Design Guidelines and Model Requirements

Renewable Energy Facilities

OUR COMMUNITY • OUR CFA

Version 3, March 2022

CFA Specialist Risk and Fire Safety Unit

Foreword

Victoria is seeing a transition from traditional energy generation to one that balances the old with new renewable alternatives. Although the focus has been on the domestic generation of solar energy using photoelectric voltaic panels often supplemented with a battery energy storage system, the role commercial generation of energy plays cannot be underestimated.

Large commercial and industrial projects are being planned and built across the country. They range in size from small installations to supplement an individual company's needs, to projects capable of supplying power to hundreds of thousands of Victorian homes each year. These projects include one of the largest operating battery energy storage facilities in Australia to date, located in Moorabool, and other large facilities planned for the Mornington Peninsula and Stawell, helping the state meet its renewable energy target of 50% by 2030.

New and emerging renewable energy technology has outpaced the development of standards and guidance in relation to fire and emergency management. To bridge this gap, CFA has worked with stakeholders nationally and globally to develop guidelines that can be used when designing a new facility or modifying or operating an existing one. These guidelines advocate a holistic approach to fire and emergency risk management.

As there is a distinct possibility that renewable energy facilities become critical electricity infrastructure, a higher expectation is placed on CFA to facilitate fast and effective suppression should any incident occur. Ensuring that designers, owners and operators consider these guidelines is critical to supporting CFA's mission to protect life and property.

It's important that all those with responsibilities in designing, constructing, and operating these facilities – large or small – are fully aware of, and understand, their responsibilities and obligations to ensure fire safety within their premises.

Fire safety not only makes good sense from a community safety point of view, it's also a good risk management business decision. CFA invites key stakeholders to consider these guidelines and work together to maintain and improve a satisfactory level of fire safety.

Jason Heffernan
CFA Chief Officer

1 Purpose

This guideline provides standard considerations and measures in relation to fire safety, risk and emergency management to be considered when designing, constructing and operating new renewable energy facilities, and upgrading existing facilities.

Facilities that support the generation of electricity in Victoria include wind energy facilities, solar energy facilities and battery energy storage systems. These facilities are the focus of this guideline.

The principles and model requirements within this guideline may be applied to emerging renewable technologies such as geothermal and biomass, where applicable.

These guidelines are designed to:

- Reduce the occurrence and consequences of fire at renewable energy facilities through risk-based design, and enable safe and effective emergency response through the provision of fire protection systems.
- Inform fire and risk management processes for all phases of a facility's lifespan, through the preparation of Risk Management Plans and Fire Management Plans by facility operators.
- Support operators to prepare Emergency Management Plans that effectively consider bushfire.
- Support the preparation of planning applications and their assessment by authorities.

1.1 How to use these guidelines

The guidelines are arranged according to facility development stages - planning and design, construction and commissioning, and operation. Where there are **additional** requirements specific to a facility type - that is, the technology proposed - they are represented under the following banners.

All Facilities

Wind Energy Facilities

Solar Energy Facilities

Battery Energy Storage Systems

1.2 Principles

While these guidelines have been developed based on the latest information available, it has not been possible to capture every possible renewable energy facility configuration or battery chemistry due to the rapid evolution of the technology. These guidelines are designed so that where the guidelines do not address a specific arrangement or technology, the principles can still be applied.

1. *Effective identification and management of hazards and risks specific to the siting, infrastructure, layout, and operations at the facility.*
2. *Siting of renewable energy infrastructure so as to eliminate or reduce hazards to emergency responders.*
3. *Safe access for emergency responders in and around the facility, including to renewable energy and firefighting infrastructure.*
4. *Provision of adequate water supply and fire-fighting infrastructure to allow safe and effective emergency response.*
5. *Vegetation sited and managed so as to avoid increased bushfire and grassfire risk.*
6. *Prevention of fire ignition on-site.*
7. *Prevention of fire spread between site infrastructure (solar panel banks, wind turbines, battery containers/enclosures).*
8. *Prevention of external fire impacting and igniting site infrastructure.*
9. *Provision of accurate and current information for emergency responders during emergencies.*
10. *Effective emergency planning and management, specific to the site, infrastructure and operations.*
11. *Effective bushfire emergency planning and response, that prioritises absence of personnel on days of Severe and above Fire Danger Rating.*

Please Note:
This guideline, *CFA's Design Guidelines and Model Requirements for Renewable Energy Facilities v3 (March 2022),* supersedes the following CFA guidance:

- *CFA Guidelines for Renewable Energy Installations, v2, March 2021*
- *CFA Guidelines for Renewable Energy Installations, v1, February 2019*
- *CFA Emergency Management Guidelines for Wind Energy Facilities, May 2015*

1.3 Key Terms

Based on information and definitions from:

- *Australian Renewable Energy Agency* (ARENA)
- *AS 5139-2019: Electrical installations - Safety of battery systems for use with power conversion equipment*.
- *FM Global 2020, Property Loss Prevention Data Sheet 5-33: Electrical Energy Storage Systems*.

Battery (Cell)
Unit consisting of one or more energy storage cells connected in series, parallel or series parallel arrangement.

Battery Energy Storage System
A system comprising one or more cells, modules or batteries, power conversion equipment (PCE) and isolation and protection devices. Battery energy storage systems convert energy into electrical energy and stores the energy internally. For the purposes of this guideline:

- Large-scale battery systems: > 1 MW
- Small-scale battery systems: ≤1 MW

Battery Module
One or more batteries linked together. May also have incorporated electronics for monitoring, charge management and/or protection. Are generally stored in racks within battery energy storage system containers/enclosures.

Battery Energy Storage System Container/Enclosure
Dedicated enclosure, often but not always resembling a shipping container, containing the battery system and associated battery system components.

Power Conversion Equipment (PCE)
Electrical device converting and/or manipulating one kind of electrical power from a voltage or current source into another kind of electrical power with respect to voltage, current and/or frequency.

Solar Energy Facility
A facility where solar panels convert sunlight into direct current (DC) electricity; then power conversion equipment (inverters) convert the power into alternating current (AC). The facility may include grid connection infrastructure to feed power into the electricity grid. Solar energy facilities may utilise either solar photovoltaic or solar thermal technologies.

- Large-scale solar: >5MW
- Micro solar: ≤5MW

Renewable Energy
Renewable energy is produced using natural resources that are constantly replaced and never run out. Common technologies include solar, wind and hydropower. Emerging technologies include geothermal, bioenergy and ocean energy.

Renewable Energy Facility
A site or installation dedicated to the generation and/or capture of renewable energy. Stand-alone battery energy storage systems are considered renewable energy facilities for the purposes of this guideline.

Solar Panel Bank (Pod or Zone)
A 'bank' of solar panels may be that connected to a single power conversion unit/inverter.

Wind Energy Facility
A facility where wind turbines use the energy of the wind to spin an electric generator which produces electricity, then power conversion equipment (inverters) convert the power into alternating current (AC). The facility may include grid connection infrastructure to feed power into the electricity grid.

Refer to FM Global 2020, Property Loss Prevention Data Sheet 5-33: Electrical Energy Storage Systems for pictographs of battery energy storage system components.

Further Guidance Material

These guidelines have been developed in support of the following material prepared by the Victorian government.

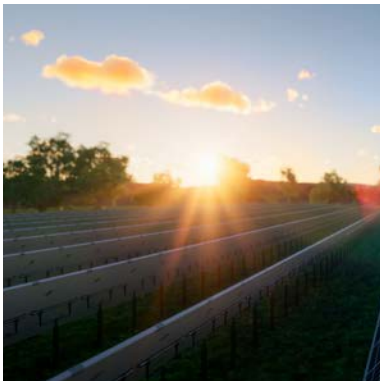
Solar Energy Facilities Design and Development Guidelines
Outlines the assessment and development process for large-scale solar energy facilities in Victoria.

Development of Wind Energy Facilities in Victoria, **Policy and Planning Guidelines**
Provides a framework, requirements and guidance on preparing planning applications for wind energy facilities.

Community Engagement and Benefit Sharing in Renewable Energy Developments
A guide for renewable energy developers.

This guideline must be read in conjunction with the above information.

Content Guide



2 CFA's Role and Legislation

2.1 Why is CFA involved in reviewing renewable energy proposals?

CFA plays a key role in fire prevention, preparedness and emergency response in the country area of Victoria. The *Country Fire Authority Act 1958 (CFA Act)* gives CFA statutory responsibilities associated with these functions.

2.2 Should CFA be consulted as part of the planning and development process?

Yes, CFA encourages consultation throughout the lifecycle of a renewable energy facility, from planning through to its construction and operation.

CFA's involvement may be needed throughout different stages of the development and approvals process, including planning. These guidelines have been developed to work across multiple platforms to help inform various application, construction and operational requirements.

This guideline provides the principles, considerations and model requirements for renewable energy facilities relating to:

- Consulting with CFA
- Planning Applications
- Fire Risk Management
- Facility Location and Design
- Facility Construction and Commissioning
- Facility Operations
- Fire Management Planning
- Emergency Management Planning

2.3 Is CFA a referral authority under the planning system?

A planning permit application for a renewable energy facility does not require referral to CFA under Section 55 of the *Planning and Environment Act 1987 (PE Act)*. However, applications may be sent to CFA for comment or notification as part of the application process.

See **Section 4** for more information on CFA's expectations for planning applications.

2.4 Other legislation

Designers and operators of renewable energy facilities are subject to various legislative frameworks and instruments including:

- *Planning and Environment Act 1987 and Planning and Environment Regulations 2015*
- *Victoria Planning Provisions*
- *Building Act 1993 and Building Regulations 2018*
- *Electricity Safety Act 1998 and Electricity Safety (Bushfire Mitigation) Regulations 2013*
- *Occupational Health and Safety Act 2004 (OHS Act) and Occupational Health and Safety Regulations 2017*
- *Dangerous Goods Act 1985 and Dangerous Goods (Storage and Handling) Regulations 2012*

2.4.1 Australian and New Zealand Standards

- *AS 1940-2017: The storage and handling of flammable and combustible liquids*
- *AS 3745-2010: Planning for emergencies in facilities*
- *AS 3780-2008: The storage and handling of corrosive substances*
- *AS 3959-2018: Construction of buildings in bushfire-prone areas*
- *AS/NZS 4681-2000: The storage and handling of class 9 dangerous goods*
- *AS/NZS 5139-2019: Electrical installations - Safety of battery systems for use with power conversion equipment*
- *AS/ISO 31000-2018: Risk management guidelines*

2.4.2 International Standards and Guidance

- *FM Global Electrical Energy Storage System Data Sheet 5-33 (2020)*
- *UL 9540: Energy Storage Systems and Equipment (2020)*
- *UL 9540A: Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (2019)*
- *NFPA 855, Standard for the Installation of Energy Storage Systems (2020)*

3 Consulting with CFA

Early consultation, prior to the development of the planning permit application, ensures that CFA can effectively consider emergency response implications.

3.1 When should consultation occur?

The design team should consult with CFA's Community Infrastructure department early in the planning and facility design phase, well before the development of planning applications.

Requests for consultation with CFA can be provided to firesafetyreferrals@cfa.vic.gov.au.

3.2 What information does CFA need for initial consultation?

In preparation for a consultation meeting with CFA, the following information should be provided in advance to enable CFA to undertake a preliminary assessment and provide relevant advice:

- The site address/land parcel information.
- Locality plan, showing the facility within the landscape.
- Details of the facility, its type and size (eg., the area, perimeter, number of solar panels/arrays, wind turbines, battery containers, power conversion equipment/units).
- A Risk Management Plan for the facility developed in accordance with **Section 5** .
- A Fire Management Plan developed in accordance with **Section 9**.
- Site plans, showing the proposed location of site vehicle access points, internal roads, solar arrays/wind turbines/battery containers, substations, buildings, fire water supplies, vegetation.
- Specifications/technical data sheets on battery energy storage systems (where applicable).
- A current VicPlan Property Planning Report.

Documentation submitted to CFA for review is to clearly outline how the proposed facility meets the requirements of this guideline, and where it does not, it is to effectively demonstrate how risk is managed to ensure the safety of emergency responders.

Any advice sought from CFA will consider the specific technologies, infrastructure, landscape hazards and operations of your facility.

3.3 Other emergency services consultation

3.3.1 Building Fire Safety

All buildings on site are required to comply with the National Construction Code (NCC). Where fire safety matters listed under Regulation 129 in the *Building Regulations 2018* do not meet the deemed to satisfy provisions of the NCC, the report and consent of the fire authority Chief Officer is required.

3.3.2 Dangerous Goods Storage and Handling

Where the facility includes a battery energy storage system or other significant quantities of dangerous goods, a request for emergency services written advice under Regulations 54 and/or 55 of the *Dangerous Goods (Storage and Handling) Regulations 2012* may be required.

The quantity of dangerous goods must be determined for the purposes of requesting emergency services written advice. For lithium-ion based battery energy storage systems, the net weight of the lithium-ion battery cells (rather than the gross weight of the battery enclosure/container) must be provided. For example, if a battery enclosure/container is 12t, the battery cells may only be 3t (25% of the gross container weight).

See **Section 8.3** for more information on CFA's expectations for dangerous goods storage and handling.

