mine blasts of particular interest due to proximity, magnitude etc. or to assess the effectiveness of on-site vibration mitigation measures. Where site facilities allow, this information shall be remotely accessible via internet connection.

4 Event Notification and Reporting

- 4.1 On-site PPV monitoring and data acquisition is typically undertaken to either facilitate site specific design/verification of substation equipment and structures, or for the purposes of measuring and controlling the blast induced vibrations received on the site.
- 4.2 Where vibration limits have been set and PPV monitoring is used for controlling site vibrations, suitable 'Alert' and 'Stop Work' levels shall be determined, and a notification system established.
- 4.3 Notifications shall be automatically produced when a vibration limit is exceeded, and all parties advised accordingly. Vibration alerts shall contain the following details as a minimum;
- Date time stamp of the event,
 - Event type as an "Alert" notification or "Stop Work" level,
 - Project site location,
 - Sensor location description,
 - Peak Particle Velocity in mm/s,
 - Frequency range of vibration causing the alert
- 4.4 The PPV measuring equipment shall capture the full waveform causing the alert, allowing this information to be downloaded by the monitoring service.
- 4.5 The following PPV monitoring reports for site vibrations shall be prepared and submitted to Ausgrid;
- The first full day of monitoring,
 - Each exceedance event,
 - Weekly reports if no exceedance events are recorded.

The reporting frequency can be reduced to monthly where there are no exceedance events recorded over the preceding two months.

5 Acceptable PPV Limits

5.1 Blasting Plan

- 5.1.1 All blasting shall comply with the mine/quarry operator's blasting plan which forms part of the development approval for the mine/quarry. Any vibration, airblast or flyrock events that are outside of the approval limits shall be brought to the attention of the mine/quarry operator and/or the relevant mining authority (DPI) for resolution.

5.2 Substations

- 5.2.1 For Ausgrid substation assets that are affected by mine/quarry blasting activities, the PPV limits as indicated in Table 1 shall apply, unless alternative PPV limits have been approved in writing by Ausgrid (refer to Clause 5.4).
- 5.2.2 For substation sites as categorised in Table 1, the relevant PPV limits within the substation boundary are as indicated and;
- shall apply for 90% of blasting events over a rolling period of 12 months; and
 - shall not exceed the maximum values as shown, for any one blasting event.
- 5.2.3 The PPV limits indicated in Table 1 are based on the typical equipment, configurations and support systems found within Ausgrid substations.

5.2.4 Factors such as the type, age, condition and sensitivity of electrical equipment, the minimal strength and low ductility of various components, and the use of rigid connections with low flexibility may further reduce the allowable PPV limits for specific substation sites.

Table 1 - Substation Equipment and Asset Protection PPV Limits

Specific PPV Limits (mm/s)		
Equipment Type / Category	90% of Blasting Events	Maximum Blasting Event
Substation sites with Main Transformer - Oil Impregnated Paper Bushings	≤10	15
Substation sites with sensitive equipment (Note 1)	≤10	15
All other substation sites (Note 2)	≤20	25

¹ Substations may contain specific structures, components or sensitive electrical equipment with reduced PPV limits.

² The site asset protection PPV limits shall apply where sensitive equipment are not present, or are effectively isolated.

5.2.5 Ausgrid may consider alternative PPV limits where it can be demonstrated by the mine/quarry operator that the substation equipment and buildings can safely tolerate greater vibration levels. Refer to Clause 5.4.

5.3 Overhead Power Lines

5.3.1 For overhead pole type power lines (timber, concrete or steel pole structures) a maximum PPV of 100 mm/s shall apply.

5.3.2 At specific locations, a reduced PPV of 50 mm/s shall apply. These locations include, but are not limited to, poles with stay wires, pole substations and poles that are overloaded, decayed, cracked or damaged and hence will require further assessment on a site specific basis.

5.3.3 For steel lattice towers the PPV limit for low frequency vibrations shall be 50 mm/s below 4 Hz, increasing to 100 mm/s at 10 Hz and above.

5.3.4 PPV predictive modelling shall be undertaken by the mine/quarry operator prior to any blasting, and a report shall be submitted with this information. Where any towers are predicted to experience 60% or more of the maximum PPV, monitoring will be required. Non-destructive testing of the towers is also required at various times, including:

- prior to the commencement of mine blasting operations,
- if the maximum PPV is exceeded, and
- at the conclusion of the mine operation.

5.3.5 Steel lattice towers which contain overloaded or significantly deteriorated components shall be subject to reduced PPV limits, as determined and advised by Ausgrid on a site specific basis.

5.3.6 For both pole and steel lattice structures, the PPV limits shall be subject to effective and ongoing monitoring of mine blast vibrations at and above ground level, and the implementation of controls to ensure prevention of damage due to flyrock and dust build-up.

5.3.7 Monitoring of overhead power lines shall be in accordance with the requirements of Clause 3.

5.4 Alternative PPV Limits

5.4.1 It shall be the responsibility of the mine/quarry operator to demonstrate that any alternative PPV limits are appropriate, and to accept the cost of any necessary remedial works that may be required.

6 Acceptable Airblast Overpressure

- 6.1 For the substation equipment and buildings the maximum airblast peak SPL shall not exceed 133 dBL for any blasting event at any one mine/quarry development.
- 6.2 For overhead power lines (timber, concrete, steel pole or steel lattice tower) the maximum airblast peak SPL shall be as advised by Ausgrid in writing for each specific site location.

7 Acceptable Controls for Flyrock

- 7.1 The mine/quarry operator shall take all steps necessary to prevent flyrock from entering any Ausgrid property, or damaging any Ausgrid assets including substation equipment, buildings and associated power lines.
- 7.2 The mine/quarry operator shall model and determine the expected maximum throw for flyrock as part of each blasting plan. The minimum exclusion zones shall be twice the maximum throw for overhead power lines (timber, concrete, steel pole or steel lattice tower), and four times the maximum throw for substation equipment and buildings.
- 7.3 The arrival of flyrock at any site outside the mining/quarry lease area must be reported to the DPI Mining Inspectorate for further action.

8 Damage to Ausgrid Assets

- 8.1 The mine/quarry operator shall be responsible for any loss or damage to Ausgrid's assets resulting from the mine/quarry operator's blasting induced ground vibrations.

This includes all loss arising from the third party claims relating to loss of electricity supply resulting from damage to Ausgrid assets, including from all or any outages that are required to mitigate the risk of damage to those assets.
- 8.2 The cost of any loss or damage to Ausgrid assets that results immediately or cumulatively from mining/quarrying activities in the vicinity of Ausgrid's assets shall be recoverable from the mine/quarry operator.