Australasian Institute of Dangerous Goods Consultants

AIDGC WORKSHOP

MANAGING DANGEROUS GOODS FACILITY FIRE AND EXPLOSION RISK

SYDNEY

7th of September 2023

DANGEROUS GOODS, PROCESS RISK AND BUILDING FIRE CODE COMPLIANCE

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Acknowledgement of Country

I acknowledge Aboriginal and Torres Strait Islander peoples as the traditional custodians of our land – Australia. The Gadigal of the Eora Nation are the traditional custodians of the local area we meet on today

I respect their elders past, present and emerging, and all Aboriginal people, especially those we touch base with as part of our work

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Presentation Outline

- Part 1 - Legislative Framework
- Part 2 - Holistic Fire Engineering Framework
- Part 3 - Case Study 1 - Distillery
- Part 4 - Case Study 2 – Flammable Liquid
- Part 5 - Case Study 3 - WMF

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Altens East Scotland Fire 8 July 2022

Altens East Scotland WMF Fire - 8 July22

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

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

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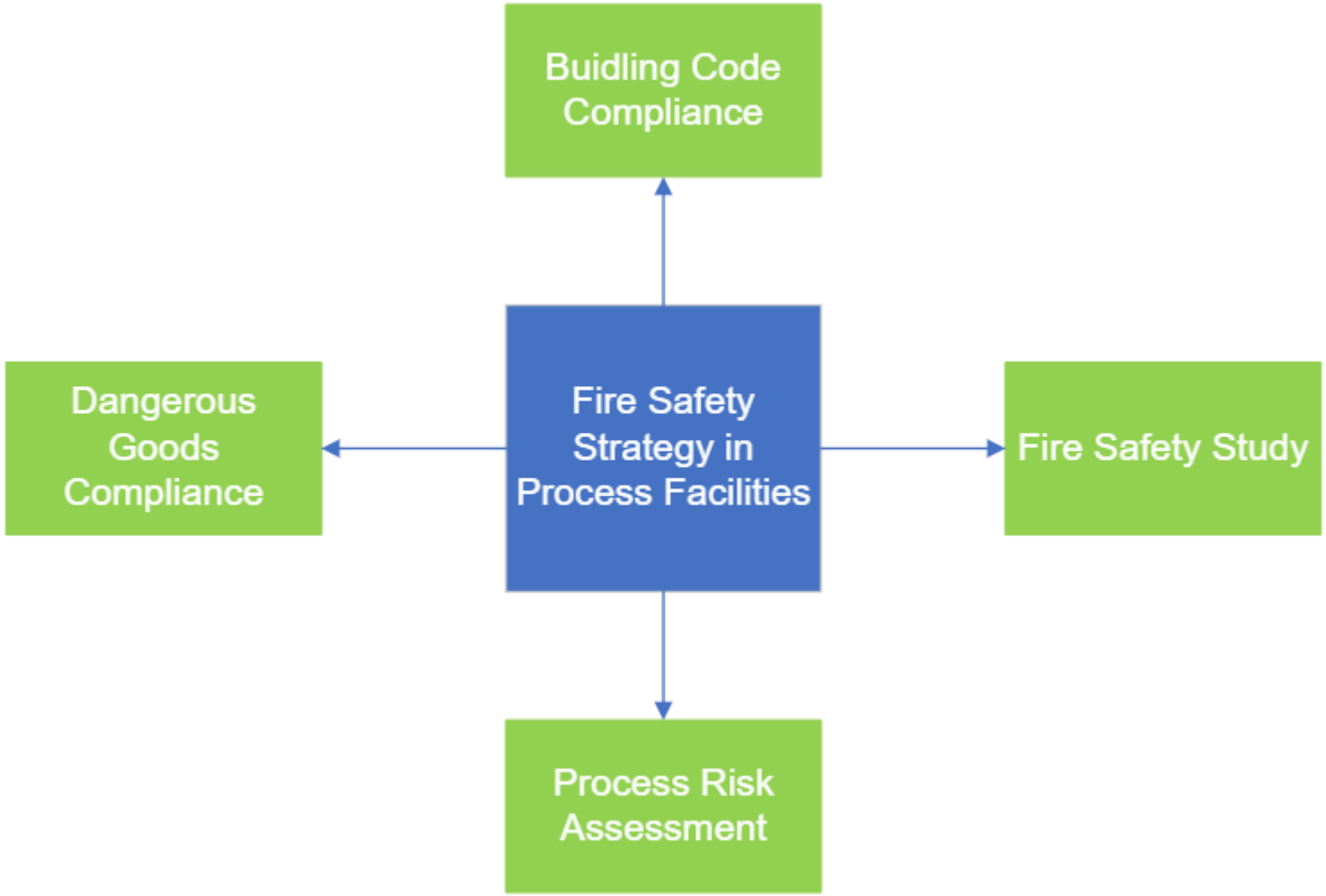
Overall fire strategy function of …



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Part 1 - Legislative Framework