3.4 Other statutory requirements

Sections 113A and 83BA of the *Electricity Safety Act 1998* require major electricity companies and specified operators of at-risk electric lines to prepare and submit a Bushfire Mitigation Plan to Energy Safe Victoria for acceptance.

Sections 6 and 7 of the *Electricity Safety (Bushfire Mitigation) Regulations 2013* contain the requirements for Bushfire Mitigation Plans.

4 Planning Applications

Planning applications must address all relevant aspects of fire safety, including landscape and bushfire hazards, and hazards to and from the proposed technologies.

4.1 Developing planning applications

To enable CFA to provide relevant and timely comments on a proposal, the appropriate level of information must be provided within the planning application. The level of information will vary depending on the type of facility, proposed technology, scale, location and complexity of the proposal.

The planning application must be prepared with consideration to the design advice and model requirements provided in this guideline, as far as practical at the planning stage.

Where advice in this guideline may be adapted by CFA to be a recommended condition for a planning permit, it has been highlighted as a Model Requirement:

Model Requirement (Example Only)
The development of a Fire Management Plan, in conjunction with CFA, before development starts.

Any modifications to the model requirements must be in consultation with CFA prior to submitting the planning permit application.

Further Guidance Material

The following publications offer support in developing a bushfire hazard assessment.

Victoria Planning Provisions, Clause 13.02 (Bushfire Planning) (2022)

DELWP Planning Permit Applications Bushfire Management Overlay - Technical Guide (2017)

DELWP Bushfire Hazard (2022)

CSIRO Assessing Bushfire Hazards (2022)

4.2 CFA's expectations for planning applications

In addition to the information listed in **Section 3.2** of this guideline, CFA expects that planning applications:

- Address bushfire risk according to the *Victoria Planning Provisions, Clause 13.02-1S (Bushfire Planning)*, through bushfire hazard identification and assessment (including a bushfire hazard site and landscape assessment) .
- Address risks to the proposed technologies from the landscape (bushfire/grassfire).
- Address risks from proposed technologies. For battery energy storage systems, CFA recommends that a Fire Safety Study is conducted in accordance with NSW Planning's Hazardous Industry Planning Advisory Paper 2: Fire Safety Study Guidelines (2011).
- Clearly indicate where exact specifications of elements within the renewable energy facility will be determined during the detailed design phase, such as solar panel and wind turbine model/manufacturer, battery chemistry.
- Explicitly state that the following documentation will be prepared in accordance with this guideline, in conjunction with CFA, before development starts:
  - Risk Management Plan (where applicable)
  - Fire Management Plan
  - Emergency Management Plan

While renewable energy facilities are not referenced under the use and development policy contained within Clause 13.02-1S Bushfire Planning, other policies in the control still apply. CFA's expectation is that the risk of bushfire to people, property and community infrastructure is considered, and that appropriate bushfire protection measures to address the identified bushfire risk are proposed within the planning application.

4.3 CFA's response to planning applications

CFA will review the planning application and supporting information, develop conditions, and recommend the conditions to the responsible authority. Where CFA determines that the requirements in this guideline have not been satisfactorily addressed, CFA will recommend conditions to the relevant authority specific to those matters.

5 Fire Risk Management

Fire risk must be identified and measures to eliminate or reduce its occurrence and consequences must be incorporated into facility design and operations.

5.1 Why should fire risk be managed at my facility?

Identifying and managing fire risk at renewable energy facilities protects site personnel, firefighters and the community. Designers have a duty under occupational health and safety legislation to ensure that buildings and structures are safe and without risks to health.

"A person who designs a building or structure or part of a building or structure who knows, or ought reasonably to know, that the building or structure or the part of the building or structure is to be used as a workplace must ensure, so far as is reasonably practicable, that it is designed to be safe and without risks to the health of persons using it as a workplace for a purpose for which it was designed."

s28 OHS Act

A risk management process that meets occupational health and safety requirements for eliminating or reducing risk so far as is reasonably practicable provides the foundation for effective fire management and emergency management planning.

5.2 How can fire risk be managed?

CFA's expectation is that a comprehensive risk management process is undertaken to identify the hazards and risks specific to the facility and develop, implement, maintain and review risk controls. The following two documents are outputs of this process.

A **Risk Management Plan** describes the risk management process and its outcomes, including the specific site hazards/risks and their analysis, control measures, and the monitoring and review process. The Risk Management Plan must inform the design of the facility.

A **Fire Management Plan** is based on the outcomes of the Risk Management Plan and outlines the activities, processes and accountabilities for the ongoing management of fire risk at the facility. See **Section 10** for more information on developing a Fire Management Plan.

Risk Management

CFA recommends the adoption of a risk management process, in line with AS/ISO 31000-2018: Risk Management Guidelines, to identify and address fire risk at renewable energy facilities.

Risk management involves:

Risk identification to understand the potential sources of fire including on-site hazards (eg. electrical faults, operational faults, chemical releases, operational practices/processes, animal management); off-site hazards (eg. bushfire, grassfire, storm, lightning, flood), and any other operational, financial or strategic risks that could affect the ability of the organisation or operation to meet its objectives.

Risk analysis and risk evaluation involves identifying the nature of risk and its characteristics and identifying evidence-based controls for risks based on the hierarchy of controls, and industry good practice. Analysis includes investigation and evaluation of controls, based on assessment of their effectiveness and the practicality of their implementation.

Risk treatment involves the selection and implementation of controls for each identified risk.

Monitoring and review, recording and reporting involves regular and comprehensive review of risks and controls through monitoring of site hazards, risks, systems and processes to ensure that emerging risks are identified; existing risks are effectively controlled; and controls are appropriate and effective.

The risk management process should be:

- Comprehensive and consultative, involving those involved in the design, construction, operation and management of the facility (including employees and contractors).
- Include analysis of infrastructure, activities and operations at the facility, and take into consideration lessons from previous fires and other emergencies at similar facilities in Australia and globally.
- Project- and organisation-wide, supported by organisational management at all levels, documented, underpinned by organisational policy, and integrated into organisational decision-making.

5.3 Developing a Risk Management Plan

All Facilities

A Risk Management Plan provides the framework for the planning, design, construction and operation of renewable energy facilities. A Risk Management Plan may be structured to follow the framework outlined in *AS/ISO 31000-2018: Risk Management Guidelines*.

The Risk Management Plan must inform the design of the facility.

CFA recommends the development of a Risk Management Plan for all renewable energy facilities to facilitate greater on-site fire safety through design to operation. A Risk Management Plan also supports CFA to understand and provide advice in relation to potential emergency response implications including:

- The hazards and risks at and to the facility and their proposed management.
- Any safety issues for firefighters responding to emergencies at the facility.
- Safe access to and within the facility for emergency vehicles and responders, including to key site infrastructure and fire protection systems.
- The adequacy of proposed fire detection and suppression systems (eg., water supply) on-site.
- Natural and built infrastructure and on-site processes that may impact or delay effective emergency response.

5.3.1 Factors Influencing Facility Design

The following factors must be considered in the risk-based design of renewable energy facilities.

- **Location and siting within the landscape.** Is the site in a designated Bushfire Prone Area or within the Bushfire Management Overlay? Is there a risk of grassfire from neighbouring properties? Is there peat on the property? Is the site located near hazardous industry?
- **Layout.** Does the proposed layout of the site impact fire risk? Is fire service infrastructure safely accessible? Are there hazards or infrastructure that may impact safe evacuation?
- **Fuel load and vegetation on-site.** Does the prevalence, type, density or location of vegetation (including screening vegetation) impact fire risk?
- **Infrastructure - electrical, chemical, technological.** Does the infrastructure on site contribute to fire risk, or potentially impede firefighting operations? Are dangerous goods stored on site?
- **Site activities and operations.** What activities undertaken on-site contribute to fire risk? How is electricity infrastructure de-energised and isolated? How often is critical maintenance undertaken?
- **Site occupancy.** Will the facility be occupied or unoccupied? Will there be vulnerable occupants?
- **Local weather conditions.** What is the prevailing wind speed and direction? Rainfall during the year? Humidity and temperature during the Fire Danger Period?

5.3.2 Hazards Specific to Facility Type

Determining the fire hazards at your facility can be achieved with various tools and techniques, some of which are detailed in *SA/SNZ HB 89-2013 Risk management - Guidelines on risk assessment*.

Hazards will be specific to each facility due to the unique location, infrastructure and operations. However, there are common hazards to each type of facility that must be considered due to their potential to ignite, spread or intensify fire.

Please note: *The below is not an exhaustive list; hazards must be identified through the risk management process.*

Wind Energy Facilities

Fire hazards at wind energy facilities may include:

- Electrical hazards, such as wind turbine electrical faults; power surges; hot surfaces; lightning strike.
- Chemical hazards, such as the leakage of oils and lubricants within the turbine/ancillary equipment.
- Potential fire spread, due to air flow impact or falling debris from fire-impacted turbines.
- Landscape hazards, such as bushfire/grassfire ignition from fire within the facility, or external ignition of site infrastructure from embers or radiant heat.
- Falling blades.
- Wind turbines as a potential obstruction for aerial firefighting. See **Section 6** for guidance on mitigating this hazard.

Solar Energy Facilities

Fire hazards at solar energy facilities include:

- Electrical hazards, such as panel/inverter electrical faults; power surges; lightning strikes; water ingress; retained DC electricity in solar panels after shut-down/isolation.
- Potential fire spread and limited emergency response due to proximity of panel banks to each other, on-site infrastructure and vegetation (including screening vegetation).
- Landscape hazards, such as bushfire/grassfire ignition from fire within the facility, or external ignition of site infrastructure from embers or radiant heat.

Battery Energy Storage Systems

Fire hazards at facilities with battery energy storage systems include:

- Electrical hazards, such as battery faults; overcharging; rapid discharge; loss of remote monitoring systems; internal short circuits; overheating; water ingress; lightning strike (leading to thermal events/runaway).
- Chemical hazards, such as the inherent hazards of the stored dangerous goods; spills and leaks of transformer oil/diesel spills/leaks, refrigerant gas/coolant; chemical reactions from ignition.
- Potential fire spread due to proximity of batteries (and containers/enclosures) to each other, on-site infrastructure and vegetation (including screening vegetation).
- Mechanical damage to battery containers/enclosures due to vehicular impact.
- Landscape hazards, such as bushfire/grassfire ignition from fire within the facility, or external ignition of site infrastructure from embers, radiant heat and flame contact.

In addition to the Risk Management Plan, CFA recommends that a Fire Safety Study is conducted in relation to the risks and hazards at battery energy storage systems in accordance with NSW Planning's Hazardous Industry Planning Advisory Paper 2: Fire Safety Study Guidelines (2011).

Where the consequences of electrical and chemical hazards pose additional risks to firefighters, these must also be addressed in the Risk Management Plan. Consequences may include off-gassing and toxic smoke. The management of fire water runoff must also addressed.

Model Requirements

A Risk Management Plan must be developed for facilities with battery energy storage systems, in conjunction with CFA, before development starts.

The Risk Management Plan must:

a) Describe the risks and hazards at the facility to and from the battery energy storage system and related infrastructure.

b) Specify and justify, in accordance with **Section 6.2** of this guideline:

- The **location** of the battery energy storage system on-site and in the landscape.
- **Emergency vehicle access** to and within the facility that:
  - Includes site access points of a number suitable to the size and hazard of the facility (a minimum of two).
  - Provides access to battery energy storage systems, substations and fire service infrastructure.
- **Firefighting water supply** for the facility.
- A **fire break width** of 10m or greater, based on radiant heat flux (output) as an ignition source:
  - Around the perimeter of the facility.
  - Between any landscape buffer/vegetation screening and battery energy storage systems (and related infrastructure).
- The **separation distance**, based on radiant heat flux (output) as an ignition source, between:
  - Adjacent battery containers/enclosures.
  - Battery containers/enclosures and related battery infrastructure, buildings/structures, and vegetation.
- All other controls for the management of on- and off-site hazards and risks at the facility (including all proposed battery energy storage system safety and protective systems).

c) Provide an evidence-based determination of the effectiveness of the risk controls against the identified hazards, including justification for the omission of any battery safety and protective system/s.

d) Be peer-reviewed by a suitably qualified, independent third party.

e) Form the basis for the design of the facility.

Modifications to Model Requirements must be in consultation with CFA.

6 Facility Location and Design

6.1 Facility Location

Renewable energy facilities must be located in low-risk environments wherever possible, to eliminate or reduce the risk of external fire impacting the facility and its consequences.

Choosing the right location for a renewable energy facility requires careful consideration of a number of factors, including wider environmental conditions and other potential sources of fire hazard in the surrounding area.

Directing the development of renewable energy facilities to low-risk areas helps minimise the risk and consequence of fires that start outside of the site. It also helps limit the impacts of fires that may start within the facility on the environment and the wider community.

6.1.1 High-Risk Environments

Renewable energy facilities in high-risk environments present increased safety risks that may impact effective firefighting operations.

Where renewable energy facilities are located within high-risk environments, strengthened or additional risk mitigation measures will be required. High-risk environments include:

- The Bushfire Management Overlay.
- Bushfire Prone Areas.
- Areas with peat.
- Timber plantations.

