Cleanaway Operations Pty Ltd

Melbourne Energy and Resource Centre

Hazardous Substances and Industrial Hazards Technical Report

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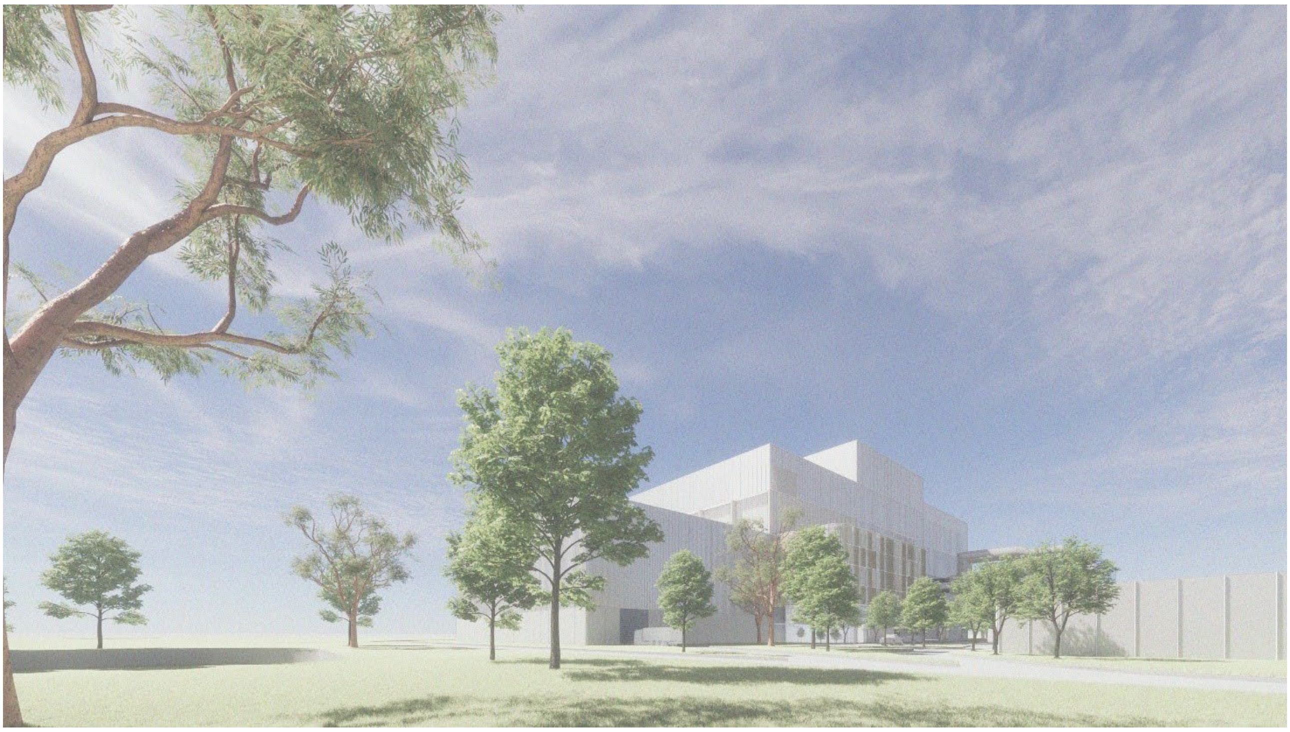

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Abbreviations

Abbreviations	Definition
APACs	Air Pollution Assessment Criteria
APCr	Air Pollution Control Residue
BREF	Best Available Techniques Reference
CEMP	Construction Environmental Management Plan
CEMS	Continuous Emissions Monitoring Systems
C&I	Commercial & Industrial
DG	Dangerous Goods
DLA	Development Licence Application
EPA	Environment Protection Authority
EP Act 2017	Environment Protection Act 2017
FEED	Front-End-Engineering-Design
FPQ	Fire Protection Quantities
FRV	Fire Rescue Victoria
GED	General Environmental Duty
HAZID	Hazard Identification Study
IBA	Incineration Bottom Ash
ID	Induced Draft
IED	European Industrial Emissions Directive
kg	Kilogram
kg/hr	Kilogram per Hour
kL	Kilolitres
L	Litres
LPG	Liquefied Petroleum Gas
m	Meters
m^3	Cubic meters
mg/hr	Milligrams per Hour
MERC	Melbourne Energy and Resource Centre
MSW	Municipal Solid Waste
NOx	Nitrous oxide
OHS	Occupational Health and Safety
SNCR	Selective Non-Catalytic Reduction
SiD	Safety in Design
t	Tonnes
UPS	Uninterrupted Power Supply

Abbreviations	Definition
WtE	Waste-to-energy

Executive Summary

The purpose of this assessment is to address risks relating to hazardous substances and industrial hazards for the construction and operation of the Melbourne Energy and Resource Centre (MERC), a proposed waste-to-energy facility located in Victoria (the Proposal).