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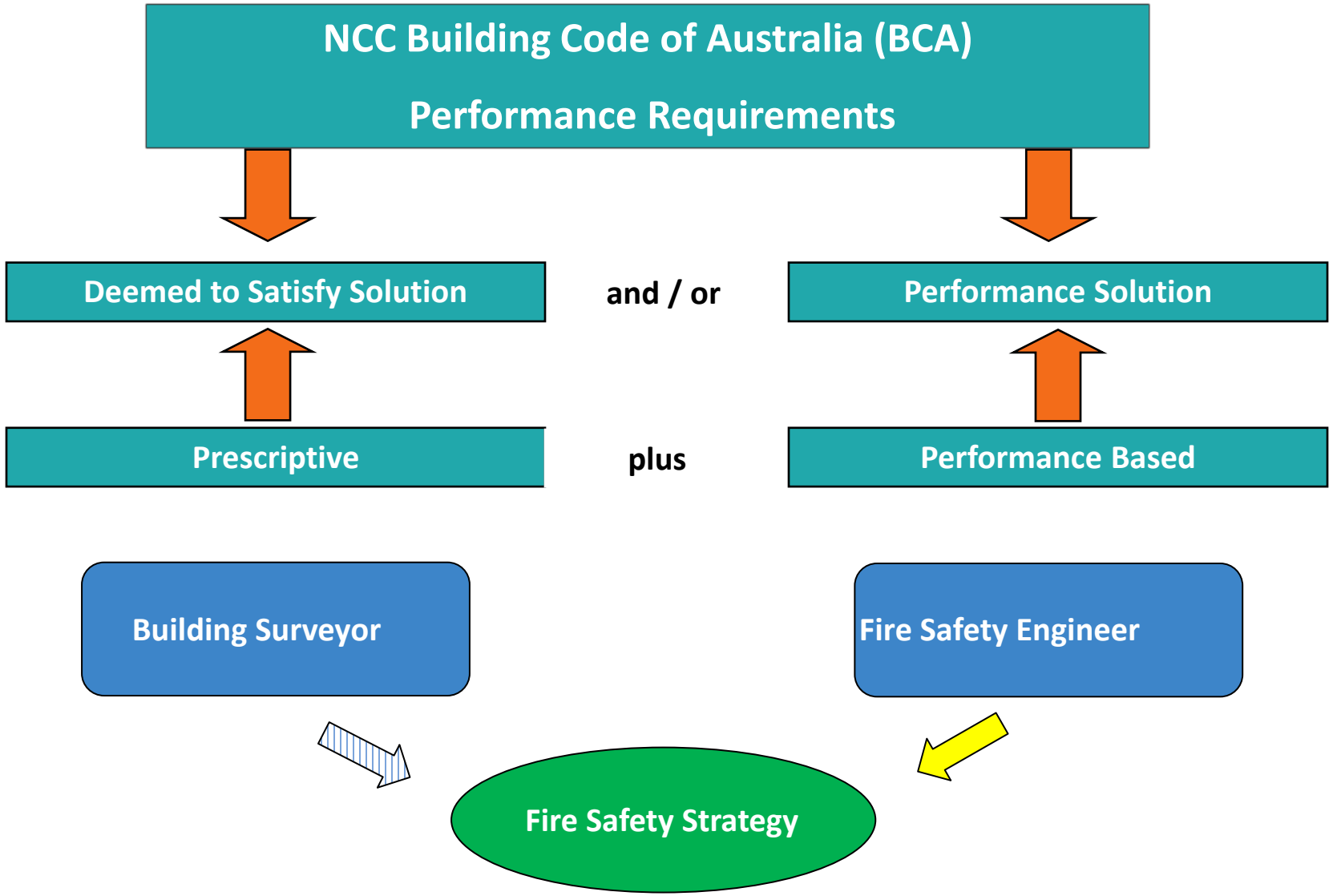
Building Compliance Pathways



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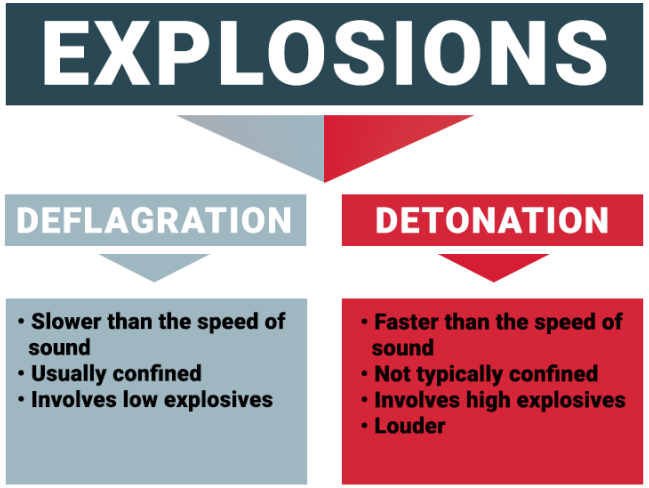
Fire & Explosion in the BCA

- Fire
- Explosion
- Deflagration
- Detonation



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BCA 2022 - Explosions

C1P6 Fire protection of service equipment

[2019: CP6]

A building must have elements, which will, to the degree necessary, avoid the spread of fire from service equipment having—

(a) a high *fire hazard*; or

(b) a potential for explosion resulting from a high *fire hazard*.

