Holistic Performance-based Framework to Address Fire Safety in Waste Management Facilities (WMF)

SFS and SFPE Joint International Conference on Holistic Fire Safety Design
26-28 July 2023
Brisbane, Australia

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Presentation Outline

- Part 1 – Waste Management Facilities Background
- Part 2 – Historical WMF Fire Incidents
- Part 3 – Legislative Framework
- Part 4 – Holistic Fire Engineering Framework

Altens East Scotland Fire 8 July 2022

Altens East Fire Timeline 10 July 22

- 15:57 Roller shutters closed
- 16:06 Smoke observed
- 16:35 Fire alarm
- 16:37 Fire Brigades alerted
- 16:44 Fire Brigades arrive
- 16:47 Fire spread to 2 other stockpiles
- 16:47 Sprinkler activation
- 16:48 Fire Brigade Intervention
- 22:00 Fire extinguished

https://www.heraldscotland.com/news/20268048.aberdeen-altens-east-recyling-plant-fire-continues-affecting-water-supplies/

Part 1 – Waste Management Facility Background

- Recycling & Waste Reduction Bill 2020 banned export of unprocessed waste offshore
- Stimulus to reconfigure local infrastructure to process onshore
- The Covid-19 Pandemic led to an increase in medical waste generated
- Pre-Covid medical waste in China was 40-50 T/day increasing to 250 T/day in 2020 (Sill, 2020) i.e. 5 fold increase

What is Waste? NSW Definition

Protection of the Environment Operations Act 1997 No 156 (PEOA)

- any **substance** (whether **solid, liquid or gaseous**) that is **discharged**, **emitted** or **deposited** in the **environment** in such volume, constituency or manner as to **cause an alteration in the environment**, or
- any **discarded**, **rejected, unwanted, surplus or abandoned substance**, or
- any **otherwise discarded, rejected, unwanted, surplus or abandoned substance intended for sale or for recycling,** processing, recovery or purification by a separate operation from that which produced the substance, or
- any **processed, recycled**, **re-used** or **recovered** substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations, or
- any substance prescribed by the regulations to be waste.
- A **substance is not precluded from being waste** for the purposes of this Act merely because it is or may be processed, recycled, re-used or recovered.

What is Waste? QLD Definition

Environmental Protection Act 1994 – Defines waste as:

- Waste includes anything, other than an end of waste resource, that is—
- (a) left over, or **an unwanted by-product**, from an **industrial, commercial, domestic** or **other activity**; or
- (b) **surplus** to the **industrial, commercial**, **domestic** or other **activity generating the waste**.

Queensland Government

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What is Waste? VIC Definition

Environmental Protection Act 2017 – Defines waste as:

- Waste includes any of the following—
- (a) **Matter**, including **solid, liquid, gaseous or radioactive matter**, that is **deposited, discharged, emitted or disposed** of into the environment in a manner that alters the environment.
- (b) A **greenhouse gas substance emitted or discharged into the environment**.
- (c) Matter that is **discarded, rejected, abandoned, unwanted or surplus**, irrespective of any potential use or value.
- (d) Matter prescribed to be waste.
- (e) **Matter or a greenhouse gas substance** referred to in paragraph (a), (b), (c) or (d) that is intended for, or is **undergoing**, **resource recovery**.

WMF vs MRF vs RRC?

- Waste Management Facilities (WMF) collection and sorting facilities for non-recyclable waste (i.e. red or green bin)
- Materials Recovery Facility (MRF) collection and sorting facility for items that are placed into household recycling bin (i.e. yellow bin)
- Resource Recovery Centres (RRC) are collection centres for items that can't be placed into household recycling bin (e.g. batteries, polystyrene, e-waste and the like)

Photo 1 *Materials recovery facilities (MRFs) sort domestic recyclables into product lines using mechanical and manual processes*

NAWMA's Adelaide MRF processes about 60 kt/yr of domestic recyclables. Clockwise from top: the start of the sorting process; manual separation of glass contaminants; unprocessed recyclables; a rotating trommel that allows small items to fall through the holes while larger items fall from the open end. *Photos kindly provided by NAWMA.*

Source: WMRR National Waste Report 2022

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Introduction to Waste Management Facilities

- Waste Management Facilities (WMFs) come in various shapes and sizes.
- The nature of the facilities and the materials stored within each present a unique set of risks.

