



Guidance Note: GN03

Fire Safety Considerations for Open Yard Storage

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NOTE: GN03

FIRE SAFETY CONSIDERATIONS FOR OPEN YARD STORAGE

1. Purpose

The purpose of this Guidance Note (GN) is to provide consistent advice regarding fire protection considerations for open yard storage that meet the FES Commissioner's operational requirements when responding to a fire incident.

This guidance note is aimed specifically at operators to help them manage open yard storage facilities as safely as practicable, and to ensure that fire mitigation strategies employed are based on established fire engineering principles, tests, data, fire incidents and field experience.

It is suggested that owners / operators may need to engage the services of a suitably experienced Fire Engineer to assist in formulating open yard layout designs based on the advice contained in this GN.

2. Scope

This GN acknowledges the minimum mandatory requirements of legislation as well as specifying DFES's recommended considerations regarding the fire mitigation strategies required for open yard materials storage areas, including shipping container storage areas.

*Australian Standard (AS)2419.1, "Fire hydrant systems, design, installation and commissioning defines an open yard as: "a designated area greater than 500m² which may be used for storage or processing of **combustible material**".*

An open yard may or may not be associated with a structure on the same allotment.

3. Regulatory Requirements

Whilst open yard storage fire hydrant requirements are prescribed in (AS) 2419.1, the requirements within are not empowered through referencing by the National Construction Code (NCC) as open yards are not an NCC classified structure.

Additionally, the fire protection requirements in AS2419.1 are generic and take no account of the types of materials stored or the configuration of storage.



This GN does not modify existing requirements within other legislation or DFES Guidance Notes for fire protection requirements for a specific type of material stored in an open yard, e.g. rubber tyre storage.

Where open yard storage is associated with a structure which under the provisions of the NCC is required to meet prescribed fire protection requirements, e.g. NCC requirements for “Large Isolated Buildings – Vehicular Access Paths”, the vehicular access and 18 metre clear space requirements prescribed in the NCC (between structure and boundary) must still be met. This GN does not modify those requirements. Refer to DFES Guide Line [GL-11](#) “**DFES Site Planning and Fire Appliance Specifications**” for general principals and technical guidance.

4. Open Yard Storage – Fire Risk Management

4.1 Managing Potential Fire Size and Impact

The most effective means of preventing a very large fire requiring considerable DFES resources over a protracted time is limiting storage (fuel) quantities through employment of adequate material separation practices. It is also by default an insuring action by owners / operators against significant loss of stock and business continuity.

Fire separation can be achieved in one of 2 ways:

- Physical non-combustible barriers between amounts of fuel, or
- Adequate distance between amounts of fuel.



Figure 1: Two (2) ways to achieve fire separation

This GN discusses separation by distance only as this is the most common storage configuration for larger fuel quantities.



4.2 Points to Consider when Determining Adequate Separation Distances

Radiant heat versus ignitability of product is the basic principal of determining an adequate separation distance, i.e. the heat received by unignited materials adjacent to the radiator (the burning pile) should be safely below the ignition temperature of the materials being stored.

The two variables affecting this are:

- The distance between piles measured from flame edge, and
- The area of the radiator facing the unburnt material (view factor).

It is suggested that a conservative safety factor be applied to the calculated distance to account for wind (causing a piloted ignition of adjacent piles), stock falling from piles, and tenability of fire fighters moving between piles. The fire engineer will determine this.

Fire separation by distance is not a new concept, for example Australian Building Codes have, for many years, required a separation distance of six (6) metres between commercial type buildings to reduce likelihood of fire spread. Yet this distance is reduced to 3.6 metres between ordinary stand-alone dwellings. The use of basic fire engineering principals, i.e. single dwelling houses are generally limited in their overall size, height, room sizes, external ignitability and a lower radiant heat is (usually) emitted to the boundary.

4.3 Pile (Fire) Size Limitations

Limiting piles to a size where a developed fire can be contained or extinguished by suitably trained and clothed site personnel, using fire extinguishers and or fire hose reels is always an optimum strategy. However, it is recognised that limiting pile sizes to this level may not always meet business requirements.

The next best practice would be to limit piles to a size where if fully involved in fire, it could be extinguished using only the water stored on a responding fire appliance. Typically, in an urban environment this will be a pumping appliance carrying approximately 1200 litres of water which can be delivered to the fire using an on-board heavy-duty fire hose reel.