Specification 30 Installation of boilers and pressure vessels

S30C1 Scope

[2019: Spec G2.2: 1]

This Specification sets out the requirements for the installation of *boilers* and *pressure vessels* in buildings.

S30C2 Explosion relief

[2019: Spec G2.2: 2.1]

The distance between the vent of any explosion relief device for a *boiler* or *pressure vessel* and any adjacent wall, roof, ceiling or other solid construction shall be calculated in accordance with Table S30C2.

Table S30C2: Minimum clearances for explosion relief

Clearance from	Minimum clearance (metres)
Adjacent wall or ceiling/roof	$0.4(V/3)^{1/3}$ or 0.4 m, whichever is the greater
Two walls at right angles; or one wall and a ceiling/roof	$0.6(V/3)^{1/3}$ or 0.6 m, whichever is the greater

Table Notes

v is the internal volume of the *boiler* or *pressure vessel* being vented up to the connection of the flue.

BCA C3D13 Separation of Equipment

C3D13 Separation of equipment

[2019: C2.12]

(1) Equipment other than that described in (2) and (3) must be separated from the remainder of the building with construction complying with (4), if that equipment comprises—

(a) lift motors and lift control panels; or

(b) emergency generators used to sustain emergency equipment operating in the emergency mode; or

(c) central smoke control plant; or

(d) *boilers*; or

(e) a *battery system* installed in the building that has a total voltage of 12 volts or more and a storage capacity of 200 kWh or more.

(2) Equipment need not be separated in accordance with (1) if the equipment comprises—

(a) smoke control exhaust fans located in the air stream which are constructed for high temperature operation in accordance with Specification 21; or

(b) stair pressurising equipment installed in compliance with the relevant provisions of AS 1668.1; or

(c) a lift installation without a machine-room; or

(d) equipment otherwise adequately separated from the remainder of the building.

(3) Separation of on-site fire pumps must comply with the requirements of AS 2419.1.

(4) Separating construction must have—

(a) except as provided by (b)—

(i) an FRL as *required* by Specification 5, but not less than 120/120/120; and

(ii) any doorway protected with a *self-closing* fire door having an FRL of not less than –/120/30; or

(b) when separating a lift *shaft* and lift motor room, an FRL not less than 120/–/–.

Boiler: *A vessel or an arrangement of vessels and interconnecting parts, wherein steam or other vapour is generated, or water or other liquid is heated at a pressure above that of the atmosphere, by the application of fire, the products of combustion, electrical power, or similar high temperature means, and—*
(a) includes superheaters, reheaters, economisers, boiler piping, supports, mountings, valves, gauges, fittings, controls, the boiler settings and directly associated equipment; but
(b) excludes a fully flooded or pressurised system where water or other liquid is heated to a temperature lower than the normal atmospheric boiling temperature of the liquid.

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BCA E1D17 & E2D21 (E1.10 & E2.3)

- Clause E1D17 and E2D21 'Provisions for Special Hazards'
- This clause requires consideration of additional measures not strictly specified by the BCA DtS Provisions where a hazard presents a special problem for fire-fighting.
- Gas or fuel services must not be installed in a required exit (D3D8)
- Additional fire extinguishers may be required to cover fire risks in relation to special hazards provided for in E1D17 (E1D14(5)(c)

E1D17 Provision for special hazards

Suitable additional provision must be made if special problems of fighting fire could arise because of—

(a) the nature or quantity of materials stored, displayed or used in a building or on the allotment; or

(b) the location of the building in relation to a water supply for fire-fighting purposes.

E2D21 Provision for special hazards

Additional smoke hazard management measures may be necessary due to the—

(a) special characteristics of the building; or

(b) special function or use of the building; or

(c) special type or quantity of materials stored, displayed or used in a building; or

(d) special mix of classifications within a building or *fire compartment*,

which are not addressed in E2D4 to E2D20.

BCA Hazard Specific Fire Safety Equipment

- Detection - TAS E1D17 Fire detection and alarm system. An automatic fire detection and alarm system must comply with S20C4 and S20C8.
- PFE - In Class 2 to 9 buildings (except within sole-occupancy units of a Class 9c building), portable fire extinguishers must be provided to cover Class B fire risks in locations where flammable liquids in excess of 50 litres are stored or used (not including that held in fuel tanks of vehicles).
- FHR - A farm building not provided with a fire hose reel system in accordance with E1D3 must be provided with (a) one portable fire extinguisher rated at not less than 5ABE in each room containing flammable materials or electrical equipment; and one portable fire extinguisher rated at not less than 4A60BE adjacent to every required exit door.