The Proposal will be designed to thermally treat 380,000 tonnes per annum (tpa) of waste feedstock that would otherwise be sent to landfill, primarily consisting of residual Municipal Solid Waste (MSW) and residual Commercial and Industrial (C&I) waste. The Proposal will also incorporate maturation and processing of bottom ash to recover recyclable metals, with the intent to utilise the remaining ash as an aggregate in construction.

The WtE process would generate approximately 46.3MW of gross electricity, 4.7MW of which would be used to power the facility itself and the associated on-site by-product and residue handling processes, with 41.6MW exported to the grid as base load electricity. In addition to supplying electricity to the grid, there is also potential to supply energy in the form of heat and/or process steam to local industrial users.

The following legislation was reviewed in relation to hazardous substances and industrial hazards for both the construction and operational phases of the Proposal:

- *Environment Protection Act 2017* (EP Act)
- Dangerous Goods (Storage and Handling) Regulation 2022
- *Occupational Health and Safety Act 2011* (OHS Act).

The outcomes from the relevant regulatory requirements and the key risks identified for MERC were:

- Regulatory outcomes:
  - The Fire Protection quantities for ammonium hydroxide (if used), Air Pollution Control Residues (APCr) and diesel will be exceeded. The proponent is required to submit an Application for Written Advice for the emergency services authority (Fire Rescue Victoria (FRV)), in accordance with Regulation 52 of the Dangerous Goods (Storage and Handling Regulations) 2022
  - In accordance with Regulation 53 of the Dangerous Goods (Storage and Handling Regulations) 2022, a written emergency plan must be developed, implemented and maintained to reduce the risk associated with an emergency, so far as is reasonably practicable. This too must be provided to FRV, written advice sort and due regard given to that advice
- A HAZID workshop was undertaken to identify relevant risks and mitigation measures in relation to hazardous substances and industrial hazards for MERC. Five hazards were identified as having potential to pose significant risks to the Proposal. The key risk and mitigation measures identified for the MERC are:
  - **Fire in the waste bunker**: Mitigation measures to eliminate or reduce a potential waste bunker fire includes continuous thermal monitoring, water cannons, remote crane operated removal of hot spots in the bunker, negative air pressure, supervised loading and selective feeding
  - **Hazardous waste materials unintentionally received by the facility**: The furnace design allows for explosions to occur if items such as pressurised Liquefied Petroleum Gas (LPG) containers are fed into the furnace without prior removal by the operators
  - **Activated carbon dust explosion**: A permanent nitrogen blanket will be adopted at all times. This will help minimise oxidation by reducing the oxygen content in the surrounding environment. Typical material safety requirements include storage in a dry, cool, well-ventilated area, away from strong oxidizers, strong acids, ignition sources, combustible materials and heat. An adequate air gap between packages is recommended to reduce propagation in the case of fire. As with all finely divided materials, all transfer, blending, and dust collecting equipment shall be grounded to prevent static discharge. Good housekeeping practices will prevent the accumulation of dust or dusty

conditions in areas associated with activated carbon handling and storage. Where dust is unavoidable, dust-proof boxes and regular electrical line maintenance is recommended. Hazardous Area Classification as required by AS/NZS 60079.10.2:2016 Explosive atmospheres Part 10.2: Classification of areas – Explosive dust atmospheres, including around the storage area and equipment. Appropriate standard operating procedures will be developed by the proponent for maintenance and use

- **Offsite impacts from a diesel fire**: The design of the diesel storage area will comply with AS1940 and consideration will be given to the advice obtained in response to the Application for Written Advice to FRV, to address potential offsite impacts that FRV may identify
- **Uncertainty if ammonia or urea will be used for the SNCR process**: The controls around ammonia and urea are well known. If ammonia is used, a placeholder location has been identified. It will be in a separate bund outside, away from incompatible substances, with water sprays around the bunded area. Unlike ammonia, urea is not classified as a dangerous good.