What is the Hazard & Related Fire Risk?

- Type of materials being stored and processed on site?
  - Is the material combustible?
  - Is the material capable of self-heating?
  - Is the material capable of propagating a fire?
  - In the event of a fire will the material release gases that are detrimental?
- What is the process that is occurring on site?
  - Is it a sorting facility?
  - Is it a storage facility?
  - Is it a materials recovery facility?
- Other factors such as incorrect waste disposal

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Part 2 – Major Historical Waste Fire Incidents

Source: Bunbury Mail 2018

Source: Canberra Weekly 2022

Source: BBC UK 2018

Bellevue Hill, Western Australia, 2001

- Facility contained around 500,000 L of chemicals and toxic solvents
- A chemical drum exploded resulting in a major fire incident involving toxic chemicals
- Water was applied to the fire to control it, however this resulted in contaminated run off
- It took 10 years for the WA government to remediate the site

Source: ABC News 2010

Coolaroo, Victoria, 2017

- The fire originated in a pile of cardboard stored on site
- The facility functioned as a Materials Recovery Facility with a focus on household recycling and waste
- Fire took 3 weeks to extinguish with around 140 million litres of water used
- Raised community concerns about the location of such facilities and the proximity to residential communities

Source: Australian Institute of Disaster Resilience

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Eastern Creek, New South Wales, 2023

- Cause of the incident is still being investigated
- Fire originated in a waste separator
- Spreading via the conveyor belt to the adjoining building

View of the smoke plume
Source: Sky News Australia

Aftermath of the fire
Source: Sky News Australia

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Part 3 – Legislative Framework & State Guidelines

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Fire safety in waste management facilities

PROCEDURAL

GUIDELINE
Version 1.0
5 May 2022
Doctrine ID: 3095

NSW GOVERNMENT

Queensland Government

VICTORIA State Government

NSW GOVERNMENT | FIRE + RESCUE

Fire safety guideline
Fire safety in waste facilities

Version 02.02
Issued 27 February 2020

ENVIRONMENTAL SERVICES AND REGULATION

Guideline – Prevention of fires in waste stockpiles

Owner: Compliance Support, Enforcement Services **ESR/2020/5409**
Last Reviewed 02/12/2020 **Version 1.00**

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2. Impact of a fire in a waste stockpile

Waste fires, when they occur, are a threat to the environment and human health. The consequences of fire at a waste facility include:

- Environmental harm via:
  - Release of contaminants into the air including smoke, asbestos and particulate matter.
  - Release of run-off of firewater, combustion products and firefighting chemicals that may impact ground and surface waters.
- Impact upon human health caused by the toxic nature of smoke and contaminants released into the environment by the fire.
- Significant costs associated with the clean-up following a fire.
- Compliance actions for offences under relevant legislation including the *Environmental Protection Act 1994* (EP Act) and the *Waste Reduction and Recycling Act 2011* (WRR Act).

2.1 Stockpile

'Stockpile' is a term that generally refers to any vertically piled storage of material, whether loose, baled, sorted or not, accumulated for future use. Stockpiles are not limited to solid materials. Liquid wastes accumulated for future use are also considered to be stockpiled.