E1D13 Sprinkler Protection for Excessive Hazard

- E1D13 Where sprinklers are required: occupancies of excessive hazard [2019: Table E1.5 (Note 4)]
  - Fire compartments where either of the following apply:
  - (a) A floor area of more than 2 000 m^2; or
  - (b) A volume of more than 12 000 m^3.
- (a) hazardous processes or storage including the following:
  - (i) Aircraft hangars.
  - (ii) Cane furnishing manufacture, processing and storage.
  - (iii) Fire-lighter and fireworks manufacture and warehousing.
  - (iv) Foam plastic and foam plastic goods manufacture, processing and warehousing e.g. furniture factory.
  - (v) Hydrocarbon based sheet product, manufacture, processing and warehousing e.g. vinyl floor coverings.
  - (vi) Woodwool and other flammable loose fibrous material manufacture.
- (b) combustible goods with an aggregate volume exceeding 1000 m^3 and stored to a height greater than 4 m including the following:
  - (i) Aerosol packs with flammable contents.
  - (ii) Carpets and clothing.
  - (iii) Electrical appliances.
  - (xii) All materials having wrappings or preformed containers of foamed plastics.

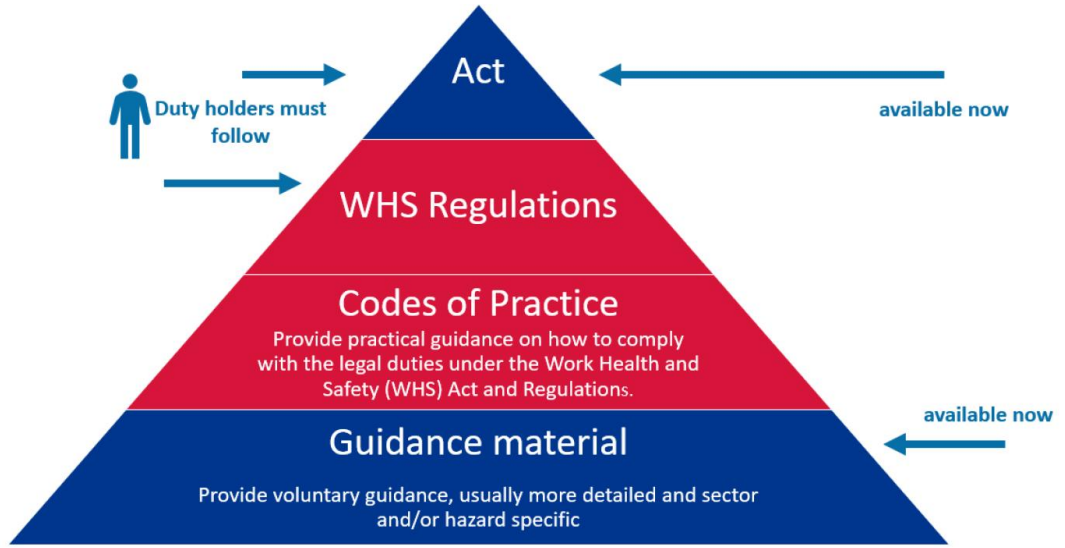
Designer Obligations under WHS Legislation

- *Duty of the Designer under the WHS Act - "The designer must ensure 'so far as is reasonably practicable' (SFAIRP), that the plant, substance or structure is designed to be without risks to the health and safety of persons."*

- *Under the WHS Act, persons who control or manage workplaces are obligated to ensure the health and safety of people 'so far as is reasonably practicable' (SFAIRP).*

- *This legislation requires consideration of risk control measures and safe systems of work.*

- *Duties as designers under WHS legislation is far more onerous that anything under building related legislation.*



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Other Legislation (e.g. WMFs)

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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Part 2 – Holistic Fire Safety Framework

