Fire Safety and Waste Management Facilities – Common Issues Encountered in the Industry

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Figure 1 – Photograph of typical waste pile within a waste sorting facility.

Introduction

The Federal Government introduced the Recycling and Waste Reduction Act 2020 [1] in early December 2020, banning the export of unprocessed waste overseas. This legislation is expected to provide a stimulus to reconfigure local infrastructure to reprocess and re-manufacture recyclables onshore in Australia. This article sheds light on fire safety considerations for the growing number of waste management facilities being established around Australia.

Waste Management and treatment Facilities (WMF) come in various shapes and sizes each processing different types of waste products ranging from household chemicals to organic waste. The nature of these facilities and the materials stored within present unique set of risks in relation to site and building fire safety.

[1] Recycling and Waste Reduction Bill 2020

WMF Operational Mode

Many of these WMF operate in a manner that allows a large deposition of waste material to be collected and piled up a typical example of which is shown in Figure 1. The waste collected here is then sorted into various segments for further treatment including recycling or disposal as shown in Figure 2. Such segregated waste is then held on site until collection, transfer or further treatment is viable.

Figure 2 – Sorted timber waste at a waste management facility awaiting collection.

WMFs may also operate on the basis of exclusively accepting certain waste streams, such as chemical waste, paints, solvents and e-waste products. Such facilities present a further unique set of risks where both the building and process risk needs consideration along with installed fire services.

BCA Considerations for WMFs

It is noted that there is no pre-defined classification for WMFs in the Building Code of Australia (BCA). However, there are typically two (2) building classifications that capture facilities namely: (i) Class 7b warehouse for waste storage and handling; or (ii) Class 8 industrial plant for waste sorting, processing and treatment. Some WMFs have a combination of Class 7b and Class 8 use with implications for occupant life safety and fire brigade intervention.

Many WMFs typically encompass long-span single storey warehousing buildings. Type C Construction, the least fire resistant construction under the BCA Deemed-to-Satisfy (DtS) Provisions can be readily applied but compartment size limitations restrict sizes to a maximum floor area of 2,000 m^2 and volume of 12,000 m^3. These limitations can be surpassed by applying Type A or Type B construction or applying Large-isolated Building provisions under BCA C2.3 as provided in the excerpt in Figure 3.

C2.3 Large isolated buildings

The size of a *fire compartment* in a building may exceed that specified in Table C2.2 where—

(a) the building does not exceed 18 000 m^2 in *floor area* nor exceed 108 000 m^3 in volume, if—

(i) the building is Class 7 or 8 and—

(A) contains not more than 2 *storeys*; and

(B) is provided with open space complying with C2.4(a) not less than 18 m wide around the building; or

(ii) the building is Class 5, 6, 7, 8 or 9 and is—

(A) protected throughout with a sprinkler system complying with Specification E1.5; and

(B) provided with a perimeter vehicular access complying with C2.4(b); or

(b) the building is Class 5, 6, 7, 8 or 9 and exceeds 18 000 m^2 in *floor area* or 108 000 m^3 in volume, if it is—

(i) protected throughout with a sprinkler system complying with Specification E1.5; and

(ii) provided with a perimeter vehicular access complying with C2.4(b); or

(c) there is more than one building on the allotment and—

(i) each building complies with (a) or (b); or

(ii) if the buildings are closer than 6 m to each other they are regarded as one building and collectively comply with (a) or (b).

C2.4 Requirements for open spaces and vehicular access

(a) An open space *required* by C2.3 must—

(i) be wholly within the allotment except that any road, river, or public place adjoining the allotment, but not the farthest 6 m of it may be included; and

(ii) include vehicular access in accordance with (b); and

(iii) not be used for the storage or processing of materials; and

(iv) not be built upon, except for guard houses and service structures (such as electricity substations and pump houses) which may encroach upon the width of the space if they do not unduly impede fire-fighting at any part of the perimeter of the allotment or unduly add to the risk of spread of fire to any building on an adjoining allotment.