As landscape risk increases there must be a corresponding increase in the bushfire mitigation. For example, where there is forest vegetation in the landscape, timber plantations, long fire runs, or areas of higher fuel load, a tailored set of requirements is likely to apply.

Consultation with CFA in relation to fire risk management for renewable energy facilities located in high-risk environments must occur at the facility planning and design stage.

Bushfire Prone Areas and the Bushfire Management Overlay

Properties identified as within a Bushfire Prone Area (BPA) or the Bushfire Management Overlay (BMO) are those likely to be subject to bushfire.

Whether a facility sits within these areas can be determined through the Victorian Government's Department of Environment, Land, Water and Planning VicPlan Portal.

Understanding the level of risk and likely fire behaviour at the site are critical factors in determining whether the location of a proposed facility is appropriate.

All planning applications within a BPA must consider and address policy at *Clause 13.02-1S (Bushfire Planning)*.

The requirements of the BMO can be used to guide prepare a bushfire response and application material, even when no permit is triggered under the control.

Model Requirements

Planning applications for all renewable energy facilities proposed in high-risk environments must address the following, in addition to providing an assessment against policy at *Clause 13.02-1S (Bushfire Planning)*:

a) The impact of any ignitions arising from the infrastructure (solar panels, wind turbines, battery energy storage systems, electrical infrastructure) on nearby communities, infrastructure and assets.

b) The impact of bushfire on the infrastructure (eg. ember attack, radiant heat impact, flame contact).

c) Assessment of whether the proposal will lead to an increase in risk to adjacent land and how the proposal will reduce risks at the site to an acceptable level.

Modifications to Model Requirements must be in consultation with CFA.

Peat

Peat is generated gradually in wetlands through the build-up of partially decayed vegetation. Peat is vegetation with a high carbon content that has decomposed and become a section of the soil profile. Peat sources can be found above ground or buried many metres below the soil surface. Wetlands close to each other may be interconnected by subsurface peat deposits.

Once ignited by the presence of a heat source (eg. a bushfire penetrating the subsurface), it smoulders. These smouldering fires can burn undetected for very long periods of time (months, years, and even centuries) propagating in a creeping fashion through the underground peat layer.

Peat may experience a fire at any stage of its life and the suppression methods employed to achieve success will vary. Peat fires are extremely difficult to extinguish, and fire authorities require large amounts of water to suppress fires within peat.

Developers of renewable energy facilities must undertake an assessment to ascertain the presence of peat within subject lands.

Where peat is found:

a) All reasonable steps must be taken to ensure that facility infrastructure is not located in peat areas on-site.

b) An exclusion zone of at least 10 (ten) metres, or greater as determined through a risk management process, must be provided between peat areas and facility infrastructure.

c) A Risk Management Plan must inform the provision and capacity of fire protection systems and equipment at facilities with peat areas.

Low-Risk Location Attributes

Indicators of a lower risk bushfire landscape where development should be directed, include:

- Grassland.
- No continuous other vegetation types within 1-20km of the project site.
- Generally flat topography, some undulation may be present.
- Slopes are less than 5 degrees.
- Good road access with multiple routes available to and from the project site.
- No BMO applies.

Wind Energy Facilities

Where practicable, wind energy facilities can be located on open grassed areas, such as grazed paddocks. Vegetation throughout the facility must be managed in line with planning permit conditions and **Section 8.1** of this guideline.

Where wind energy facilities are located within high-risk environments (including timber plantations), strengthened or additional fire risk mitigations will be required.

Solar Energy Facilities

Where practicable, solar energy facilities can be sited on grazed paddocks. In this case, vegetation must be managed in line with planning permit conditions and **Section 8.1** of this guideline.

Battery Energy Storage Systems

Wherever possible, battery energy storage systems must be sited in low-risk environments. The Risk Management Plan must inform the siting for battery energy storage systems.

6.2 Facility Design

Renewable energy facilities must be designed to eliminate or reduce the risk of fire occurring at, or entering, the facility and its consequences.

6.2.1 Emergency Vehicle Access

All Facilities

Providing adequate vehicle access to and within facilities assists CFA in responding to and managing fires.

The following requirements represent CFA's minimum expectations for emergency vehicle access at renewable energy facilities.

Model Requirements

a) Construction of a four (4) metre perimeter road within the perimeter fire break.

b) Roads must be of all-weather construction and capable of accommodating a vehicle of fifteen (15) tonnes.

c) Constructed roads should be a minimum of four (4) metres in trafficable width with a four (4) metre vertical clearance for the width of the formed road surface.

d) The average grade should be no more than 1 in 7 (14.4% or 8.1°) with a maximum of no more than 1 in 5 (20% or 11.3°) for no more than fifty (50) metres.

e) Dips in the road should have no more than a 1 in 8 (12.5% or 7.1°) entry and exit angle.

f) Roads must incorporate passing bays at least every 600 metres, which must be at least twenty (20) metres long and have a minimum trafficable width of six (6) metres. Where roads are less than 600 metres long, at least one passing bay must be incorporated.

g) Road networks must enable responding emergency services to access all areas of the facility, including fire service infrastructure, buildings, and battery energy storage systems and related infrastructure.

h) The provision of at least two (2) but preferably more access points to the facility, to ensure safe and efficient access to and egress from areas that may be impacted or involved in fire. The number of access points must be informed through a risk management process.

Modifications to Model Requirements must be in consultation with CFA.

Wind Energy Facilities

Construction of a four (4) metre perimeter road is not required for wind energy facilities (6.2.1(a)). However, suitable emergency vehicle access is required to each turbine and building on-site.

Model Requirement

Constructed roads developed during the construction phase of facilities must be maintained post-commissioning and throughout the operational life of the facility, to allow access to each turbine for maintenance and emergency management purposes.

Modifications to Model Requirements must be in consultation with CFA.

Solar Energy Facilities

Micro Solar Facilities (up to and including 5MW)

Construction of a four-metre perimeter road (6.2.1(a)) and the incorporation of passing bays to perimeter roads (6.2.1(f)) may be disregarded for micro solar facilities without battery energy storage systems.

6.2.2 Firefighting Water Supply

All Facilities

In the event of a fire (structure fire, grassfire or bushfire), sufficient water must be available and safely accessible to emergency responders and trucks to ensure that fire suppression activities are safe, timely, effective and not hindered in any way.

Firefighting water supply and infrastructure must be designed to allow effective response to the risks and hazards at the facility. The quantity of water supply must be established through a comprehensive risk management process that considers all relevant hazards.

Model Requirements

a) Water access points must be clearly identifiable and unobstructed to ensure efficient access.

b) Static water storage tank installations must comply with *AS 2419.1-2005: Fire hydrant installations – System design, installation and commissioning.*

c) The static water storage tank(s) must be an above-ground water tank constructed of concrete or steel.

(Continued overleaf.)

Model Requirements (Continued)

d) The static water storage tank(s) must be capable of being completely refilled automatically or manually within 24 hours.

e) The static water storage tanks must be located at vehicle access points to the facility and must be positioned at least ten (10) metres from any infrastructure (solar panels, wind turbines, battery energy storage systems, etc.).

f) The hard-suction point must be provided, with a 150mm full bore isolation valve **(Figure 1)** equipped with a Storz connection, sized to comply with the required suction hydraulic performance.

Adapters that may be required to match the connection are: 125mm, 100mm, 90mm, 75mm, 65mm Storz tree adapters **(Figure 2)** with a matching blank end cap to be provided.

g) The hard-suction point must be positioned within four (4) metres to a hardstand area and provide a clear access for emergency services personnel.

h) An all-weather road access and hardstand must be provided to the hard-suction point. The hardstand must be maintained to a minimum of 15 tonne GVM, eight (8) metres long and six (6) metres wide or to the satisfaction of the CFA.

i) The road access and hardstand must be kept clear at all times.

j) The hard-suction point must be protected from mechanical damage (eg. bollards) where necessary.

k) Where the access road has one entrance, a ten (10) metre radius turning circle must be provided at the tank.

Figure 1: *150mm full-bore isolation valve.*

l) An external water level indicator must be provided to the tank and be visible from the hardstand area.

m) Signage **(Figure 3)** indicating 'FIRE WATER' and the tank capacity must be fixed to each tank.

n) Signage **(Figure 4)** must be provided at the front entrance to the facility, indicating the direction to the static water tank.

Modifications to Model Requirements must be in consultation with CFA.

Figure 2: *125mm, 100mm, 90mm, 75mm, 65mm Storz tree adapters.*

Wind Energy Facilities

A fire protection system must be provided for wind energy facilities. The fire protection system must be designed to allow adequate response to the risks and hazards at the facility, in consultation with CFA.

Model Requirements

a) The fire protection system for wind energy facilities must incorporate at least one static fire water storage tank of at least 45,000L effective capacity at each site entrance.

b) Additional static fire water storage tanks of at least 45,000L effective capacity must also be incorporated in facility design. The number and location of tanks is to be determined through a comprehensive risk management process (Risk Management Plan), in consultation with CFA.

c) Fire water must be provided to cover buildings, control rooms, substations and grid connections, in consultation with CFA.

d) Nacelles must be equipped with automatic fire detection, alarm and fire suppression systems.

e) Additional fire protection systems or equipment required under any Australian Standards for dangerous goods must be provided as prescribed.

Modifications to Model Requirements must be in consultation with CFA.

Figure 3: *Fire water signage to comply with AS 2419.1-2005, Section 5.4.5: Fire hydrant tank signs.*

Solar Energy Facilities

A fire protection system must be provided for solar energy facilities. The fire protection system must be designed to allow a safe, adequate response to the risks and hazards at the facility, in consultation with CFA.

Model Requirements

a) The fire protection system for solar energy facilities must incorporate at least one (1) x 45,000L static water tank for every 100ha. For example, a 500ha site requires a minimum of five (5) x 45,000L static water tanks.

b) A fire water tank must be located at the primary vehicle access point to the facility, and elsewhere in consultation with CFA.

c) Fire water must be provided to cover buildings, control rooms, substations and grid connections, in consultation with CFA.

d) Additional fire protection systems or equipment required under any Australian Standards for dangerous goods must be provided as prescribed.

Modifications to Model Requirements must be in consultation with CFA.

Micro Solar Facilities (up to and including 5MW)

For micro solar facilities, up to and including 5MW without battery storage, fire water of not less than 22,500 litres effective capacity may be provided.

Fire water tank(s) must be located at the primary vehicle access point to the facility.

Where micro solar facilities include battery energy storage systems, additional fire protection must be provided.

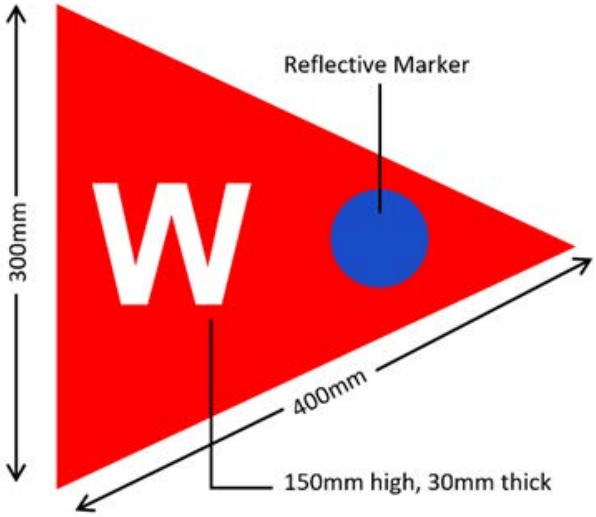


Figure 4: *Directional signage: fade resistant, fixed to a rigid post in contrasting lettering, white sign writing on red background, with a circle reflective marker. 'W' in 150mm upper case lettering.*

Battery Energy Storage Systems

A fire protection system suitable for the risks and hazards at the facility must be provided. For battery energy storage systems, the water supply quantity must:

- Enable effective cooling of surrounding infrastructure.
- Account for reasonable duration of fire events based on the proposed battery chemistry.
- Account for local weather conditions and potential fire weather conditions.
- Provide for the safety of firefighters.

The fire protection system must be designed in line with the requirements of *AS 2419.1-2005: Fire hydrant installations*, Section 3.3: Open Yard Protection, in consultation with CFA.

For the purposes of determining system requirements, the 'area' referenced within *AS 2419.1* may be considered that of the battery installation, including the fire break around the battery infrastructure, rather than the entire area of the yard or site.

Where battery energy storage systems are ancillary to solar or wind energy facilities, additional fire protection must be provided.

Where battery energy storage systems are proposed in multiple locations (such as dispersed amongst solar panel banks), fire protection requirements must be determined in consultation with CFA.

(Model requirements overleaf.)

Model Requirements

1) For facilities with battery energy storage systems, the fire protection system must include at a minimum:

a) A fire hydrant system that meets the requirements of *AS 2419.1-2005: Fire hydrant installations*, Section 3.3: Open Yard Protection, and Table 3.3: Number of Fire Hydrants Required to Flow Simultaneously for Protected Open Yards. Except, that fire hydrants must be provided and located so that every part of the battery energy storage system is within reach of a 10m hose stream issuing from a nozzle at the end of a 60m length of hose connected to a fire hydrant outlet.