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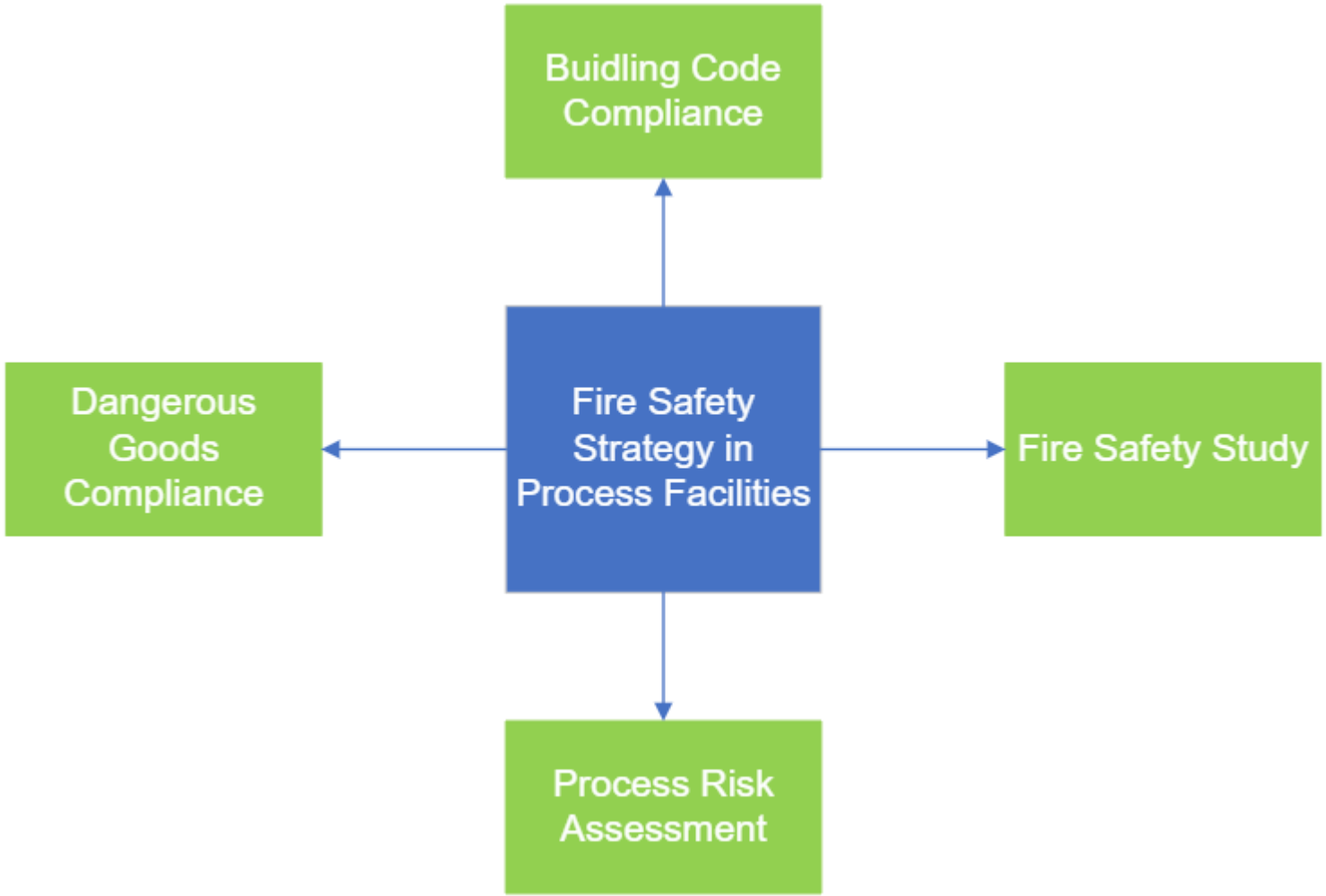
Holistic Fire Safety Framework



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What is the Hazard & Related Fire Risk?

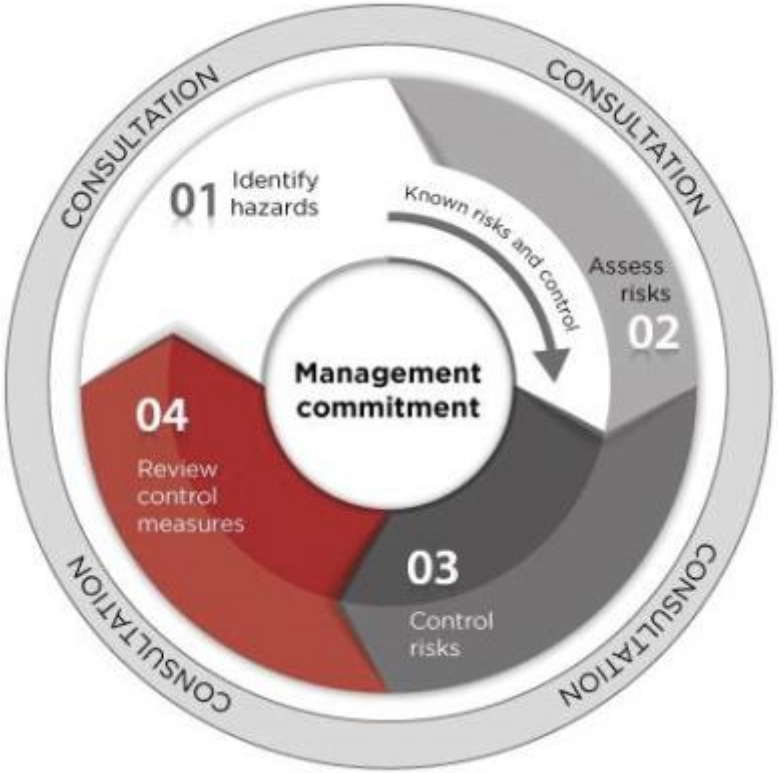
- Type of materials being stored and processed on site?
  - Is the material combustible?
  - Is the material capable of self-heating?
  - Is the material capable of propagating a fire?
  - In the event of a fire will the material release gases that are detrimental?
- What is the process that is occurring 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

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

Process Risk Assessment

- Process risk assessment forms a vital part of the fire safety strategy as it allows the identification of hazards and analysis of the risks from the process equipment and stored materials.
- A risk assessment of the entire process utilising the risk 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 where many of the emerging hazards may be missed.