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Management and storage of combustible recyclable and waste materials – guideline

Publication 1667.3 July 2021

EPA VICTORIA | VICTORIA State Government | FIRE RESCUE VICTORIA | CFA

Legislative Framework – New South Wales

NSW Environmental Protection Authority sets out the following legislation:

- Environmental Protection Act 1993
- Environmental Protection Regulations 2009
- Environment Protection (Waste to resources) Policy 2010
- Protection of the Environment Operations Act 1997

Other guidelines adopted in NSW:

- Fire Rescue NSW Fire Safety in Waste Facilities Guideline
- NSW EPA Fire Safety in Waste Facilities Guide
- New vs Existing

NSW GOVERNMENT FIRE + RESCUE

Fire safety guideline

Fire safety in waste facilities

Version 02.02
Issued 27 February 2020

Facility	'Acceptable solution'	'Alternative solution'
New facility	Assessed by the consent authority	Assessed by FRNSW
Modification of an existing facility	Assessed by the consent authority	Assessed by FRNSW
Existing facility with an issued Order or notice	Relevant consent or regulatory authority will identify specific conditions on the Order or notice	

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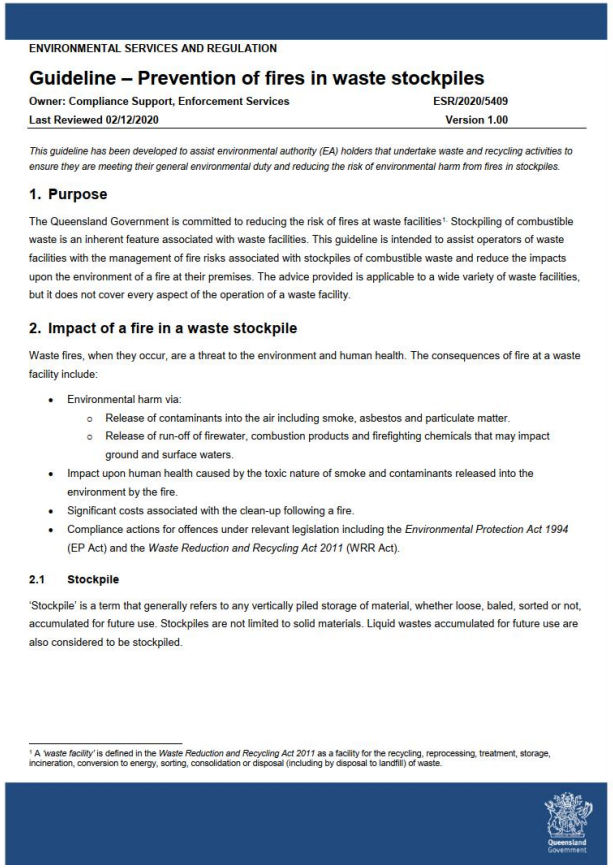
Legislative Framework - Queensland



ENVIRONMENTAL SERVICES AND REGULATION

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Queensland Government

QLD Department of Environment and Sciences sets out the following legislation:

- Environmental Protection Act 1994
- Environmental Protection Regulation 2019

Other Guidelines Adopted in QLD:

- DFES Prevention of Fires in Waste Stockpiles

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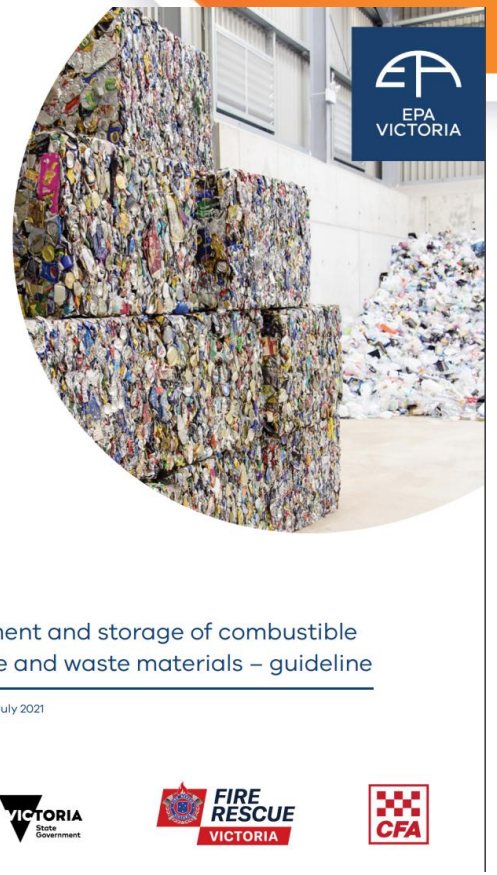
Legislative Framework - Victoria