OR

b) Where no reticulated water is available, a fire water supply in static storage tanks, where:

i. The fire water supply must be of a quantity no less than 288,000L or as per the provisions for Open Yard Protection of *AS 2419.1-2005* flowing for a period of no less than four hours at 20L/s, whichever is the greater.

ii. The quantity of static fire water storage is to be calculated from the number of hydrants required to flow from AS 2419.1-2005, Table 3.3.

(E.g., For battery installations with an aggregate area of over 27,000m2, 4 hydrant outlets are required to operate at 10L/s for four hours, which equates to a minimum static water supply of 576kL.)

iii. Fire hydrants must be provided and located so that every part of the battery energy storage system is within reach of a 10m hose stream issuing from a nozzle at the end of a 60m length of hose connected to a fire hydrant outlet.

iv. The fire water supply must be located at vehicle entrances to the facility, at least 10m from any infrastructure (electrical substations, inverters, battery energy storage systems, buildings).

v. The fire water supply must be reasonably adjacent to the battery energy storage system and shall be accessible without undue danger in an emergency. (Eg., Fire water tanks are to be located closer to the site entrance that the battery energy storage system).

vi. The fire water supply must comply with *AS 2419.1-2005: Fire hydrant installations* - Section 5: Water storage.

Modifications to Model Requirements must be in consultation with CFA.

Substations

Model Requirement

Fire water must be available to substations.

Modifications to Model Requirements must be in consultation with CFA.

Figure 5: *Best-practice arrangement of fire service infrastructure for facilities with battery energy storage systems with reticulated water supply meeting the performance requirements of AS 2419.1-2005: Fire hydrant installations.*

Figure 6: *Best-practice arrangement of fire service infrastructure at facilities with battery energy storage systems without reticulated water supply, or a reticulated water supply that does not meet the performance requirements of AS 2419.1-2005: Fire hydrant installations.*

6.2.3 Landscape Screening and On-Site Vegetation

All Facilities

Any vegetation, proposed or existing, must be considered in the Risk Management Plan for its potential to intensify and propagate fire within and away from the site.

Where landscape screening is required, for example, to screen visual impacts or to prevent visual glare from a solar energy facility, the design must consider any potential increase in fire risk due to the type (species), density, height, location and overall width of the screening.

Facilities must be designed so that the radiant heat flux (output) from vegetation does not create the potential for ignition of on-site infrastructure or other vegetation.

Radiant heat impact leading to ignition may be mitigated through:

- Vegetation removal (where permitted).
- Separation from nearby infrastructure (e.g., fire breaks; refer below).
- The provision of thermal barriers at nearby infrastructure.
- Other means in consultation with CFA.

CFA recommends that bushfire hazard site and landscape assessments are conducted for all facilities located within Bushfire Prone Areas and the Bushfire Management Overlay.

Consultation with CFA is required regarding landscape screening in high-risk environments.

Solar Energy Facilities

Where practicable, low-flammability vegetation (such as root vegetables) may be planted under solar panels, provided foliage does not extend beyond the panel footprint.

Substations and Electric Lines

The entire substation must be surfaced to eliminate all vegetation including grasses.

The *Electricity Safety (Electric Line Clearance) Regulations 2020* prescribe the vegetation clearance requirements for electric lines based on the assigned fire hazard rating for land established under Section 80 of the *Electricity Safety Act 1998*. Fire hazard ratings are available from CFA by request.

6.2.4 Fire Breaks

All Facilities

A fire break is a gap in fuel (vegetation) that reduces the potential for fire to enter or leave an area. Fire breaks may also be used for emergency vehicle access.

Model Requirements

A fire break must be established and maintained around:

a) The perimeter of the facility, commencing from the boundary of the facility or from the vegetation screening inside the property boundary.

b) The perimeter of control rooms, electricity compounds, substations and all other buildings on-site.

The width of fire breaks must be a minimum of 10m, and at least the distance where radiant heat flux (output) from the vegetation does not create the potential for ignition of on-site infrastructure.

Modifications to Model Requirements must be in consultation with CFA.

Where screening or other vegetation is a width of 20m or less (open density as per *AS 3959-2018*), or 15m or less (closed density as per *AS 3959-2018*), a fire break of 10m may be appropriate to prevent radiant heat from vegetation fully involved in fire becoming an ignition source for on-site infrastructure.

Outside of these parameters, separation must be at least the distance where radiant heat flux (output) from the vegetation does not create the potential for ignition of on-site infrastructure.

The width of the vegetation includes any existing vegetation from neighbouring properties or road reserves abutting the proposed or existing vegetation for the renewable energy facility.

Vegetation may be classified as per *AS 3959-2018: Construction of buildings in bushfire-prone areas* for the purposes of determining radiant heat flux (output).

Fire breaks must be:

- Non-combustible, constructed of concrete, mineral earth or non-combustible mulch such as crushed rock.
- Free of vegetation and obstructions at all times. No plant or equipment of any kind is to be stored in fire breaks.

Further Guidance Material

AS 3959-2018: Construction of buildings in bushfire- prone areas (SAI Global)
Contains information on classifying vegetation that may be useful for bushfire hazard assessments, see Table 2.3 and Figures 2.4(a)-(h).

CFA Plant Selection Key
The Plant Selection Key helps you choose plants for a garden in a high bushfire risk.

CFA Landscaping for Bushfire
While aimed at residential garden design, this publication contains information that may be useful for design of renewable energy facilities.

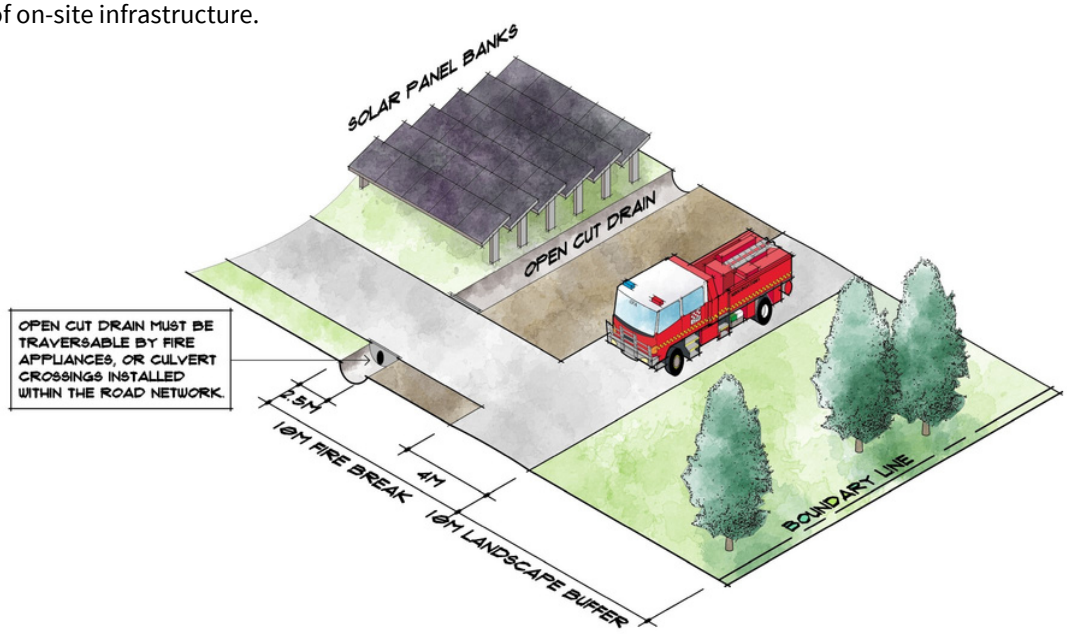


Figure 7: *Typical cross-section indicating fire break requirements at a solar energy facility.*

Wind Energy Facilities

Fire breaks are not required around the perimeter(s) of wind energy facilities.

Model Requirement

A fire break must be established and maintained around the base of wind turbines.

Modifications to Model Requirements must be in consultation with CFA.

CFA recommends that an additional reduced-fuel zone of at least 20m, abutting the fire break, is implemented around the base of wind turbines. This zone is to be cleared of trees and scrub (where permitted by the responsible authority) and grass must be no more than 100mm during the Fire Danger Period.

Any turbines located in high-risk environments are to have a fuel-reduced zone to the envelope of the wind turbine blades.

Battery Energy Storage Systems

Model Requirement

A fire break must be established and maintained around battery energy storage systems and related infrastructure.

Modifications to Model Requirements must be in consultation with CFA.

In addition to radiant heat flux (output) from vegetation, the width of fire breaks between vegetation and battery energy storage systems must be at least the distance where the radiant heat flux (output) from the battery energy storage system fully involved in fire does not create the potential for ignition of vegetation.

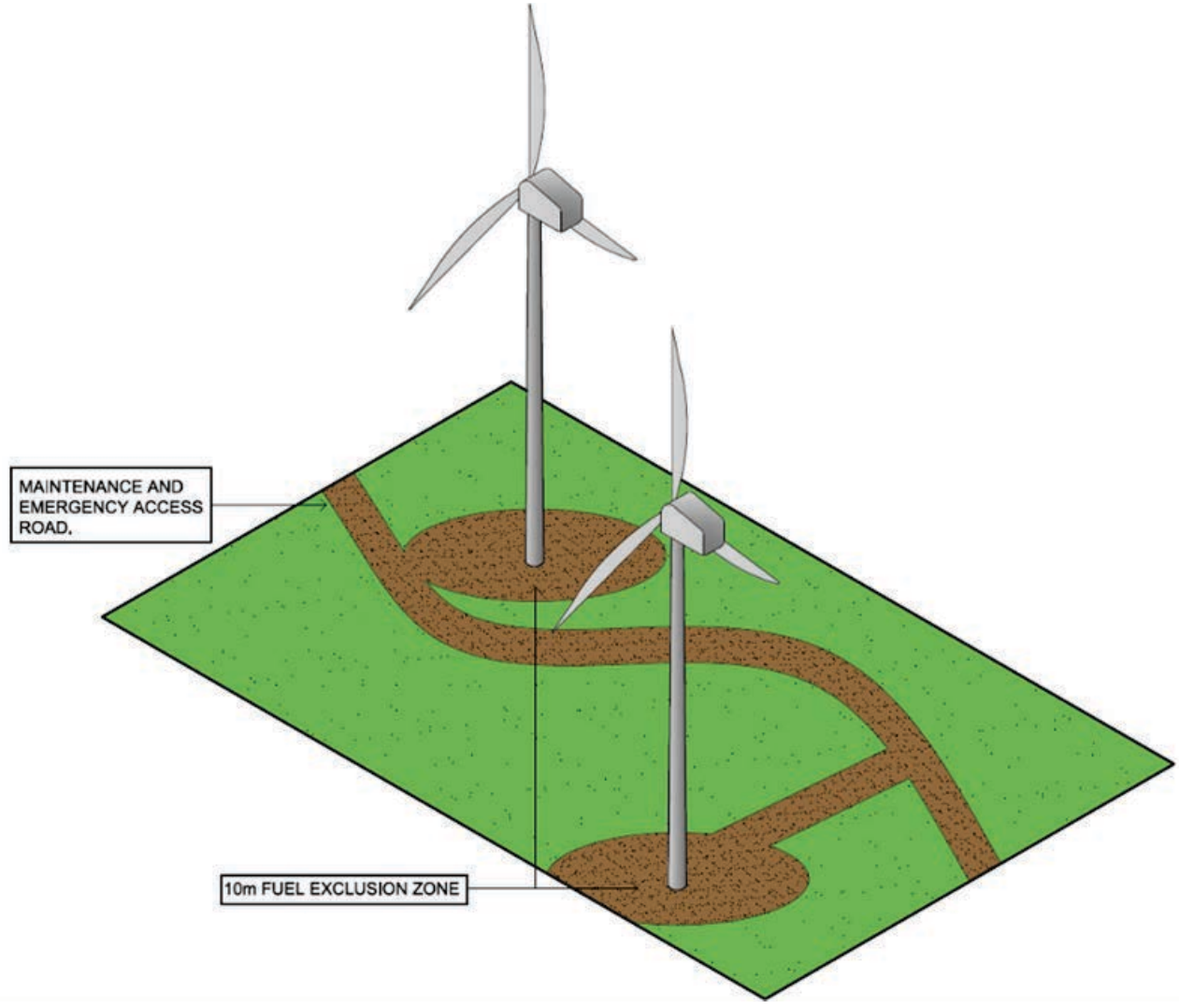


Figure 8: *Typical wind turbine arrangement with with fuel exclusion zone and access roads.*

6.2.5 Design Specific to Facility Type

Wind Energy Facilities

Wind energy facilities pose hazards for aerial firefighting operations in certain weather and terrain conditions.

Fire suppression aircraft operate under Visual Flight Rules. Most fire suppression aircraft operate during the day, but only specialised aircraft have the ability for fire suppression at night, under strict protocols.

The following model planning requirements support safe and effective firefighting operations. The installation must be notified to CFA and Air Services Australia for inclusion in the Vertical Obstruction Database.

