Substation Design Instruction

Environmental considerations for transmission/zone substations and switching stations

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Substation Design Instruction

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1.0 PURPOSE

To minimise the environmental impact from transmission and zone substations and switching stations that are constructed, operated and maintained within Endeavour Energy’s network.

2.0 SCOPE

This instruction shall be read in conjunction with Substation Design Instruction SDI 505 – Minimum design and construction requirements for transmission and zone substations and switching stations.

This instruction defines the minimum requirements to mitigate the impact of transmission and zone substations and switching stations on the environment.

3.0 REFERENCES

Board Policy (Environment) 4.0 – Environment
Company Policy (Environment) 4.4 – Industrial and construction noise
Company Policy (Network) 9.2.2 – Network Protection
Company Policy (Network) 9.2.5 – Network Asset Design
Company Policy (Network) 9.9.1 – Network Asset Maintenance
Company Policy (Network) 9.2.14 - Network Property Acquisition
Company Procedure (Environment) GPE 0009 – Contaminated land project management
Company Procedure (Environment) GPE 0075 – Storage, handling and transport of oil and oil filled equipment
Company Procedure (Environment) GPE 0069 - Polychlorinated Biphenyl Management
Company Procedure (Health & Safety) GSY 1066 - Worksite Hazard and Risk Assessment
Environmental Management Standard EMS 0001 – Environmental impact assessment and environmental management plans
Environmental Management Standard EMS 0005 – Substation landscaping
Environmental Management Standard EMS 0007 – Waste management
Substation Design Instruction SDI 503 – Transmission and zone substation fire detection, control and suppression
Substation Design Instruction SDI 505 - Minimum design and construction requirements for transmission and zone substations and switching stations
Substation Design Instruction SDI 510 – Buildings
Substation Design Instruction SDI 524 – Fencing and perimeter security at zone and transmission substations, and switching stations.
Substation Design Instruction SDI 528 – Substation signs and equipment labelling
Substation Design Instruction SDI 529 - Light and power
Substation Design Instruction SDI 532 - Plumbing and drainage
Substation Design Instruction SDI 540 - Transformer oil containment
Substation Maintenance Instruction SMI 119 - Transmission and zone substation data asset structure and nameplate details
Endeavour Energy Electrical Safety Rules
Network Management Plan December 2013 Review
Contaminated Land Management Act 1997
Environment Planning and Assessment Act 1979
Environmentally Hazardous Chemicals Act 1985
Work Health and Safety Act 2011 (NSW)
Work Health and Safety Regulation 2011 (NSW)
AS 2791:1996 High voltage switchgear and controlgear - Use and handling of Sulphur Hexafluoride (SF₆) in high voltage switchgear and controlgear and possible adverse health effects
ENVIROMENTAL CONSIDERATIONS FOR TRANSMISSION/ZONE
SUBSTATIONS AND SWITCHING STATIONS

ENA National Electricity Network Safety Code (Doc 01-2008)
EPA - NSW Industrial noise policy 2000
National Environment Protection (Assessment of Site Contamination) Measure 1999
Office of Environment and Heritage (OEH) Guidelines for Consultants Reporting on Contaminated Sites
State Environmental Planning Policy (Infrastructure) 2007
ANZECC:2001 Australian and New Zealand Guidelines for Fresh and Marine Water Quality
Australian Radiation and Nuclear Protection Agency - The controversy over electromagnetic fields

4.0 DEFINITIONS AND ABBREVIATIONS

Bund
An impervious embankment of concrete or other suitable material that may form a part or the entire perimeter of a compound and which provides a barrier to retain liquid.

EIA
Environmental Impact Assessment

EMP
Environmental Management Plan

EPA
Environment Protection Authority of New South Wales - incorporated into the Office of Environment and Heritage.

OEH
Office of Environment and Heritage

PCB
Polychlorinated biphenyl

SF6
Sulphur hexafluoride

5.0 ACTIONS

5.1 General

Endeavour Energy is committed to constructing, operating and maintaining installations in a manner that manages actual or potential environmental impacts.