Source: https://www.safeworkaustralia.gov.au/doc/model-code-practice-how-manage-work-health-and-safety-risks

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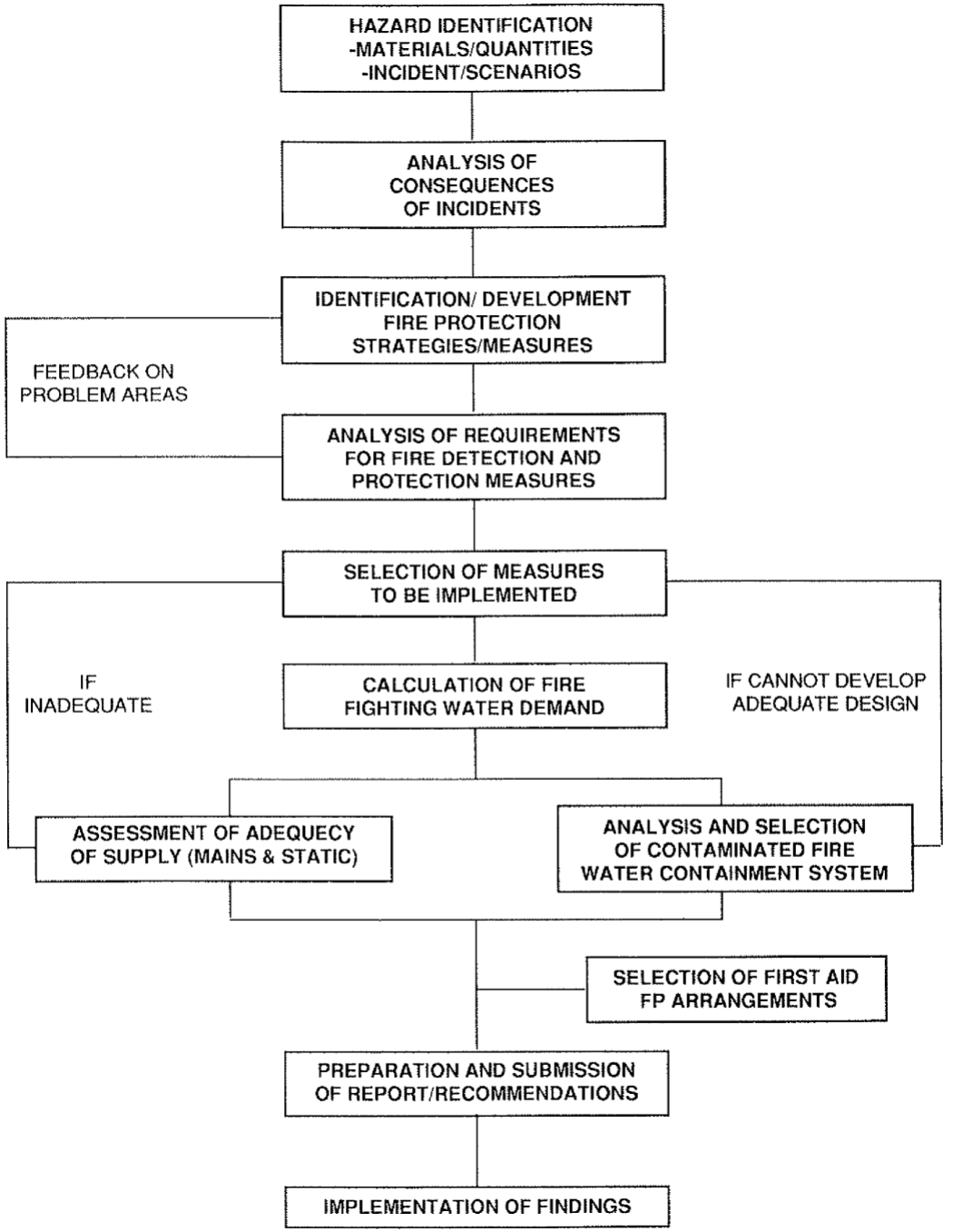
HIPAP 2 Fire Safety Study

NSW GOVERNMENT | Planning

Hazardous Industry Planning Advisory
Paper No 2

Fire Safety Study Guidelines

January 2011



Case Study 1 - Boutique Distillery

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Case Study 1 - Boutique Distillery

- Class 9b (Public Assembly) and Class 6 (Retail)
- Heritage timber building
- Built circa 1863
- Distillery (Class 8) included within the Class 6 retail portion

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Challenges

- Process risk not covered by the BCA and requires application of E1.10 and E2.3 for ‘Special Hazards’.
- The space was designed for retail food outlets and was not designed for Dangerous Goods.
- Fire Separation difficult to achieve due to the timber construction.
- Client requirement to provide glazing between bar and distillery to the patron experience.
- 4 Hour fire separation not feasible due to the building height and age.

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Fire Engineering Process

- Inception meeting to set the scope
- Risk Workshop to determine the fire scenarios
- Risk Register documenting the fire scenarios
- Fire Engineering Report Addressing E1.10 and E2.3

No.	Element	Hazard	Consequence	As designed Risk Reduction Measure	Risk Rating			Additional Recommended Risk Reduction Measure	Final Risk Rating		
					SEVERITY (S)	LIKELIHOOD (L)	LEVEL OF RISK		SEVERITY (S)	LIKELIHOOD (L)	LEVEL OF RISK

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Design Outcome

- Following this process, a project specific fire strategy that allowed the distillery to be displayed and occupants to be protected.
- Specific process controls implemented to address the credible fire scenarios.
- Residual process risk reduced to a level acceptable to all project stakeholders.