Model Requirements

a) Wind turbines must be located no less than 300 metres apart.

b) Wind turbines must be provided with automatic shut-down, and the ability to be completely disconnected from the power supply in the event of fire.

c) Installed weather monitoring stations must be notified to the Civil Aviation Safety Authority (CASA) as per CASA Advisory Circular AC 139.E-05 v1.0, May 2021 (as for all structures 110m or more above the ground).

d) All guy wires and monitoring towers must be clearly marked, even where marking is not required by CASA.

Modifications to Model Requirements must be in consultation with CFA.

CFA air response to a grass fire in a wind energy facility, February 2022.

Solar Energy Facilities

Adequate separation of solar panel banks facilitates safe and effective firefighting operations.

Model Requirement

Solar energy facilities are to have a minimum six (6) metre separation between solar panel banks.

Modifications to Model Requirements must be in consultation with CFA.

For the purposes of this guideline, a 'bank' of solar panels may be that connected to a single power conversion unit/inverter.

Micro Solar Facilities (up to and including 5MW)

Separation of solar panel banks by 6m is not required for micro solar facilities.

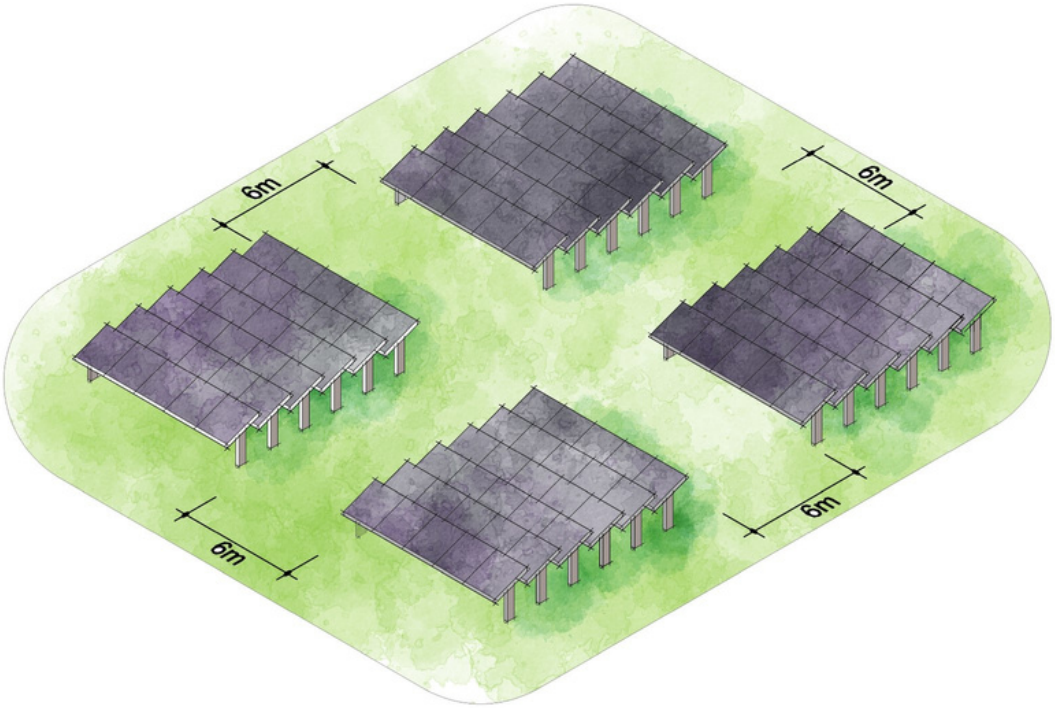


Figure 9: *Six metre separation between solar panel banks (indicative only).*

Battery Energy Storage Systems

CFA acknowledges that battery technologies are continually evolving, and that not all battery energy storage systems have the same level of fire risk. While the following design guidelines are based on lithium-ion battery chemistry, the principles of risk-based facility design can be adopted across the spectrum of large-scale battery technologies and configurations.

Facilities with battery energy storage systems must be designed with an ultimate goal of fire prevention. Facility design can reduce the potential for ignition and the consequences of fire should it occur.

Where a lithium-ion battery goes into thermal runaway, cooling surrounding infrastructure to prevent further spread may be the only safe response option available to CFA.

The battery management and safety systems within the chosen battery technology will largely dictate whether thermal runaway will occur and its initial management.

CFA recommends that consideration is to be given to the provision of non-combustible, floor-to-ceiling partition 'walls' (thermal barriers) between battery racks (stacked modules) within battery containers/enclosures. Refer to *FM Global Property Loss Prevention Data Sheet 5-33 (2020) Electrical Energy Storage Systems* for details.

In the absence of a current Australian Standard pertaining to large scale battery energy storage system facilities, the current versions of *UL 9540: Energy Storage System Requirements* and *FM Global Property Loss Prevention Data Sheet 5-33 (2020) Electrical Energy Storage Systems*, should be used in the design and operation of battery energy storage systems, except where varied by this guideline.

Model Requirements

1) The design of the facility must incorporate:
a) A separation distance that prevents fire spread between battery containers/enclosures and:

- Other battery containers/enclosures.
- On-site buildings.
- Substations.
- The site boundary.
- Any other site buildings.
- Vegetation.

Separation must be at least the distance where the radiant heat flux (output) from a battery energy storage system container/enclosure fully involved in fire does not create the potential for ignition of these site elements.

b) A fire break around the battery energy storage system and related infrastructure, of a width of no less than 10m, or greater where determined in the Risk Management Plan.

Fire breaks must be non-combustible, constructed of concrete, mineral earth or non-combustible mulch such as crushed rock.

The width must be calculated based on the ignition source being radiant heat of surrounding vegetation, including landscaping.

c) A layout of site infrastructure that:

i. Considers the safety of emergency responders.
ii. Minimises the potential for grassfire and/or bushfire to impact the battery energy storage system.
iii. Minimises the potential for fires in battery containers/enclosures to impact on-site and off-site infrastructure.

2) Battery energy storage systems must be:
a) Located so as to be reasonably adjacent to a site vehicle entrance (suitable for emergency vehicles).

b) Located so that the site entrance and any fire water tanks are not aligned to the prevailing wind direction (therefore least likely to be impacted by smoke in the event of fire at the battery energy storage system.)

c) Provided with in-built detection and suppression systems. Where these systems are not provided, measures to effectively detect and/or suppress fires within containers must be detailed within the Risk Management Plan.

d) Provided with suitable ember protection to prevent embers from penetrating battery containers/enclosures.

e) Provided with suitable access roads for emergency services vehicles, to and within the site, including to battery energy storage system(s) and fire service infrastructure.

f) Installed on a non-combustible surface such as concrete.

g) Provided with adequate ventilation.

h) Provided with impact protection to at least the equivalent of a W guardrail-type barrier, to prevent mechanical damage to battery containers/enclosures.

i) Provided with enclosed wiring and buried cabling, except where required to be above-ground for grid connection.

j) Provided with spill containment that includes provision for management of fire water runoff.

Modifications to Model Requirements must be in consultation with CFA.

CFA recommends that infrastructure is provided for the containment and management of contaminated fire water runoff from battery energy storage systems. Infrastructure may include bunding, sumps and/or purpose-built, impervious retention facilities. A fire water management plan may include the containment and disposal of contaminated fire water.

CFA recommends a containment and management capacity equivalent to the fire protection system provided on-site. Containment is to be provided as per *AS 4681-2000: The storage and handling of class 9 dangerous goods*, Section 7.3.9: Control of run-off.

Battery Energy Storage Systems Dispersed Throughout Solar or Wind Energy Facilities

Where proposed in multiple locations, such as dispersed throughout solar energy facilities rather than grouped in a single location on-site, battery energy storage systems must be separated from adjacent infrastructure, such as solar panel banks.

Separation must be to at least the distance where the radiant heat flux (output) from the battery energy storage system container/enclosure fully involved in fire does not create the potential for ignition of the adjacent infrastructure.

Battery Energy Storage System Safety and Protective Systems

Safety and protective systems will vary in battery energy storage systems based on battery technologies, chemistries and the preferences of manufacturers.

CFA recommends that battery energy storage systems are equipped with the following elements:

- **Battery management/monitoring systems** for monitoring the state of battery systems to ensure safe operation.
- **Detection systems** for smoke, heat (thermal), fire and toxic gas (off-gassing) within battery containers.
- **Suppression systems** for fire within battery containers.
- **Systems to prevent heat/fire spread** within battery containers (such as thermal barriers, shut-down separators, isolation systems, cooling systems).
- **Systems to prevent explosion** within battery containers (such as ventilation, pressure relief and exhaust systems).
- **Warning and alarm systems** within the battery containers, and/or the facility, to enable early warning for faults, operation of the battery energy storage system above 'normal'/safe parameters, smoke, off-gassing, and fire.

7 Facility Construction and Commissioning

Fire risks must be identified and effectively managed during the construction and commissioning of renewable energy facilities.

The construction of facilities comes with additional risks, including fire risks. During the construction phase, CFA's expectation is that a risk management process is undertaken to effectively identify risks and develop and implement appropriate and effective controls.

7.1 Recommended Risk Controls

All Facilities

CFA recommends the following risk controls for the construction of facilities. This is not an exhaustive list and must be supplementary to the outcomes of the site-specific risk management process and any relevant requirements under legislation.

7.1.1 Fire Detection and Suppression Systems

a) Install and commission fire detection and suppression systems for the facility at the earliest possible stage of construction.

b) Provide first-aid firefighting equipment, such as fire extinguishers (and where possible, portable fire hose reels), appropriate to the identified emergency scenarios, at all construction portables/buildings on-site, in the vicinity of all construction activities, and in site-based vehicles.

c) Provide the required fire protection equipment for any storages of dangerous goods as per the relevant Australian Standards.

7.1.2 Fire Risk Management

a) Obtain appropriate permits for work during the Fire Danger Period, and ensure that any conditions on permits are adhered to.

b) Adhere to restrictions on Total Fire Ban or days of high fire danger according to CFA's website.

c) During the Fire Danger Period, ensure vehicle operators are instructed to remain on tracks and are not permitted to drive through paddocks.

d) Restrict smoking to prescribed areas and provide suitable ash and butt disposal facilities.
Provide remotely-accessible site/system security monitoring at the facility.

7.1.3 Personnel Training

a) Provide training for personnel in the use of on-site first-aid firefighting equipment, and responsibilities during emergencies.
b) Ensure that all on-site personnel complete CFA's online training module 'Bushfire Safety for Workers'.

7.1.4 Emergency Management

Model Requirement
An Emergency Management Plan must be developed for the construction and commissioning phase, before development starts.

Modifications to Model Requirements must be in consultation with CFA.

a) The Emergency Management Plan must address the requirements of **Sections 9 and 10** of this guideline.
b) An emergency communication system must be provided that is reliable and will operate in the event of power failure.
c) CFA must be notified at least seven days prior to the commissioning of any high-risk infrastructure at the facility (eg., battery energy storage systems).

7.1.5 Occupational Health and Safety

CFA recommends the development of safe work procedures for the facility, encompassing but not limited to:

a) Electricity and chemical management.
b) Vegetation management.
c) Site security.
d) Ignition source control, including hot works.
e) Infrastructure, equipment and vehicle maintenance.
f) Emergency management.

Further Guidance

WorkSafe Victoria: Effective Emergency Response Plans on Construction Sites

8 Facility Operation

Fire risks must be effectively managed for the duration of the operational life of renewable energy facilities.

8.1 Vegetation and Fuel Management

All Facilities

The effective management of vegetation and fuel can reduce both the risk of fire entering your facility, and the consequences of fire.

All renewable energy facilities that are constructed within the Bushfire Management Overlay or a Bushfire Prone Area must maintain the vegetation to the prescriptions listed within the planning permit.

Model Requirements

Facility operators must undertake the following measures during the Fire Danger Period:

a) Grass must be maintained at or below 100mm in height during the declared Fire Danger Period.

b) Long grass and/or deep leaf litter must not be present in areas where heavy equipment will be working, during construction or operation.

c) Restrictions and guidance must be adhered to during the Fire Danger Period, days of high (and above) fire danger and Total Fire Ban days (refer to www.cfa.vic.gov.au).

d) All vehicles and heavy equipment must carry at least a nine (9)-litre water stored-pressure fire extinguisher with a minimum rating of 3A, or firefighting equipment as a minimum when on-site during the Fire Danger Period.

Modifications to Model Requirements must be in consultation with CFA.

Solar Energy Facilities

Solar energy facilities must have grass maintained to no more than 100mm under solar panels during the Fire Danger Period.

Operators of solar energy facilities on grazed paddocks must ensure that if additional measures to maintain grass to this level are required, they are implemented prior to, and for the duration of the Fire Danger Period.

Battery Energy Storage Systems

Containers/enclosures and infrastructure for battery energy storage systems must be maintained to be clear of vegetation, including grass, for at least ten (10) metres on all sides, or greater as informed by the Risk Management Plan.

Substations and Electric Lines

Vegetation management within any electric line easement is to be such that falling trees would not impact the transmission lines, towers and associated infrastructure.

8.2 Maintenance

All Facilities

Ensuring that facility infrastructure, equipment and vehicles are maintained in safe, effective working order contributes to efficiency, reliability and importantly, fire safety.