(b) Vehicular access *required* by this Part—

(i) must be capable of providing continuous access for emergency vehicles to enable travel in a forward direction from a public road around the entire building; and

(ii) must have a minimum unobstructed width of 6 m with no part of its furthest boundary more than 18 m from the building and in no part of the 6 m width be built upon or used for any purpose other than vehicular or pedestrian movement; and

(iii) must provide reasonable pedestrian access from the vehicular access to the building; and

(iv) must have a load bearing capacity and unobstructed height to permit the operation and passage of *fire brigade* vehicles; and

(v) must be wholly within the allotment except that a public road complying with (i), (ii), (iii) and (iv) may serve as the vehicular access or part thereof.

Figure 3 – Extract from National Construction Code Building Code of Australia 2019 Volume 1 Amendment 1.

Large-isolated Building provisions trigger other requirements like sprinkler protection, smoke hazard management and perimeter vehicle access for fire brigade appliances. This can pose design challenges especially for existing facilities. However, a performance based fire engineered approach can provide an avenue to address the latter.

Fire and Rescue NSW (FRNSW) Guideline

Due to the recent fire incidents at WMFs and the potential for undetected fires to rapidly escalate within waste stockpiles, FRNSW has published a guideline for fire safety in waste facilities (FRNSW 2020). The objective being to address the various regulatory requirements for WMFs using information gathered from first-hand fire-fighting and operator experience in NSW and other jurisdictions in Australia.

The FRNSW Guide provides explanatory direction on common fire safety considerations during WMF design, some of which are discussed below:

Consideration 1: Waste Stockpile Fire Hazard

There are two causes for concern here, firstly there is a potential for certain waste products to self-heat and as such ignite materials around it. Such fires could potentially be deep seated within the stockpile making fire detection and intervention difficult.

To assist with firefighting operations, the FRNSW Guideline recommends that the maximum stockpile height should be no more than 4 m. Furthermore, in a fire situation attending firefighters would utilise the onsite equipment (excavators and the like) to relocate stockpiles that are stored within enclosed areas.

This allows Fire Safety Engineers to make informed decisions regarding maximum stockpile heights, face angles and isolation distances to minimise the potential fire spread between stockpiles.

Consideration 2: Fire Detection Efficacy

The environment within the building has a significant impact on the fire detection system proposed in a WMF. Typically, the environment within a WMF is dependant upon the waste material being processed or stored often leading to a dusty environment, air-borne particles or debris all of which can cause false fire alarms. Furthermore, vehicle emissions from garbage trucks and on-site material handling vehicles e.g. excavators or front loaders, also impact on the efficacy of fire detection systems. Hence, careful consideration is required. Hence, there can be design challenges with the efficacy of conventional fire detection and newer technologies like thermal imaging, flame detection or video smoke detection are possible solutions. However, these newer solutions may require site specific customised design, testing and monitoring to provide a reliable means of fire detection in WMFs.

Consideration 3: Smoke Hazard Management

The building geometry, internal wall layouts, roof ventilation design, make-up air provisions and spatial configuration of respective sorting machinery greatly impact on the smoke management strategy within the building. Often the building is designed as a shell with the internal configuration an after-thought. Understanding the internal spatial design of the building during operation is critical for the development of a robust fire safety strategy for a WMF. A detailed Computational Fluid Dynamics (CFD) smoke model of various operational modes during the life of the building is a valuable design tool to enable the Fire Engineer and other design team members to address occupant evacuation and fire brigade intervention to meet BCA Performance Requirements.

Tailor-made Site-Specific Fire Design

A holistic performance-based fire safety strategy is essential to address BCA Performance Requirements and FRNSW Operational Requirements for modern WMFs. The management of waste stockpiles in relation to fire hazard, fire detection efficacy and smoke hazard are some of the key considerations for WMF fire safety design. A ‘tailor-made’ site specific fire engineering approach is recommended for each WMF considering the processing/ treatment functions being undertaken, intended various operational modes and the type of waste being processed/ stored.

Further Links

FRNSW (2020), 'Fire safety in waste facilities', FRN14/3255 D17/81582 Version 2.02, available on: https://www.fire.nsw.gov.au/gallery/files/pdf/guidelines/guidelines_fire_safety_in_waste_facilities.pdf Last accessed on 28 Jan 2021.

UTS (2020), 'Australia's waste export ban becomes law', available on: https://www.uts.edu.au/news/social-justice-sustainability/australias-waste-export-ban-becomes-law Last accessed on 28 Jan 2021.

Waste Contractors and Recyclers Association of NSW (2019), available on: http://wcra.com.au/ Last accessed on 28 Jan 2021.