5.2 Location selection and site procurement

Electrical substation locations shall be selected, where possible, to minimise their impact on the surrounding environment and the community. Selection shall be based upon a due diligence methodology whereby a preliminary environmental impact assessment of the proposed substation location, and at a minimum, a Phase 1 Environmental Site Assessment investigation into potential environmental risks at the site is undertaken in accordance with Office of Environment and Heritage (OEH) guidelines, prior to the purchase of a property.

Where contamination is suspected at the site following the Phase 1 Environmental Site Assessment, a Phase 2 Environmental Site Assessment in accordance with OEH guidelines may be required to determine the extent and severity of the potential contamination before a decision on whether or not to purchase the property can be made.
Land procured for the construction of substations shall meet, as a minimum, the requirements of industrial land use as specified in the National Environmental Protection (Assessment of Site Contamination) Measure 1999.

The substation site shall be free from flooding by remaining above the 1:100 flood levels.

The land titles of proposed sites shall indicate that the site is free from encumbrances that may hinder the development of that site as an electrical substation.

Sites shall be free of Endangered Ecological Communities.

New substation sites wherever possible shall not be located next door to schools or childcare centres.

Substation sites shall be procured in accordance with Company Policy (Network) 9.2.14 - Network Property Acquisition.

Site frontages shall be of sufficient size to allow the ultimate intended capacity to be delivered.

5.3 Development approval

Substation development is permitted without consent under Section 41 of the State Environmental Planning Policy (Infrastructure) 2007.

The impacts to the environment of the substation construction works shall be assessed to determine if it is suitable to proceed under Section 110 Part 5 of the Environmental Planning and Assessment Act 1979.

5.4 Waste management

All waste generated as part of the substation construction works shall be managed in accordance with Environmental Management Standard EMS 0007 – Waste Management. A waste management plan shall be developed as required in accordance with the Notice of Determination. The plan shall consider the management of waste generated through the demolition, construction and operational phases of the substation.

The Project Manager shall obtain waste disposal docket/waste data on a regular basis for all waste disposed of during the substation construction. This information shall be retained and made available for audit purposes.

5.5 Excavated and imported material

Excavated material can be re-used on site if it meets the requirements for industrial land use. Imported material for use as fill on site shall be certified as virgin excavated natural material or excavated natural material and it shall be free of any signs of contamination. If recovered aggregates are used, these shall be free of any contaminants, certified and be sourced from a suitably licensed supplier.

5.6 Environmental Impact Assessment

An Environmental Impact Assessment (EIA) shall be prepared for the construction of new transmission and zone substations and switching stations and for the refurbishment of existing
facilities. It is the responsibility of the Network Environmental Assessment Section within Project Development to undertake this work. The EIA shall be carried out in accordance with all relevant legislation and in accordance with Environmental Management Standard EMS 0001 – Environmental Impact Assessment and Environmental Management Plans.

The EIA shall set out in detail the environmental requirements to be followed during the design, construction and operation of the substation. The report shall also include the approved mitigation measures to be undertaken during these phases to minimise any impact that the development may have on the environment.

Construction impacts shall be identified and where possible, mitigated in accordance with Environmental Management Standard EMS 0001 – Environmental impact assessment and environmental management plans and the specific conditions imposed as part of each Determination/ Environmental Management Plan.

5.6.1 Noise emissions

Noise emissions emanating from Endeavour Energy substations shall be managed in accordance with the NSW Industrial Noise Policy 2000. The policy is specifically aimed at assessing noise from industrial sources scheduled under the Protection of the Environment Operations Act 1997. Endeavour Energy substations are not classified as scheduled premises under this Act, because Endeavour Energy is not required to hold a licence under the Act to operate its substation premises. However, in the absence of other relevant standards, the limits set out in this policy shall be used to determine whether or not the level of noise emanating from a substation premises is considered to be annoying.

Where a noise source, such as the transformers and capacitor banks in a substation contains certain noise characteristics, such as tonality, impulsiveness, intermittency, irregularity or dominant low frequency content, there is evidence to suggest that it can cause greater annoyance than other noise at the same noise level. Acceptable noise levels will vary depending upon the location of the substation site (for example, rural, residential, or industrial).