Model Requirement

Inspection, maintenance and any required repair activities must be conducted for all infrastructure, equipment and vehicles at the facility. Maintenance must be in line with any relevant Australian Standards and the manufacturer's requirements.

Modifications to Model Requirements must be in consultation with CFA.

A procedure, including a schedule and relevant personnel accountabilities, must be developed in relation to the inspection and maintenance of all infrastructure, equipment and vehicles.

Any activities that involve flame cutting, grinding, welding or soldering (hot works) must be performed under a 'hot work permit' system or equivalent job safety hazard or risk management process.

Battery Energy Storage Systems

Battery energy storage systems, including the battery management system and any associated safety systems, must be regularly serviced to the manufacturer's specifications.

A procedure, including a schedule and relevant personnel accountabilities, must be developed in relation to the inspection of battery energy storage systems.

Battery energy storage systems are to be regularly inspected for:

- Any signs of mechanical damage to the external containers/enclosures.
- Any accumulation of combustible materials (including leaf litter) in or within ten (10) metres of any battery energy storage systems and related infrastructure.

Any identified issues must be immediately rectified.

8.3 Dangerous Goods Storage and Handling

All Facilities

Signage and labelling compliant with the *Dangerous Goods (Storage and Handling) Regulations 2012* and the relevant Australian Standards must be provided at the site entrance, dangerous goods storage locations, and storage tanks where applicable.

Appropriate material for the clean-up of dangerous goods spills and leaks (including absorbent, neutralisers, tools, disposal containers and personal protective equipment) must be provided and available on-site.

Training must be provided for site personnel on the hazards, safe use and emergency response for spills, leaks and fire involving dangerous goods.

All dangerous goods stored on-site must have a current Safety Data Sheet (SDS). Safety Data Sheets must be provided within the facility's Emergency Information Book(s), in the Emergency Information Container(s).

The requirements of the dangerous goods legislative framework, and all relevant Australian Standards must be complied with for all facilities, including facilities with battery energy storage systems.

8.4 Facility and System Monitoring

All Facilities

Model Requirement

Appropriate monitoring for facility infrastructure must be provided, to ensure that any shorts, faults or equipment failures with the potential to ignite or propagate fire are rapidly identified and controlled, and any fire is notified to 000 immediately.

Modifications to Model Requirements must be in consultation with CFA.

Battery Energy Storage Systems

For battery energy storage systems, appropriate monitoring and intervention measures must be provided to ensure that the following are rapidly identified and notified to 000 immediately:

- Any shorts, faults, temperature increases above normal parameters (eg. precursor to thermal events/runaway).
- Equipment failures with the potential to ignite or propagate fire.
- Off-gassing, smoke or fire.

The provision for direct alarm monitoring to the fire brigade for battery energy storage system automatic detection systems must be considered.

8.5 Risk Management Review

All Facilities

While there is no legislative obligation for operators of existing renewable energy facilities to implement the design advice in this guideline retrospectively, fire risk must be effectively managed to meet obligations for providing a safe workplace under the OHS Act.

CFA recommends that facility operators:

- Review (or develop) the **Risk Management Plan**, to ensure that all hazards and risks are identified and effectively managed. This must incorporate an assessment of the existing fire protection systems and equipment and their adequacy for the facility.
- Review (or develop) the **Fire Management Plan**, to ensure that all of the activities to eliminate or reduce the potential for ignition and consequences of fire.
- Review (or develop) the **Emergency Management** Plan, to ensure that it accurately captures the emergency arrangements on-site.
- Arrange for the above documents to be peer-reviewed by a suitably qualified, independent third party.

9 Fire Management Planning

Fire prevention and management must be considered in facility operation.

All Facilities

Model Requirement

A Fire Management Plan must be developed for the facility, in conjunction with CFA, before development starts.

Modifications to Model Requirements must be in consultation with CFA.

A Fire Management Plan details the fire hazards and risks at and to your facility, and facilitates the implementation of appropriate and effective risk control measures to reduce the potential for fire occurring, and limit the consequences of fire. An effective Fire Management Plan is based on a sound risk management process.

The Fire Management Plan informs operational and emergency management practices at your facility.

The Fire Management Plan may be a stand-alone document or incorporated into the facility's Emergency Management Plan as an addendum (refer to **Section 10**).

CFA's expectation is that the Fire Management Plan effectively describes all fire hazards and provides clear actions and accountabilities for their management.

9.1 Fire Management Plan requirements

CFA's requirements for a Fire Management Plan, including some suggested risk controls, are provided below.

Where bushfire is a hazard at your facility it must be included in your Fire Management Plan and Emergency Management Plan. Facility operators may opt instead for a dedicated 'Bushfire Management Plan' which incorporates the fire management and emergency management content specific to bushfire into a stand-alone document. More information on bushfire management planning is provided in **Section 11**.

Table 1: Fire Management Plan Requirements

A summary of fire hazards and risks to and from the site, specific to its location, infrastructure, activities and occupancy.	Based on sound hazard identification and risk management processes. This must include risks to firefighter safety during emergencies.
Description of control measures to prevent fire occurring and limit the consequences of fire at the facility.	Fire permits, ignition source controls, hot work permits, job hazard analyses, infrastructure/vehicle/equipment/road/fence/access maintenance, waste management, compliant dangerous goods storage and handling, vegetation/fuel reduction and management, peat management, Emergency Management Plan.
Description of control measures to prevent and reduce the consequences of external fire impacting the facility.	Bushfire monitoring, bushfire preparedness, reduced personnel presence/ activities/travel on days of Severe and above Fire Danger Rating, creation and management of fire breaks at the site perimeter and around infrastructure, vegetation/fuel reduction and management, Emergency Management Plan.
Details of equipment and resources to manage fire at the facility.	Fire detection and suppression systems, fire water supplies, automatic shut-down and isolation systems, monitored alarms, communications equipment, occupant warning systems, designated evacuation assembly areas, Emergency Information Container(s), Emergency Management Plan.
Policies and procedures that ensure all control measures are appropriate and effective, and remain so.	Performance standards for risk controls, specific activities to verify controls (serving/maintenance, housekeeping inspections, external audits), review processes for risk control effectiveness.
Procedures for review of the Plan.	Review triggers and schedule, organisational accountability for the Plan, allocated responsibilities (to persons or roles) for the ongoing development and review of the Plan.

Battery Energy Storage Systems

A Fire Management Plan for a facility that incorporates a battery energy storage system must also include:

a) A schedule, list of activities and accountabilities for the inspecting, testing, monitoring and servicing of the battery and its monitoring, safety and protective systems.

b) Monthly inspections of battery enclosures/ containers and related infrastructure for physical damage. Any damage must be immediately assessed and rectified by a suitably qualified person.

c) Seismic activity as a trigger for inspecting, testing and servicing of the battery energy storage system and its related infrastructure. Any damages or changes in operating parameters must be immediately assessed and rectified by a suitably qualified person.

d) Regular inspection and removal of all combustible materials within the vicinity of the battery enclosures/ containers and related infrastructure.

CFA Renewable Energy Fire Safety Resources

https://www.cfa.vic.gov.au/plan-prepare/building-planning-regulations/renewable-energy-fire-safety

Fire Danger Ratings

The Fire Danger Rating tells you how dangerous a fire would be if one started.

The four-day Fire Danger Rating forecast is available on the CFA website during the Fire Danger Period.

https://www.cfa.vic.gov.au/warnings-restrictions/total-fire-bans-and-ratings

Find out what you can and can't do during the declared Fire Danger Period, and on days of Total Fire Ban at:

https://www.cfa.vic.gov.au/warnings-restrictions/total-fire-bans-and-ratings/can-i-or-cant-i

Emergency Warnings

You should never wait to receive an official warning before you leave. Fires can start quickly and threaten homes and lives within minutes.

Warnings are issued when a fire has started and you need to take action.

Make sure you understand the three levels of warnings and what they mean. The three levels of warnings are:

- Advice
- Watch and Act
- Emergency Warning

Don't expect warnings to be issued in any particular order. The first warning you could get could be an Emergency Warning.

https://www.cfa.vic.gov.au/warnings-restrictions/about-warnings

10 Emergency Management Planning

Emergencies at renewable energy facilities must be effectively managed.

Effective emergency planning ensures that your facility is prepared in the event of an emergency, providing for safety of site personnel, emergency responders and the community.

An emergency planning process, informed by *AS 3745-2010: Planning for emergencies in facilities*, provides a framework for the development of an Emergency Management Plan through the formation and activities of an Emergency Planning Committee. The Emergency Planning Committee is responsible for the development, implementation and maintenance of the Emergency Management Plan.

10.1 Emergency Management Plan

10.1.1 Why Develop an Emergency Management Plan?

An Emergency Management Plan (EMP) details the structures, procedures, resources, training for managing emergencies. EMPs must be specific to the infrastructure, operations and location of facilities, and informed by a sound risk management process.

An Emergency Management Plan may also assist employers to meet their obligations under the OHS Act in providing a workplace that is safe and without risks to heath.

All Facilities

Model Requirement

An Emergency Management Plan must be developed specific to the facility, in conjunction with CFA, before development starts.

Modifications to Model Requirements must be in consultation with CFA.

CFA recommends that facility operators develop an Emergency Management Plan (EMP) consistent with the requirements of *AS 3745-2010: Planning for emergencies in facilities*.

10.1.2 Contents of Emergency Management Plans

EMPs must be developed to cover both the construction and operational phases and must include:

a) Emergency prevention, preparedness and mitigation activities.

b) Activities for preparing for, and the prevention of emergencies (eg. training and maintenance).

c) Control and coordination arrangements for emergency response (eg. evacuation procedures, shelter-in-place arrangements, emergency assembly areas and procedures for response to emergencies).

d) The agreed roles and responsibilities of on-site personnel (eg. equipment isolation, fire brigade liaison, evacuation management, shelter-in-place management, if applicable).

To facilitate fire brigade response, CFA's expectation is that EMPs include:

a) A facility description, including infrastructure details, operations, number of personnel, and operating hours.

b) A site plan depicting infrastructure (solar panels, wind turbines, inverters, battery energy storage systems, generators, substations, grid connection points, dangerous goods storages, buildings, bunds), site access points and internal roads; fire services (water tanks, pumps, booster systems, fire hydrants, fire hose reels); drainage; and neighbouring properties.

c) Up-to-date contact details for facility personnel, and any relevant off-site personnel that could provide technical support during an emergency.

d) Details of emergency resources, including fire detection and suppression systems and equipment; gas detection; emergency eye-wash and shower facilities; spill containment systems and equipment; emergency warning systems; communication systems; personal protective equipment; first aid.

e) A manifest of dangerous goods (if required under the *Dangerous Goods (Storage and Handling) Regulations 2012*).

f) Evacuation procedures.

g) Shelter-in-place procedures for facilities at-risk of bushfire or grassfire, in the event that it is too late to safely evacuate.

(Continued overleaf.)

h) Emergency procedures for all credible hazards and risks, including building, infrastructure and vehicle fire, grassfire and bushfire.

i) A Fire (or Bushfire) Management Plan (refer to **Section 9**).

Procedures must include details for notifying the emergency services, at the earliest possible stage of the emergency. The person or role responsible for making or verifying the notification must be specified. '000' must be included in the procedure.

Where your facility is within a Bushfire Prone Area or the Bushfire Management Overlay, refer to **Section 11** for CFA's advice on bushfire emergency planning.

Wind Energy Facilities

A wind energy facility EMP must include:

- Emergency procedures for fires within, and in the vicinity of, wind turbines.
- Details of any triggers or circumstances for ceasing operation of wind turbines or shutting down the facility, such as on Code Red Days or approach of bushfire/grassfire to the facility.
- Maximum (safe) operational wind speed and temperature conditions and operating procedures to limit fire risk.

This information must also be provided within the facility's Emergency Information Book.

Wherever possible, rotors are to be stopped into a 'Y' pattern during emergencies.

Solar Energy Facilities

A solar energy facility EMP must include:

- Emergency procedures for isolation and shut-down where solar panels and/or related infrastructure are involved in fire.
- Emergency procedures for fires within the vicinity of solar energy facilities.
- Specifications for safe operating conditions for temperature, and the hazards related to electricity generation at the facility.

This information must also be provided within the facility's Emergency Information Book.

Battery Energy Storage Systems

EMPs for facilities with battery energy storage systems must include:

a) Contact information for 24/7/365 specialist technical support for the battery energy storage system.

b) Emergency procedures based on identified risks and hazards of the battery energy storage system and related infrastructure, including but not limited to:

i. Electrical infrastructure faults and fire.

ii. Battery energy storage system damage or faults, including battery monitoring faults, temperature increases above normal operating parameters, electrical faults, chemical spills or reactions, off-gassing, thermal events/runaway, smoke and fire.

iii. Bushfire and grassfire.

iv. The management of fire water runoff.

c) A plan for partial and full decommissioning of the battery energy storage system in the event of an emergency incident that renders the facility inoperable or unsafe, prior to its anticipated end-of-life.

10.2 Provision of Emergency Information for Responders

Renewable energy facilities pose special hazards for firefighters during emergency response. Providing accurate, current information about potential risks and hazards to emergency responders during emergencies facilitates effective intervention, reduces delays during response, and contributes to providing a safe workplace for emergency responders.