VIC Environmental Protection Authority sets out the following:

- Environmental Protection Act 2017
- Environment Protection Regulations 2021
- General Environmental Duty
- EPA 1667.3 Management and Storage of Combustible Recyclable and Waste Materials Guideline
- Victorian Parliament inquiry into recycling & Waste Management 2022



https://new.parliament.vic.gov.au/get-involved/inquiries/inquiry-into-recycling-and-waste-management

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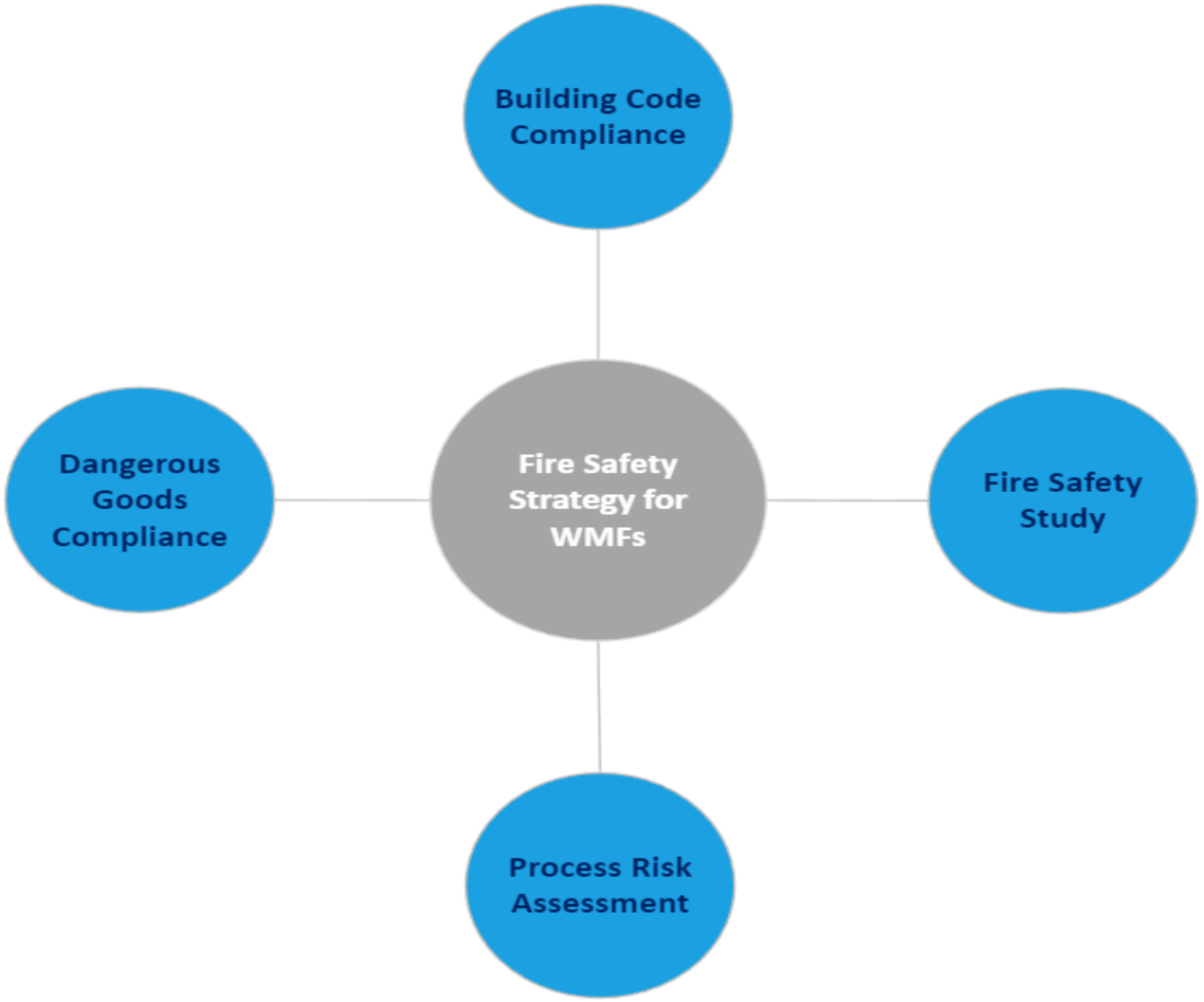
National Construction Code