In addition to the fuel management strategies recommended, there is a requirement in AS2419.1 to provide fire hydrant coverage to all areas of open yard storage exceeding 500m².

4.4 Examples of Incidents Involving Open Yards

FIRE IN PLASTIC GRAPE BINS STORED IN AN OPEN YARD

Piles are either too large or too close considering:

- Ignitability.
- Radiant - heat release rate of product and
- Flame size - length / velocity properties, figure 2 and 3.



Figure 2: Fire in plastic grape bins stored in an open yard

MOULDED PLASTIC GRAPE BINS IN OPEN YARD

- Fire spread is uncontrollable, figure 3.



Figure 3: Moulded plastic grape bins in open yard



SCRAP METAL YARD FIRE

- Contained to a single pile due to stockpile separation practices.
- However, this stockpile is excessively large, figure 4.



Figure 4: Scrap metal yard fire

FIRE IN PILED AND BALED RECYCLABLES IN VICTORIA, 2017

- Significant stock destroyed as there was no separation practices used.
- Fire took 3 days to control and over a week to extinguish, figure 5.



Figure 5: Fire in piled and baled recyclables in Victoria, 2017



WA SALVAGE

- The fire that destroyed this store started in a pallet of citronella oil displayed in the yard outside of the building, figure 6 & 7.



Figure 6: WA Salvage Incident



Figure 7: Location of stored citronella oil in yard relative to building



5. Fire Hydrants

Fire hydrant systems should be provided, located, and designed to operate at a residual pressure in accordance with the provisions of AS2419.1 as it applies to open yard hydrant coverage.

Every part of all storage, production equipment and plant in the protected area is to be within reach of a 10m hose stream issuing from a nozzle at the end of a maximum 60m length of hose connected to a fire hydrant outlet.

Where any part of the fire hydrant pipework is situated above ground and within 150m of any structure in the protected area, fire hydrants shall be placed not more than 60m apart along the pipe work.

Hydrants shall be sited at an accessible location and at a minimum two sides of storage area to allow firefighting from an upwind direction.

The number of fire hydrant outlets required to discharge simultaneously for protected open yards shall be determined in accordance with Australian Standard 2419.1, Table 3.3 at a flow rate and pressure in accordance with Table 2.2 and Table 2.3.

Further to the provisions of AS2419.1, the positioning of hydrants should not require a fire appliance or firefighter to pass within 10 metres of stored materials to make a connection to a fire hydrant. To achieve this objective, more hydrant standpipes may be required than the number prescribed by AS2419.1

6. Provisions for Special Hazards (Fire-Fighting Water Supplies)

Where the materials being stored are fire sensitive dangerous goods or have:

- Inherently low temperature ignitability properties or,
- Properties making extinguishment difficult such as tyres, combustible metals, compost / mulch / peat and the like, bulk baled carbonaceous materials such as hay, wastepaper (awaiting recycling) expanded plastics, etc. or,
- A storage configuration making extinguishment difficult (high stacking, large footprint piles such as scrap metal yards), or has several multidimensional protected areas (protected from extinguishing water penetration) such as auto dismantler or crushing yards, etc.

Suitable additional provisions should be made as special problems for firefighting are likely to arise. The problems encountered are possibly going to require a water supply that exceeds the minimum requirements prescribed in AS2419.1 to account for longer duration fire-fighting effort or higher flow rates to permit a greater number of hose streams.

Refer to DFES Guidance Note [GN01](#) "**Firefighting Water Supply Considerations Special Hazard & Dangerous Goods Sites**" for general principals and technical guidance on determining an appropriate fire-fighting water supply volume and duration.



7. Emergency Vehicular Access and Hardstand

The ability to apply water effectively to a fire is a critical element of timely extinguishment. This capability needs to be supported by the provision of adequate vehicular access through and around stored materials.

Generally, the fire hydrant coverage requirements detailed in AS2419.1 will guide where vehicular access is required, however there are additional provisions that can be made to ensure a fire service response is effective, safe and meets DFES operational requirements:

- Vehicular access paths should be a minimum of 4 metres wide, widening to 6 metres at the approaches and departures of bends more acute than 120°. There should be at least 2 means of accessing the vehicular access path and they should be as far apart as possible.
- Vehicular access paths should meet the construction requirements for a hard stand surface as defined in AS2419.1.
- Hard standing surfaces adjacent to hydrants should be impervious to water, i.e. asphalt, concrete surfaces and be capable of supporting the weight of a fire service pumping appliance.
- A vehicular access path should be provided around the entire perimeter of the yard to facilitate the fire service operating (generally) up wind of the fire location.
- Where vehicular access paths traverse areas between piles of stored materials, no part of the path should be closer than 10 metres to the stored material.
- There should be no dead-end vehicular access paths allowing a continuous forward movement along all paths.
- The vehicular access path layout should not require a fire appliance to be less than 10 metres of stored materials.