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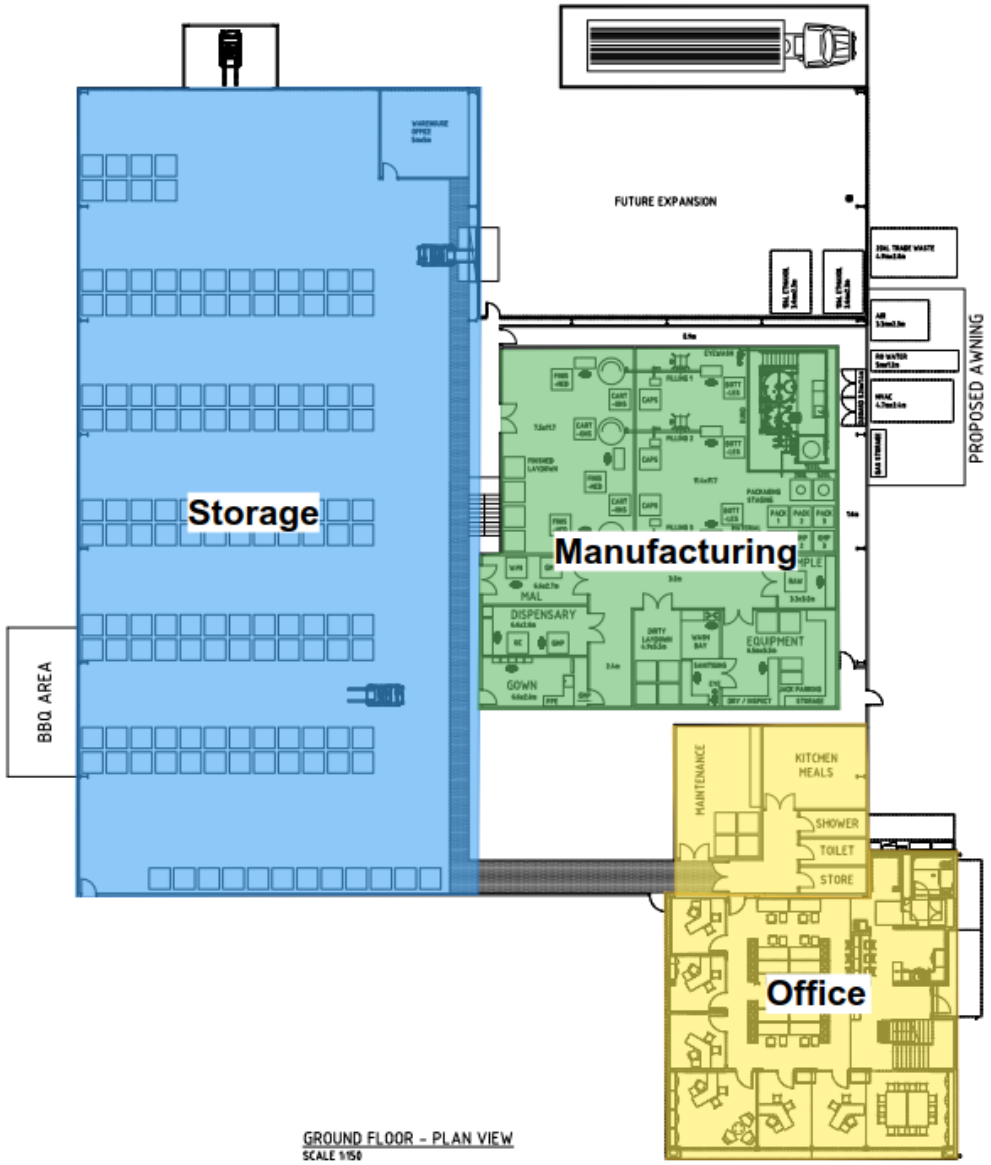
Case Study 2 – Flammable Liquid Warehouse



- Development Application to change use of existing warehouse building (Class 7b) to an industrial building (Class 8)
- The Process
  - Raw materials (i.e. Flammable Liquid) stored onsite in bulk store tanks
  - Raw materials fed into manufacturing tanks to be blended, filled, bottled and capped to be stored in the warehouse then distributed

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DG and Fire Engineering Scope

Dangerous Goods

- SEPP 33 Report – PHA Not Required
- Dangerous Goods Report
- Hazardous Area Classification
- Fire Safety Study

Fire Engineering

- Fire Engineering Performance Solution Report

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Challenges Faced

- Interfacing between Dangerous Goods and Fire Engineering Strategy
- BCA Clauses E1.10 and E2.3 (BCA 2022 Clauses E1D17 and E2D21)
- Additional mitigation measures over and above the BCA DtS Provisions based on the outcomes of the Dangerous Goods Report:
  - Additional provisions for fire hydrant flows
  - Additional fire separation for the manufacturing and storage areas