- WMF fire risks are not readily covered by the prescriptive Deemed-to-Satisfy (DtS) provisions of the Building Code of Australia (BCA) necessitating a Performance-based approach.
- The application of BCA Clauses E1.10 (E1D17) and E2.3 (E2D21) referring to Special Hazards, states that additional provision must be made if problems of fighting a fire could arise because of certain aspects.
- How do you meet the intent of BCA Clauses E1.10 (E1D17) and E2.3 (E2D21) when addressing WMFs?

Part 4 – Holistic Fire Safety Framework



Dangerous Goods Assessment

- Are Dangerous Goods (DG) (as per AS 1940 or other relevant DG legislation) being stored / processed on site?
- If yes, then a DG assessment / review would be proposed to capture the potential risks
- The DG assessment / review would potentially dictate the fire services required on site
- Consideration of the Dangerous Goods must be undertaken as part of the holistic approach to fire safety in WMF's

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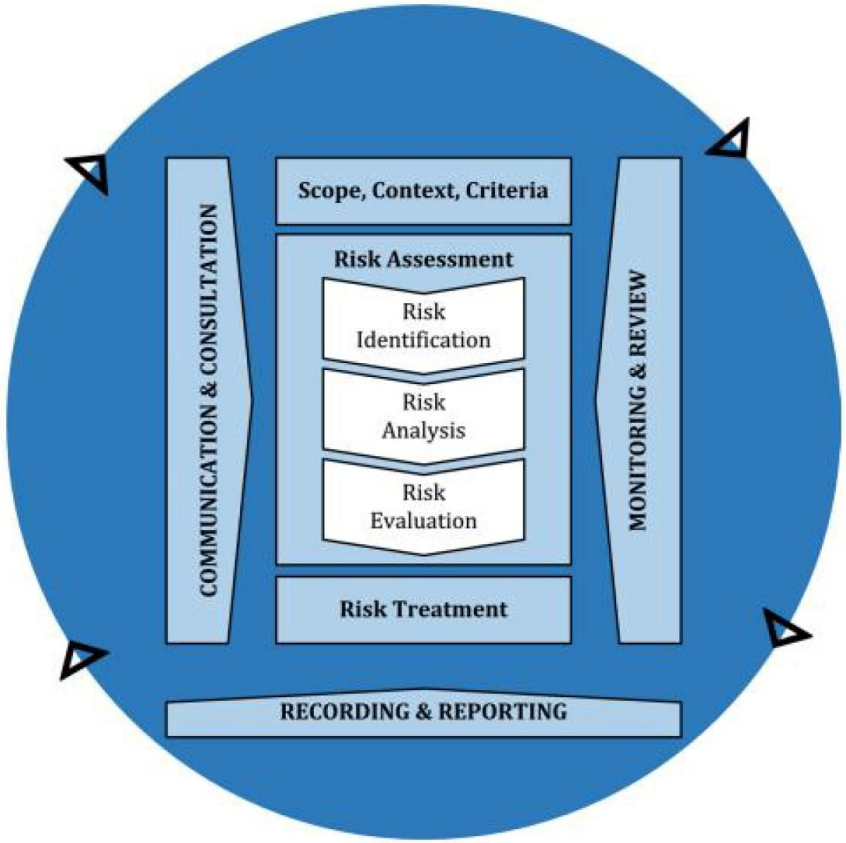
Process Risk Assessment

- Process risk assessment forms a vital part of the fire safety strategy as it allows the identification of hazard and analysis of the risks from the process equipment and stored waste.
- A risk assessment of the entire process utilising the ris management framework in ISO 31000:2018.
- A first principles ground up risk assessment of the site to facilitate a comprehensive understanding of the potential fire hazards and likely consequences.
- This contrasts with the traditional top-down approach in the WMF sector where many of the emerging hazards may be missed.