The provision of emergency information to responding emergency services is also a requirement of numerous Victorian regulations and Australian Standards.

CFA's preferred format for the provision of emergency information is an Emergency Information Book, provided within an Emergency Information Container.

10.2.1 Developing an Emergency Information Book

All Facilities

Model Requirement

An Emergency Information Book must be developed and available to emergency responders. Emergency Information Books must be located in Emergency Information Containers, provided at each vehicle entrance the facility.

Modifications to Model Requirements must be in consultation with CFA.

CFA's Guideline for the Provision of Emergency Information outlines CFA's expectations for developing an Emergency Information Book.

The Emergency Information Book must include:

a) A description of the premises, its infrastructure and operations.

b) Site plans that include the layout of the entire site, including buildings, internal roads, infrastructure, fire protection systems and equipment, dangerous goods storage areas, battery energy storage systems, substations/terminals, grid connections, drains and isolation valves, neighbours and the direction of north.

c) Up-to-date contact details for site personnel, regulatory authorities and site neighbours.

d) A manifest of dangerous goods (if required) as per Schedule 3 of the *Dangerous Goods (Storage and Handling) Regulations 2012*.

e) Safety Data Sheets (SDS) for dangerous goods stored on-site.

f) Procedures for management of emergencies, including evacuation, shelter-in-place (for facilities at-risk of bushfire/grassfire), containment of spills and leaks, and fire procedures (including infrastructure/plant fires, vehicle fires, grassfire/bushfire).

Emergency Information Containers must be:

a) Painted red and marked 'EMERGENCY INFORMATION' in white contrasting lettering not less than 25mm high.

b) Located at all vehicle access points to the facility, installed at a height of 1.2 metres – 1.5 metres.

c) Accessible with a fire brigade standard '003' key.

d) Kept clear of obstructions, including products, rubbish, vehicles, vegetation and any hazards (eg. pest infestation).

Battery Energy Storage Systems

Operators of facilities with battery energy storage systems must provide information on hazards to emergency responders. This information must be provided within the site's Emergency Information Book, and must include:

a) Specifications for safe operating conditions for temperature.

b) Schematics and technical data for battery energy storage system containers/enclosures, the number of containers/enclosures on-site, and the number of battery racks or modules within each container/enclosure.

c) Details of the hazards for the battery energy storage system, including thermal events/runaway, electrical safety hazards, explosion hazards, dangerous goods hazards (including off-gassing), and the effects of fire on the battery energy storage system (eg., explosion, release of toxic gases).

d) Details of all provided battery failure/safety and protective systems, including a description, the activation process/automatic trigger, and any hazards associated with these systems.

e) The shut down and/or isolation procedures if the batteries are involved in fire, and appropriate personnel contact details for verifying that the battery enclosure/container system has been isolated/shut-down and de-energised during emergencies.

Small-Scale Battery Installations

Information must be available to emergency responders for small-scale installations supplementary to business operations, such as roof-mounted solar panels and small-scale batteries (≤1MW) installed at commercial and industrial buildings.

The location of solar panels, inverters, small battery energy storage systems, and system shut-down controls must be marked on:

- Site plans for the use of emergency services (eg. within the Emergency Information Book and at the Fire Indicator Panel/FDCIE).
- Block plans for the facility (as per *AS 2419.1-2005: Fire hydrant installations*, Clause 7.11: Block plans).
- Essential Services drawings for the facility.

Instructions for isolating or shutting down the system must be provided at the PCE/inverters, the battery energy storage system (if present), and within the Emergency Information Book.

A summary of the installation must be included in the Emergency Information Book and at the FIP/FDCIE. The summary is to include:

- The capacity of the system (eg. 30kW).
- The number of solar panels.
- The details of any battery energy storage system (capacity, chemistry, safety systems, isolation).
- The location of all system infrastructure on-site.

For example: *This facility contains 140 solar panels with a capacity of 30kW, installed on the roof of the production building, connected to power conversion units (inverters) located at the rear of the production building. Please refer to drawing number A102, Revision 1, dated 18/1/22.*

10.3 Personnel Training

All Facilities

Employers must provide information, instruction and training in accordance with the *Occupational Health and Safety Act 2004*.

CFA recommends at least the following information and training is provided to any personnel working at the facility, and visitors as appropriate.

- Facility and operational risks and hazards.
- Facility emergency management roles, responsibilities and arrangements (as per the Emergency Management Plan).
- The on-site emergency warning systems and location of evacuation assembly areas.
- The safe and effective use of any fire-fighting equipment where there is an expectation for staff to undertake first aid firefighting.
- The storage, handling and emergency procedures for dangerous goods at the facility.
- The location of first aid facilities and application of first aid equipment.

For facilities with bushfire or grassfire risk, CFA recommends that all site personnel:

- Download the VicEmergency App and set ‘watch zones’ for the facility location and any related areas of travel.
- Information and training on the warning levels and messages issued by CFA and Emergency Management Victoria.
- Complete CFA's free ‘Bushfire Safety for Workers’ e-learning module prior to the Fire Danger Period. CFA recommends that this module is considered mandatory professional development for all personnel at the facility.

10.4 Emergency Exercises

All Facilities

Emergency exercises provide useful opportunities to test the effectiveness of Emergency Management Plans (EMP). Emergency exercises should be planned in advance, and be focused on strengthening emergency management structures, responsibilities and activities.

Where personnel are present on-site, an annual emergency exercise should be conducted at the facility, with an invitation extended to the local CFA brigade to participate.

CFA recommends that an ongoing program of site-specific emergency response exercises is developed as per *AS 3745-2010: Planning for emergencies in facilities* – Section 7: Emergency response exercises.

Emergency exercises should:

- Test emergency structures, prescribed activities, personnel knowledge, and any assumptions built into the EMP.
- Be consistent with the emergency procedures (based on identified hazards) in the EMP.
- Be conducted in a variety of formats, from internal desktop to multi-agency practical field exercises.
- Be appropriately designed, conducted and evaluated.
- Incorporate 'failure', that is, things 'going wrong' or 'not to plan', such as communication system failures, the absence of the Chief Warden, delays in the arrival of the fire brigade, escalation scenarios. How well does the Plan work in those instances? How can it be modified to be adaptable?
- Be prefixed with an announcement indicating it as an exercise only, and include provision for alerting participants of an actual emergency during the exercises (i.e., 'NO DUFF').
- Incorporate a 'no blame' feedback/evaluation process that includes debriefing and at least one additional feedback method that enables anonymous feedback to be provided.
- On completion, be summarised in written format as a consolidated record of 'lessons identified', with measures and accountabilities to ensure those lessons are incorporated into the Emergency Management Plan (or elsewhere) as required.
- Be a trigger for reviewing the EMP.

Fire Brigade Site Familiarisation

Prior to commissioning of the facility, operators are to offer a familiarisation visit and explanation of emergency procedures to CFA brigades and other emergency services.

Information on the facility's operations, all site access points, its layout and infrastructure, the specific hazards, and fire detection and suppression systems must be provided during this visit. This is particularly critical for renewable energy facilities, where there are processes and infrastructure that pose additional hazards for firefighters during emergency response.

Contact information for at least two persons who may be able to provide information or support during emergencies (24 hours a day) must be provided for unoccupied facilities.

A schedule for ongoing site familiarisation to account for changing personnel, facility infrastructure and hazards, and emergency exercises should be developed in conjunction with the local CFA brigade.

Contact with the local CFA brigade can be made through the local CFA district office. Refer to: https://www.cfa.vic.gov.au/contact/#district.

Further Guidance

CFA recommends the Australian Institute for Disaster Resilience Handbooks, particularly:

- **Managing Exercises** (2017) for further guidance on the designing, conducting and evaluating of practical exercises.
- **Lessons Management** (2019) for further guidance on applying learning experiences from events and exercises.

10.5 Reviewing Emergency Management Plans

All Facilities

Emergency Management Plans are a 'living document' that must be regularly reviewed to ensure their currency and effectiveness.

CFA recommends that EMPs are reviewed:

- Following any changes to the risk on-site pertaining to site infrastructure and operations (Risk Management Plan).
- Following any review of the Fire Management Plan.
- After any activation of the EMP or incident involving notification to the emergency services.
- After emergency exercises.
- At least annually.

Reviews of Emergency Management Plans for renewable energy facilities should be conducted in conjunction with reviews of the Risk Management Plan and the Fire Management Plan.

CFA is able to provide support and advice on emergency planning for renewable energy facilities, and provide advice on Emergency Management Plans. Requests can be made via CFA's Fire Safety Referrals team at firesafetyreferrals@cfa.vic.gov.au.

Notifications

Early notification to CFA during emergencies via 000 allows CFA the best opportunity to provide safe and timely response in the event of rapid escalation.

Outside of emergencies, the local CFA district must also be notified by phone or email at least seven days prior to:

- The commissioning of battery energy storage systems.
- Annual servicing of battery energy storage systems.

CFA recommends that annual servicing of battery energy storage systems should not take place on days of Severe or above Fire Danger Rating, except where the system is experiencing malfunction or abnormal behaviour.

Contact with the local CFA brigade can be made through the local CFA district office. Refer to: https://www.cfa.vic.gov.au/contact/#district.

Fire protection system outages (eg., water-off due to faults or maintenance activities) must be notified to ESTA at burnoffs@esta.vic.gov.au or 1800 668 511.

11 Bushfire Emergency Planning

Effective planning for bushfire can reduce the potential of its impact and severity on your facility and personnel.

11.1 Do I need to plan for bushfire?

Bushfire risk is different for every location, and the potential impact of bushfire is unique to renewable energy facilities facility due to the infrastructure, electrical and chemical hazards. If your facility is at-risk of bushfire it must be addressed in your facility's risk management processes.

11.2 Is my facility at-risk of bushfire?

Your facility may be at-risk of bushfire or grassfire if it is:

- Located in an area where it is close to or amongst dense or open bush, unmanaged grassland, near coastal scrub, or at an urban fringe.
- Identified as being in a Bushfire Prone Area, or within the Bushfire Management Overlay.

Site occupiers have a responsibility to:

- Understand how a bushfire may affect the facility and the possible consequences for its occupants, infrastructure and the surrounding community.
- Be proactive in maintaining both a culture of bushfire awareness and safety.
- Establish and maintain a relationship with the local CFA brigade.

11.3 How can I prepare my facility for bushfire?

Preparing for bushfire is a year-round activity. Plans must be in place for preparing for bushfire well before the commencement of the Fire Danger Period.

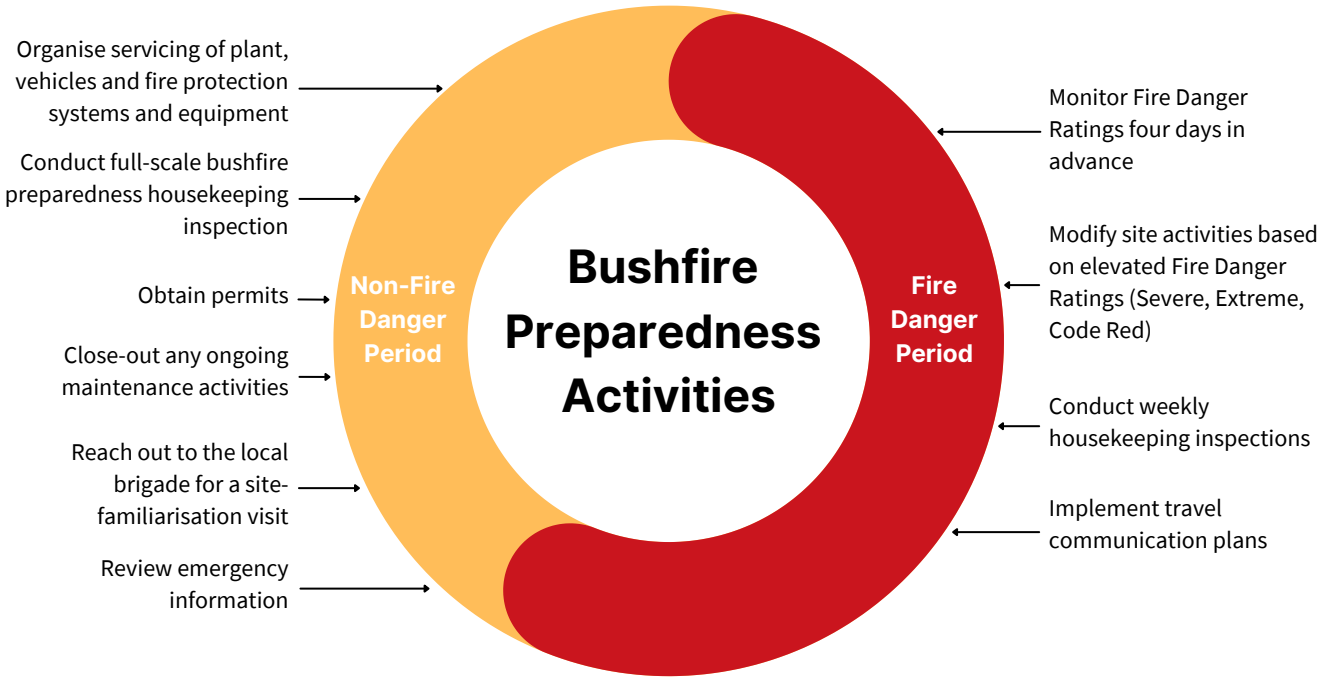
11.3.1 Incorporating Bushfire Preparedness into Your Fire Management Plan and Emergency Management Plan

Bushfire preparedness activities must be detailed within the facility's Fire Management Plan. The activities must be supported by procedures that state the personnel accountable for their completion, the specific actions required, and a schedule.