8. Further Design/Layout Considerations

When assessing the location of fire hydrants for open yard storage, the following points need to be considered in the context of an assumed fire event/incident:

- Protection of above ground fire hydrants and or associated pipe work from external damage.
- The amount of radiant heat the fire hydrant may be exposed to.
- Fire hydrant locations should be external to bunds.
- Proximity of isolation valves to stored materials.
- Proximity of fire hydrants to stored products.
- Consideration of the topography and drainage in relation to contaminated fire water run-off.
- The location of monitors, especially if they are manually operated, are subject to the above considerations.
- Site security – limit access of unauthorized personnel and or public.



9. Shipping Container Storage Yard

Typical intermodal shipping containers are designed to be stacked 6 to 9 containers high and to hold weights of 32205kg (of often indeterminate content) making extinguishment of a fire event a particularly challenging and possibly dangerous operation. The inherent strength and typically low levels of ventilation (0.0079% of the wall and roof area) make them particularly prone to an explosive failure should volatile contents combust rapidly, e.g. flammable gas vessel leakage, chemical reaction, etc.

When considering the layout / design of open yards for shipping container lay-up, the following should be considered (in addition to all the above points and relevant legislation):

- Provide adequate lighting to whole of yard, (assists fire services and deters unauthorised access).
- Use only pillar type hydrants, (below ground hydrants are prone to being covered and can be difficult to locate).
- All (filled) containers are to be positioned with a door end readily accessible.
- Hydrant system isolation valves are to be outside of designated storage areas.
- Containers having known volatile contents should be distributed laterally across the yard Rather than Stacked in A Single Cluster.

10. Container Storage Yard

Access by fire fighters to container doors is restricted by the set down / lay-up configuration used, figure 8.

NOTE: Configuration is acceptable if all are empty.

Storage configured with all door ends accessible to fire-fighters, and not stacked overly high, figure 9.





Figure 8: Container Storage Yard



Figure 9: Storage configuration all doors accessible to firefighters

Examples of Challenging incident's faced by firefighters and operators at container storage yards:

- Ability to access incident scene extremely challenging, figures 10.
- A difficult and costly clean-up for the operator, figure 11.



Figure 10: An extremely challenging firefighting incident



Figure 11: A challenging clean-up for the operator

11. Key Message

Key message is:

- Keep pile sizes as small as practicable and as far apart as practicable.
- Engage a Fire Engineer to determine maximum pile sizes vs separation distance.
- Provide a fire water supply commensurate with fire scenario.
- Provide access to all stored materials for fire appliances and fire fighters.
- Keep stored materials away from structures and ignition sources.

This Guidance Note should be read in conjunction with DFES Guidance Note (GN01) “**Firefighting Water Supply Considerations for Special Hazard & Dangerous Goods Sites**”.

12. References

Australian Standard 2419.1 – 2005 Fire Hydrant Installations – System design, installation and commissioning.

DFES GN1 - Firefighting Water Supply Considerations for Special Hazard and Dangerous Goods Sites.

DFES GN2 - Bulk Storage of Rubber Tyres and Shredded and Crumbed Tyres.

Melbourne Metropolitan Fire Brigade.

13. Legislation

Building Code of Australia - ABCB National Construction Code (only in relation to structures associated with an open yard).



Please note: This is a controlled document. DFES Guidance Notes are available on the DFES Website: www.dfes.wa.gov.au under Regulation and Compliance.

Should the information provided in this Guidance Note require further clarification, please contact DFES Manager Critical Infrastructure/Heavy Industry (08) 9395 9300.

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Contact

Department of Fire and Emergency Services

Emergency Services Complex
20 Stockton Bend
COCKBURN CENTRAL WA 6164

PO Box P1174 Perth WA 6844

Tel: +61 8 9395 9300

Email: dfes@dfes.wa.gov.au

Web: www.dfes.wa.gov.au