Hazard Number				Hazard Identification		Treatments	Current Rating			Risk Treatment	Residual Rating			Comment
No.	Area	Category	Element	Hazard	Consequences	Controls	Consequence Rating	Likelihood Rating	Risk Rating	Tasks/Actions	Consequence rating	Likelihood rating	Residual Risk	
1. Non-Fire Related														
1.1	MRF 2	Egress	Stockpile - Co mingled	Accumulation of general material under machines blocking access to exits in the facility	Inability to exit the facility as material would be blocking the exit	1.General maintenance to ensure that access paths around machinery are maintained and well defined.	Major	Possible	12	1. Control measure to ensure that the egress paths are always clear this could be egress paths provided with barriers. Line marking on the floor / bunkers and the like 2. Additional overhead illuminated exit signage hanging from the ceiling to be provided in the MRF 3. Intermediate exit signage to be provided	Major	Unlikely	8	
2. Environmental														
2.1	External	Environmental	Diesel Fuel Pod	Spillage of diesel fuel occurring whilst filling tank	Environmental impact of diesel fuel	1.Fight fire using dry powder fire extinguishers 2.Have escape route should fuel container rupture 3.Use spill absorbent to make bunds to prevent fire water from entering storm water 4. Compliance with AS 1940 and UL requirements - placarding , decanting procedures and spill procedures	Moderate	Likely	12	1.Disel Fuel tank located above ground 2.Spill clean kits 3. DG Input on the Diesel fuel tank 4. Approx. 10 m from buildings 5. Pod gets refulled approx. every 6 to 8 weeks *8. Vehicles refuel every 2nd day*	Moderate	Unlikely	6	
2.2	External	Environmental	Diesel Fuel Pod	Vehicle collision with the tank leading to spillage of diesel fuel	Environmental impact of diesel fuel	Speed limits will be imposed on site to reduce the likelihhod of vehicle impacts on the fuel pod.	Moderate	Likely	12	1.Barriers such as bollards to mitigate the likelihood of vehicle impact on the fuel pod 2.Vehicles refuel every 2nd day	Moderate	Unlikely	6	
2.3	External	Environmental	Diesel Fuel Pod	General leak of the tank	Environmental impact of diesel fuel	The tank is self bunded and self contained	Moderate	Unlikely	6	Compliance with AS 1940 and UL requirements - placarding , decanting procedures and spill procedures			#N/A	
2.4	External	Environmental	Fire from neighbouring building	Fire from neighbouring building	Ignition of external stockpiles in MRF 1 due to thermal radiation	1.Raise alarm locally to get site management to attend 2.Staff member assumes the role of Chief Warden 3.Chief Warden to: 3a.Call 000 to confirm FRV notified 3b.Contact Councils and transporters to advise of the situation and/or divert 4. Esclation Plan and complaince with EPA license. 5. Time duartion that stockpiles are stored on site - 2 weeks for AL and 2 weeks for steel 6. MRF 1 only aluminuim and steel stored outside.	Minor	Unlikely	4	1. Use of hose reels on site 2. Use of portable water monitors	Minor	Rare	2	Subject to purchase of portable water monitors
2.5	External	Environmental	Lightning	Lightning	Potential damage or loss of electrical equipment leading to a fire		Minor	Unlikely	4				#N/A	
2.6	External	Environmental	Bushfire	Bushfire	Ignition of external stockpiles due to thermal radiation	No large bush areas beside the surrounding the site	Minor	Rare	2				#N/A	
2.7	External	Environmental	Fire water runoff	Potential runoff of fire water into the environment and environmental damage	Potential runoff of fire water into the environment and environmental damage	1.MRF 1 and 2 are partially bunded and contain pits 200 kL and 250 kL respectively. MRF 3 not bunded	Major	Unlikely	8	1. Review of the stormwater management plan to determine if the bunding is adequate as nominated by	Major	Rare	4	Subject to purchase of portable water monitors
2.8	External	Environmental	Arson	Arson	Fire spread due to small scale arson attempt	Management in use provisions	Major	Unlikely	8	1. Use of hose reels on site 2. Use of portable water monitors	Major	Rare	4	Subject to purchase of portable water monitors
3. Fire Risks														
3.1	Sitewide	Fire	Machinery	Electrical fault in the sorting machinery due to accumulated dust on electric motors	Fire caused by defective plant whilst facility in operation	1.Emergency stop machinery 2.Look for escape routes before fighting fire 3.Fight fire using: 3a.hose reels on waste and rubber 3b.dry powder fire extinguishers on motors and hydraulic oil and electrical cabinet 4.Check all around conveyer for fire spread - underneath, in the pit, outlet and inlet	Moderate	Possible	9				#N/A	
3.2	Sitewide	Fire	Machinery	Sparking from defective plant equipment in MRF due to accumulated dust on electric motors	Fire caused by defective plant whilst facility in operation	1.Emergency stop machinery 2.Look for escape routes before fighting fire 3.Fight fire using: 3a.hose reels on waste and rubber 3b.dry powder fire extinguishers on motors and hydraulic oil and electrical cabinet 4.Check all around conveyer for fire spread - underneath, in the pit, outlet and inlet	Moderate	Possible	9	Regular thermographic survey of baler control boards and electric motors	Moderate	Unlikely	6	Regular thermographic survey of baler control boards and electric motors