Accordingly, an environmental noise impact report, prepared by a reputable acoustic consultant, shall be obtained when:

- planning to construct a new substation;
- upgrading substation facilities, for example, constructing/extending control buildings or constructing additional buildings on the site;
- replacing transformers;
- installing additional transformers;
- installing capacitor banks;
- installing any other equipment or doing any other type of work that has the ability to interfere with or permanently change the existing noise environment at the site; and
- receiving complaints regarding the noise emanating from an existing substation site.

Where the noise impact report indicates that the site contravenes the recommendations outlined in the policy, all reasonable measures shall be adopted to incorporate proposals for noise mitigation, as outlined in the noise impact report. Where a non-compliance is identified with existing infrastructure any proposed remediation shall be approved by the Chief Engineer.

The results and recommendations of the environmental noise impact report shall be included in any EIA carried out for any proposed substation/switching station development.
5.6.2 Construction noise

Reasonable measures shall be undertaken to reduce the noise levels\(^1\) during construction and/or maintenance. Where this requirement is unavoidable, due to the nature of the work to be performed, Endeavour Energy will take reasonable measures to notify those likely to be affected by the noise of the expected duration of the activities and the reasons for undertaking the work.

All construction works on site, including out of hours works shall be undertaken in accordance with Company Policy (Environment) 4.4 – Industrial and Construction Noise.

In emergency situations, the provision of notifications may not be possible. In these cases, every effort shall be made to limit noise disturbance from ensuing operations.

5.7 Oil containment

Oil containment shall be in accordance with:
- Substation Design Instruction SDI 540 – Transformer oil containment ; and
- Company Procedure (Environment) GPE 0075 – Storage, handling and transport of oil and oil filled equipment.

5.8 Contaminated land

Contaminated land within substations shall be treated in accordance with the Contaminated Land Management Act 1997 and Company Procedure (Environment) GPE 0009 – Contaminated land project management.

5.9 Hazardous chemicals, dangerous goods and hazardous materials

The use of hazardous chemicals at substations shall be minimised. Known carcinogens shall not be used in new substations. Equipment containing known carcinogens, in existing substations, shall be managed in accordance with current legislation and Endeavour Energy guidelines.

A manifest of chemicals, asbestos and other hazardous materials is required for each site in accordance with Substation Design Instruction SDI 528 – Substation signs and equipment labelling.

Polychlorinated biphenyl (PCB) materials, including oil with PCB, shall be managed in accordance with Company Procedure (Environment) GPE 0069 - Polychlorinated Biphenyl Management and the Environmentally Hazardous Chemicals Act 1985.

5.10 Drainage

Measures shall be taken so that water leaving any of Endeavour Energy’s substations does not contain more than 10ppm of oil or grease, and not more than 30 milligrams of suspended solids in each litre of discharge water\(^2\).

Equipment used to separate oil, grease or other contaminants from water shall be designed for a 24-hour, one in 20-year storm.

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\(^1\) Company Policy 4.4 (Environment) - Industrial and construction noise.

Works shall be undertaken to avoid pollution of surrounding water bodies from the work site. Pollution refers to anything other than clean water entering the stormwater system including water that is pumped out of open trenches.

Discharging soil, cement or other building materials to stormwater is illegal. Stormwater drainage for new sites shall be designed by a qualified hydraulic engineer. Stormwater drainage on all sites shall be in accordance with local council requirements. Drainage design shall be conducted in accordance with Environmental Management Standard EMS 0001- Environmental impact assessment and environmental management plans, and the Protection of the Environment Operations Act 1997.

Any site specific issues shall be addressed in the EIA, the Notice of Determination and the EMP prepared for the project. Refer also to Substation Design Instruction SDI 532 – Plumbing and drainage for further plumbing and drainage details.

5.11 Fire

The NSW fire authorities shall be consulted to determine the fire risk (including bushfire risk) and the mitigation measures to be undertaken at the substation due to its location.

Endeavour Energy shall commission its own bushfire hazard assessment for any proposed substation development in any bushfire prone area. The recommendations contained in this report shall be included in the EIA and the Notice of Determination prepared for the project and incorporated into the substation design as required.