Any emergency management actions for bushfire must be detailed within the facility's Emergency Management Plan. This must include specific details of activities on days of Code Red, Extreme and Severe Fire Danger Rating.

11.3.2 Review of Emergency Management Plans and Emergency Information

A review of the Emergency Management Plan and the information contained within the facility's Emergency Information Container and Book must be undertaken prior to the Fire Danger Period. Any corrections, removal or addition of information must be completed as a matter of urgency.



11.3.3 Prior to the Fire Danger Period

Bushfire Preparedness Housekeeping Inspection

Site-wide bushfire preparedness housekeeping inspections must be conducted at least three months, and again one month, prior to the Fire Danger Period.

The inspections must focus on:

- **Facility access** - ensuring all vehicle site access points, including emergency access points, are clear and accessible.
- **Fire protection systems and equipment** - ensuring that all equipment is unobstructed, in-service and performing optimally.
- **Fuel/vegetation management** - ensuring that any accumulation of combustible materials are cleared and removed from site.

Fire Protection Systems and Equipment

Fire detection and protection (suppression) systems, alarms, warning, communications and any other emergency equipment must be in effective working order at all times, and any defects, faults or matters affecting the performance of systems must be identified through routine testing and servicing. Maintenance activities must be closed-out prior to the Fire Danger Period.

Managing Fuel/Vegetation On-Site

- Gutters, roof surfaces and valleys, kerbs, traps, sumps, bunds, drains, rooves or any other accumulation points for leaf litter, dry vegetation, or any other combustible materials must be cleared, and the debris removed from site.
- Vegetation management activities must be conducted across the entire facility (eg. grass slashing or mowing, removal of dead/fallen vegetation).
- Extraneous materials or vegetation in fire breaks at the site perimeter, at external building walls, and at other any site plant/assets must be cleared and removed from site.
- Extraneous or unnecessary materials (fuel loads) must be removed from site, eg. dilapidated/stored vehicles, plant or equipment; excess fuel/chemicals; any combustible waste materials.

Facility Plant and Equipment

Procedure(s) must be developed and in place for the isolation, shut-down, fail safe or management of critical/high-risk plant, equipment, and utilities (eg., electricity/gas) at the facility, should evacuation be required.

11.3.4 During the Fire Danger Period

All activities during the Fire Danger Period must be planned prior to the commencement of the Fire Danger Period.

Bushfire Monitoring

Having an understanding of the potential for bushfire in the vicinity of your facility allows maximum implementation time for agreed actions, such as modifying site activities, on days of Severe and above Fire Danger Rating.

Bushfire monitoring involves the identification of bushfire activity within 50km of the facility, through the VicEmergency website, app, or ABC local radio.

A nominated person/role in your Emergency Control Organisation must be responsible for identifying, responding to and communicating the Fire Danger Rating at least four days ahead.

This information must be communicated to everyone likely to be present on-site, and relevant off-site personnel.

Modifying Site Activities

Procedures must be developed and in place to identify and appropriately respond to the Fire Danger Ratings/Total Fire Ban status during the declared Fire Danger Period.

The Fire Danger Rating may require site activities to be altered. Non-essential activities, high-risk maintenance activities, or travel to and from the facility, must be managed in accordance with the advice for the rating.

This means that activities may be postponed or modified on Severe, Extreme and Code Red days. CFA recommends that site emergency plans clearly outline activities based on the requirements of:

- Any Fire Danger Period or Total Fire Ban permits.
- Fire Danger Ratings.

Your procedures must clearly list the activities for each fire danger rating level (eg. this is what we do on Code Red days, this is what we do on Extreme days, etc.)

Activities on these days must be decided well in advance, as part of risk management and emergency planning processes, and not left to be decided on the day.

Activities may include (but are not limited to):

- Closing the site on days of (for example) Extreme and above Fire Danger Rating.
- Limiting non-essential activities on days of Severe and above Fire Danger Rating.
- Limiting travel on days of Severe and above Fire Danger Rating.
- Include bushfire ignition hazards in any Job Hazard Analysis or similar activity-based risk management process for site activities.
- Communicating modified activities and expectations to site staff (and visitors).

On the threat of bushfire impact:

- Communicating with site personnel and supporting their physical relocation.
- Ensuring all buildings and plant are properly secured.
- Initiating any bushfire protection measures such as sprinkler or deluge systems.
- Liaising with the emergency services.
- Ensuring that evacuation/shelter in place areas are equipped with suitable resources.

Travel

Where driving on days of Severe and above Fire Danger Rating is critical and unavoidable, procedures must be developed and in place for planning and undertaking this travel. Never travel into any high-risk bushfire area where a Code Red has been declared.

- Download the VicEmergency App and set 'watch zones' for areas of travel.
- Save the number for the VicEmergency Hotline in your phone: 1800 226 226.
- Safety equipment must be provided, and serviced, in all company vehicles that may be used during the Fire Danger Period.
- A communications plan must be in place to verify that personnel required to travel have arrived safely at each destination.

See CFA's advice on staying safe when you travel.

11.4 Evacuation and Shelter-in-Place

Being absent from site, or leaving early, on days of Severe and above Fire Danger Rating is the safest option to protect site personnel and those for which employers have a duty of care under the Occupational Health and Safety Act 2004. Leaving early means leaving the area before a fire starts, not when flames or smoke is visible.

Evacuating or sheltering-in-place at your workplace during a bushfire potentially puts you, your site personnel and firefighters at extreme risk. This risk is amplified where your business involves:

- Large numbers of people.
- High fire-risk operations or processes.
- Production of combustible materials or their storage/use in production.
- Electrical infrastructure (substations, solar panels, battery energy storage systems).
- Unrestrained products, plant or equipment.
- The storage and handling of dangerous goods.

Commercial and industrial buildings have not routinely been constructed with any additional bushfire protections and may only provide very limited protection.

Leaving once a fire has started may be an option in some circumstances. This is an inherently risky option and safety will be affected by many factors, including the proximity of the fire, access to safe evacuation routes and timely access to incident information.

AS 3745-2010: Planning for emergencies in facilities advises that sheltering in place should only be considered where an evacuation might reasonably expose people to a greater level of danger.

Sheltering-in-place at your facility should only be considered when the following are thoroughly analysed through a risk management process:

- The type of facility.
- Where the facility is located relative to the threat.
- Whether the buildings have been constructed against bushfire impact.
- Whether the grounds and buildings are being maintained to suitable standards.
- The area of defendable space around buildings and infrastructure.
- How the buildings, grounds and plant may be affected by a bushfire.
- The number of occupants.
- Occupants requiring personal emergency evacuation plans (PEEP).
- Accessibility of the site (number and quality of roads in and out of the facility).

Where the Emergency Planning Committee considers sheltering in place an option at your facility, CFA recommends that last-resort procedures are developed to provide direction to site personnel in the event that it is too late to safely evacuate due to bushfire threat, and sheltering-in-place is the only remaining option.

Emergency Management Victoria advises that informal places of shelter should only be considered when all other survival options have failed. Informal shelter options (such as a workplace) may provide some level of protection from radiant heat, the biggest killer in a bushfire.

Emergency procedures for sheltering-in-place are to consider:

- Who will make the decision for personnel to shelter on-site.
- When the decision is made.
- Where personnel are to shelter on-site.
- How to communicate the need to shelter, and the sheltering location, to personnel on-site.
- The on-site emergency resources and equipment to be provided to this location.
- The provision of appropriate signage to identify the shelter location. Signage may also provide additional information such as procedures relating to the use of the place during a fire event.
- Access to incident information.
- Company position and actions if someone insists on leaving the site.
- All vehicle site access points, including emergency access points, must be clear and accessible.

12 References and Resources

12.1 CFA Resources

Country Fire Authority 2019, Guideline for the Provision of Emergency Information - 2019 Update, Burwood, Victoria.

Relevant information from the CFA website (current at the time of publishing):

- Renewable Energy Fire Safety
- Total Fire Bans and Ratings
- Fire Danger Period Restrictions
- Can I or Can't I?
- About Warnings
- Fire Permits
- Am I at Risk?
- Staying Safe When You Travel
- Bushfire Safety for Workers
- Planning and the Bushfire Management Overlay
- Landscaping for Bushfire
- Plant Selection Key
- Electric Line Fire Hazard Ratings

12.2 Victorian Government Resources

Agriculture Victoria, Emergency Management - Bushfires (*Accessed March 2022*).

Emergency Management Victoria, Bushfire Shelter Options (*Accessed March 2022*).

Energy Safe Victoria 2022, Safety standards for High Voltage and Complex electrical installations, ESV, Melbourne.

Environment Protection Authority (Victoria) 2018, 1698: Liquid storage and handling guidelines, EPA, Melbourne.

Victorian Department of Environment, Land, Water and Planning, Building in bushfire prone areas (Accessed March 2022).

Victorian Department of Environment, Land, Water and Planning, Bushfire hazard and behaviour (Accessed March 2022).

Victorian Department of Environment, Land, Water and Planning 2017, Bushfire Management Overlay - Technical Guide, DELWP, Melbourne.

Victorian Department of Environment, Land, Water and Planning 2021, Community Engagement and Benefit Sharing in Renewable Energy Developments, DELWP, Melbourne.

Victorian Department of Environment, Land, Water and Planning 2019, Development of Wind Energy Facilities in Victoria - Policy and Planning Guidelines, DELWP, Melbourne.

Victorian Department of Environment, Land, Water and Planning 2019, Solar Energy Facilities – Design and Development Guidelines, DELWP, Melbourne.

Victorian Department of Environment, Land, Water and Planning 2021, Victoria Planning Provisions.

Victorian Department of Environment, Land, Water and Planning, Victoria Planning Provisions Clause 13.02-1S: Bushfire Planning (*Accessed March 2022*).

Victorian Department of Environment, Land, Water and Planning, Victoria Planning Provisions Clause 53.02: Bushfire Planning (*Accessed March 2022*).

12.3 Relevant Legislation

For acts and statutory rules currently in force for the below, refer to Victorian Legislation.

Building Act 1993
Building Regulations 2018
Dangerous Goods Act 1985
Dangerous Goods (Storage and Handling) Regulations 2012
Electricity Safety Act 1998
Electricity Safety (Bushfire Mitigation) Regulations 2013
Electricity Safety (Electric Line Clearance) Regulations 2020
Electricity Safety (Equipment Safety Scheme) Regulations 2019
Electricity Safety (General) Regulations 2019
Occupational Health and Safety Act 2004
Occupational Health and Safety Regulations 2017
Planning and Environment Act 1987
Planning and Environment Regulations 2015

12.4 Australian Resources

Australasian Fire and Emergency Service Authorities Council 2018, Wind Farms and Bushfire Operations Guideline (AFAC Publication No. 2053), AFAC, Melbourne.

Civil Aviation Safety Authority 2021, Advisory Circular AC 139.E-05 v1.0, Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome.

CSIRO, Assessing Bushfire Hazards (*Accessed March 2022*).

NSW Planning 2011, NSW Planning's Hazardous Industry Planning Advisory Paper 2: Fire Safety Study Guidelines (2011).

Safe Work Australia 2012, Fact Sheet - Emergency Plans and Procedures.

12.5 Australian Standards

Standards Australia 2019, AS/NZS 5139-2019: Electrical installations – Safety of battery systems for use with power conversion equipment, Sydney NSW, SAI Global. *(For systems 200kW or less.)*

Standards Australia 2018, AS ISO 31000-2018: Risk Management – Guidelines, Sydney NSW, SAI Global.

Standards Australia 2017, AS 1940-2017: The storage and handling of flammable and combustible liquids, Sydney NSW, SAI Global.

Standards Australia 2013, SA/SNZ HB 89: Risk management - Guidelines on risk assessment techniques, Sydney NSW, SAI Global.

Standards Australia 2010, AS 3745-2010: Planning for emergencies in facilities, Sydney NSW, SAI Global.

Standards Australia 2008, AS 3780-2008: The storage and handling of corrosive substances, Sydney NSW, SAI Global.

Standards Australia 2005, AS 2419.1-2005: Fire hydrant installations – System design, installation and commissioning, Sydney NSW, SAI Global.

12.6 International Guidance and Standards

CFPA Europe, Wind Turbines Fire Protection Guideline (CFPA-E No. 22:2022 F), March 2022.

FM Global 2020, Property Loss Prevention Data Sheet 5-33: Electrical Energy Storage Systems, FM Global.

National Fire Protection Association (NFPA) 2020, NFPA 855: Standard for the Installation of Stationary Energy Storage Systems, NFPA.

UL, Energy Storage Systems and Equipment (2020), UL 9540.

UL, Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems (2019), UL 9540A.

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