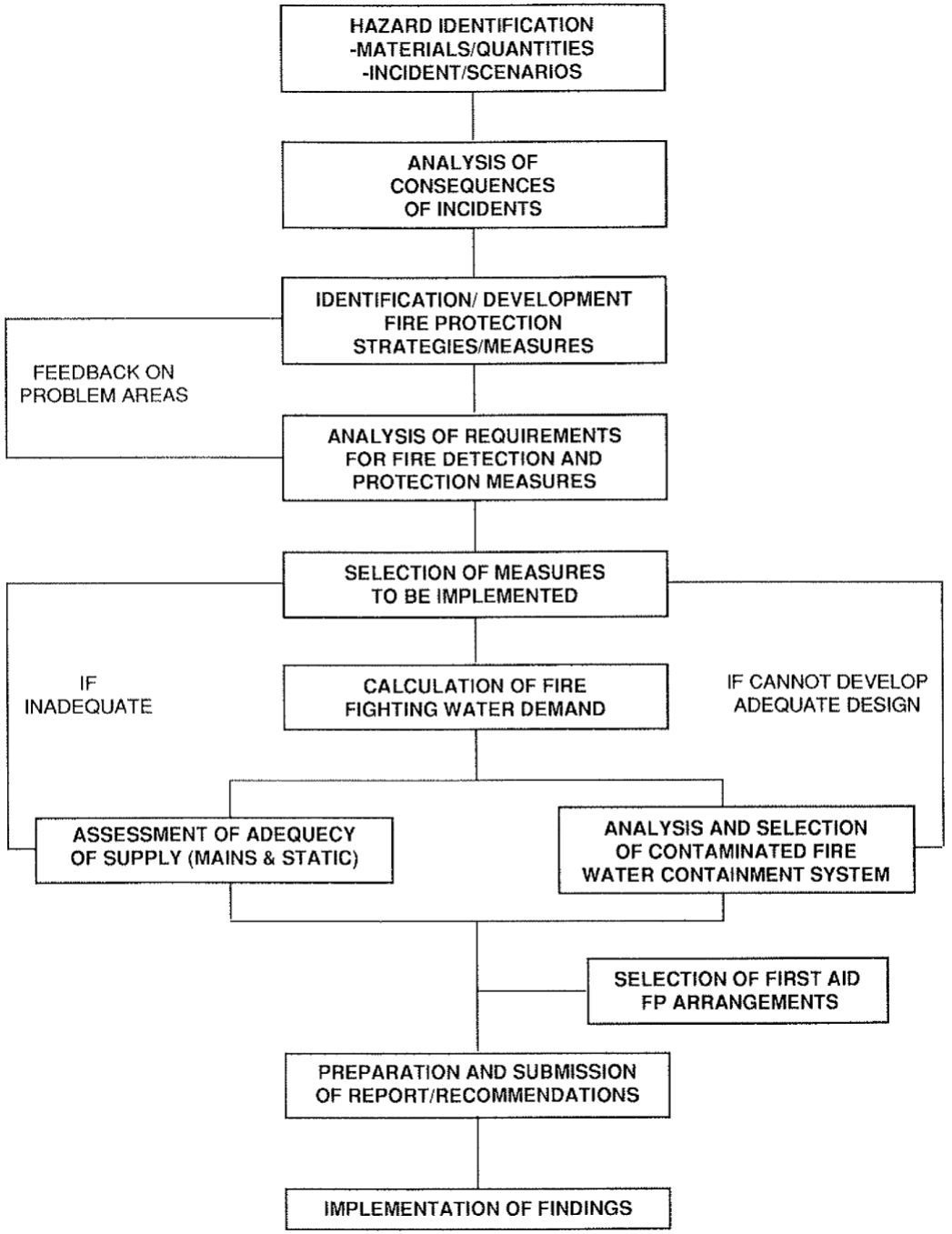
HIPAP 2 Fire Safety Study

NSW GOVERNMENT | Planning

Hazardous Industry Planning Advisory
Paper No 2

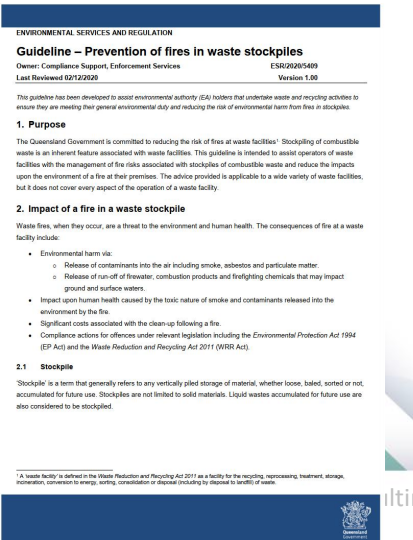
Fire Safety Study Guidelines

January 2011



Building Code Compliance

- WMFs fall under Class 7b or 8 building
- Prescriptive BCA Deemed-to-Satisfy (DtS) Provisions do not address the unique fire hazards in a WMF
- All four (4) fire brigade guidelines discussed previously nominate that BCA Clauses E1.10 (E1D17) and E2.3 (E2D21) need to be considered for WMFs
- Compliance with the various waste management guidelines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PROCEDURAL

GUIDELINE
Version 1.0
5 May 2022
Doctrine ID: 3095

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Publication 1667.3 July 2021


Fire safety guideline

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Holistic Assessment of WMFs

- A ‘tailor-made’ site specific holistic fire engineering approach is essential for WMFs:
  - considering the processing/ treatment
  - various operational modes
  - the type of waste being processed/ stored
- A rigorous fire hazard assessment and consultative design consultation process led by the Fire Safety Engineer with relevant input by various project stakeholders
- Techniques to address fire safety in WMFs using a first-principles risk management approach:
  - ISO 31000 Risk Management Framework
  - Fire Safety Study methodology from the NSW HIPAP 2 (Planning NSW) Guidelines

Thank you for your Attention

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