Refer also to Substation Design Instruction SDI 503 – Transmission and zone substation fire detection, control and suppression for fire suppression and segregation details.

5.12 Electric and magnetic fields

The National Health and Medical Research Council’s Guidelines suggest a magnetic field exposure limit for members of the public (24 hour exposure) is 0.1 millitesla (1,000 milligauss), and for occupational exposure (whole working day) is 0.5 millitesla (5,000 milligauss).

The substation design shall not compromise these magnetic field levels. Magnetic field levels at the substation boundary fence shall be verified after commissioning.

5.13 SF6 usage and containment

SF₆ used in electrical equipment is a potent greenhouse gas, therefore its use shall be considered only after other suitably proven and less environmentally harmful insulating or arc quenching media have been found to be unsuitable.

SF₆ equipment used in any substation shall have a leak rate of less than or equal to 0.1% a year. In selecting SF₆ equipment to be used, designs with the lowest mass of SF₆ shall be given preference.

Generally, SF₆ equipment shall be capable of being subjected to a vacuum of 1-millibar. This requirement will enable the extraction of SF₆ from equipment during maintenance. The Network

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3 Currently recommended by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
4 AS 2791-1996 High voltage switchgear and controlgear – Use and handling of Sulphur Hexafluoride (SF6) in high voltage switchgear and controlgear.
5 Information from product manuals.
Substations Manager shall be consulted for approval of equipment that does not meet this requirement.

5.14 Preventing graffiti

Anti-graffiti measures shall be undertaken to reduce the effect of vandalism. Where any of these measures are undertaken, their effects on the environment shall be assessed.

5.15 Aesthetics

When the design of the substation is being prepared, it shall take into consideration the environment into which it will be placed. The aesthetics of the substation shall be considered by the use of:

- colour;
- grey coloured bushings;
- screening with trees and bushes to hide protrusions - balanced with security needs (refer to Environmental Management Standard EMS 0005 – Substation Landscaping); and
- construction methods that consider the potential aesthetic impact of the site.

Refer also to:

- Company Policy (Network) 9.2.5 – Network Asset Design;
- Substation Design Instruction SDI 510 – Buildings;
- Substation Design Instruction SDI 524 – Fencing and perimeter security at zone and transmission substations, and switching stations; and
- Substation Design Instruction SDI 529 – Light and power.

6.0 AUTHORITIES AND RESPONSIBILITIES

Chief Engineer has the authority and responsibility for approving this instruction.

Manager Primary Systems has the authority and responsibility for making recommendations to the Chief Engineer in respect to this instruction.

Network Substations Manager has the authority and responsibility for keeping the content of this instruction up to date.

Endeavour Energy employees and/or contractors are responsible for:

- meeting the requirements of this instruction and Substation Design Instruction SDI 505 - Minimum design and construction requirements for transmission and zone substations and switching stations;
- working in accordance with local and statutory requirements; and
- working in accordance with Endeavour Energy’s Electrical Safety Rules and systems when conducting works associated with this instruction.

Project managers have the authority and responsibility for:

- meeting the requirements of this instruction within their area of responsibility;
- overseeing that Endeavour Energy employees and/or contractors engaged to perform the work have appropriate qualifications;
overseeing that data is entered into Ellipse in accordance with SMI 119 and associated drawings are entered in the company document management system; and

obtaining waste disposal dockets/waste data on a regular basis for all waste disposed of during the substation construction.

Manager Project Development is responsible for:

- complying with all appropriate environmental legislation;

- undertaking the appropriate level of environmental impact assessment to align with the type of development proposal;

- checking that the formal Environmental Impact Assessment document is prepared, risks identified have been adequately addressed, and the EIA is included in the overall design/work package;

- checking that the consent conditions contained in the Notice of Determination and/or Environmental Management Plan prepared for the project is appropriate and reasonable; and

- checking that any Notice of Determination for the development is formally approved and distributed to the project management staff responsible for overseeing the project.

Manager Property and Fleet has the authority and responsibility for complying with the land acquisition requirements of this document.

7.0 DOCUMENT CONTROL

Documentation Content Coordinator: Network Substations Manager

Documentation Distribution Coordinator: Branch Process Coordinator