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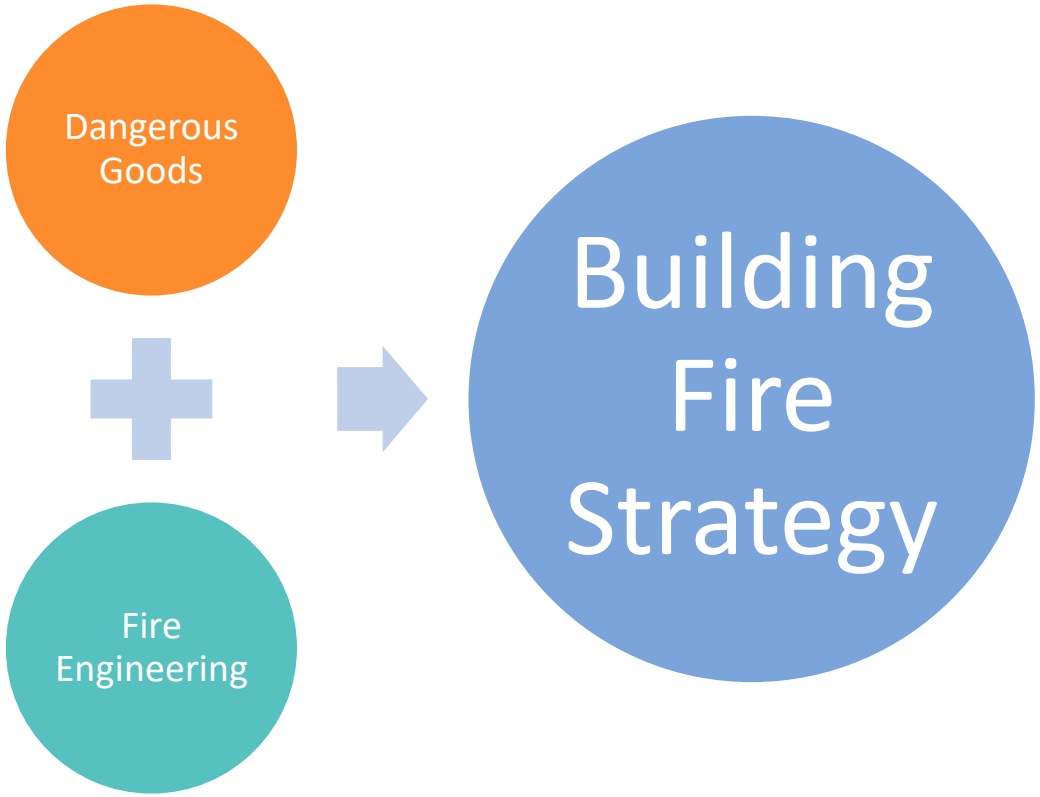
Design Outcome

- Complimentary Dangerous Goods and Fire Engineering Strategy to meet DG as well as the BCA Performance Requirements



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Case Study 3 – Waste Management Facility

- Existing Class 7b waste management facility
- Large number of chemicals and dangerous goods stored on site
- The project related to the construction of an awning between two (2) buildings

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DG and Fire Engineering Scope

Dangerous Goods

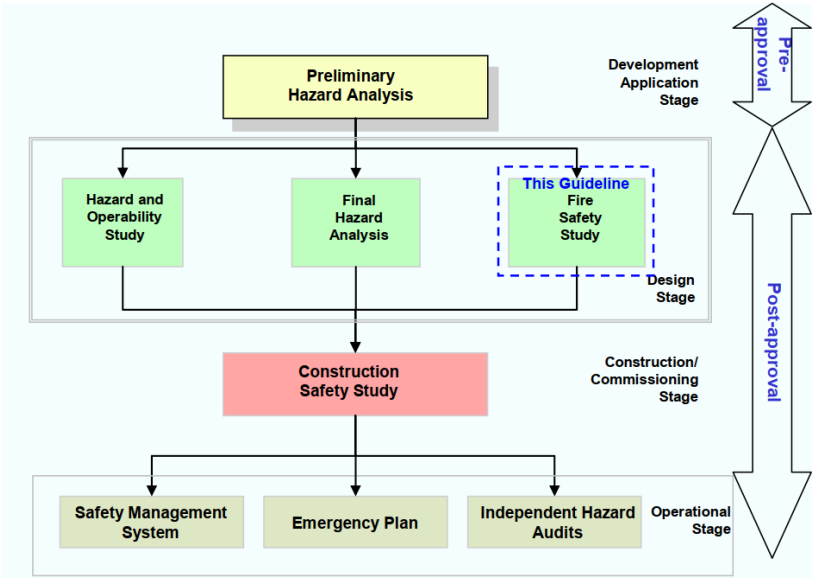
Fire Safety Study

Fire Engineering

Fire Engineering Performance Solution Report

Building Code Compliance

BCA report



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Challenges – Case Study 3

- Extent of Upgrade triggered by the Development Application (DA)
- Process not covered by the BCA and requires application of E1.10 and E2.3 for ‘Special Hazards’
- Documentation of the awning resulted in non-compliances to the BCA in the existing building
- Storage heights and volumes triggered a sprinkler system
- Holistic fire safety strategy that considered the impact of DGs on site

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Holistic Assessment Fire Safety Framework

DG Assessment → Process Risk Assessment → Fire Safety Study → Building Code Compliance

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

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Thank you for your Attention

- Dr Amer Magrabi
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