This assessment has also included identification of risks (and mitigation measures) from pollution or waste, to help Cleanaway discharge its general environmental duty (GED) under the EP Act. The residual risks that could pose harm to human health and the environment will be managed operationally by Cleanaway.

The next steps required by Cleanaway, as dictated by the legislative requirements, include:

- Making an Application for Written Advice to FRV in accordance with Regulation 52 of the Dangerous Goods (Storage and Handling) Regulations 2022, as the Fire Protection quantities for a number of dangerous goods are exceeded. This Application for Written Advice shall cover the potential high risks that were identified in the HAZID. These include fire in the waste bunker, activated carbon dust explosion, diesel spill and bund fire and the release of ammonium hydroxide (if used). This application will need to discuss what appropriate firefighting infrastructure and systems have been provided to address the potential hazard and relevant emergency response
- Develop, implement, and maintain a written emergency plan which reduces the risk associated with an emergency, so far as is reasonably practicable, in accordance with Regulation 53 of the Dangerous Goods (Storage and Handling) Regulations 2022. This too must be provided to FRV, written advice sort and due regard given to that advice
- A range of additional actions are recommended to be undertaken in the subsequent phase of the Project to manage risks posed by this report, including implementing Safety in Design (SiD).

1. Introduction

1.1 Purpose

The purpose of this assessment is to address risks relating to hazardous substances and industrial hazards for the construction and operation of the Melbourne Energy and Resource Centre (MERC), a proposed waste-to-energy facility located in Victoria (the Proposal).

As part of this assessment, this report demonstrates how the MERC meets its general environmental duty (GED) in regard to management of hazardous substances and industrial hazards from pollution or waste.

1.2 Proposal overview

V Cleanaway Operations Pty Ltd (Cleanaway) is an Australian waste management, recycling, and industrial services company. Cleanaway is developing a waste-to-energy (WtE) facility in Victoria known as the Melbourne Energy and Resource Centre (MERC) (the Proposal).

The MERC has been designed to thermally treat a design capacity of 380,000 tonnes per annum (tpa) of waste feedstock, consisting of residual Municipal Solid Waste (MSW) and residual commercial waste, which is waste that would otherwise be sent to landfill. Waste feedstock processed by the MERC will be subject to a Waste Acceptance Protocol to determine eligibility and suitability for processing both prior to arrival and upon arrival on-site. The Proposal will also incorporate maturation and processing of bottom ash to recover recyclable metals, with the intent to utilise the remaining ash as an aggregate in construction.

Residual waste is waste that is left over from recycling and resource recovery operations and waste from source separated collections. Source separation involves separating waste into common material streams or categories for separate collection. Waste processed at the site will be subject to a Waste Acceptance Protocol to ensure only appropriate waste is used as feedstock.

The WtE process would generate approximately 46.3MW gross of electricity, 4.7MW of which would be used to power the facility itself and the associated on-site by-product and residue handling processes, with 41.6MW (328,700 MWh/year) exported to the grid as base load electricity. In addition to supplying electricity to the grid, there is also potential to supply energy in the form of heat and/or process steam to local industrial users.

Some residual materials are produced because of the WtE process, including Incinerator Bottom Ash (IBA), boiler ash and flue gas treatment residue. The boiler ash and flue gas treatment residue are typically combined and together are referred to as Air Pollution Control residue (APCr). Overall, the WtE process typically leads to about 90% reduction in the volume, or 80% reduction in mass (tonnes), of waste that would otherwise go to landfill. If IBA is reused as an alternative construction product to virgin materials, this percentage increases further to approximately 95% reduction in volume and mass of waste that would otherwise go to landfill. The final volume of waste diverted from landfill is dependent on the classification and market for the residues and by-products generated by the WtE facility.

The Proposal includes the construction and operation of an IBA maturation and processing facility on site. The purpose of this facility is to store the IBA to mature (stabilise) it, before mechanically processing IBA from the WtE facility into an aggregate for reuse. As part of this process, both ferrous and non-ferrous metals will be recovered from the IBA for recycling and sale to market.

The Proposal also includes a stabilisation facility for APCr, a necessary treatment step to immobilise leachable components of the APCr prior to removal from site by vehicle and disposal at an appropriately licenced landfill.

The Proposal will use best available techniques and technologies in the engineering design, operation, maintenance and monitoring activities associated with the MERC. Moving grate technology has been chosen as the means to thermally treat incoming waste to recover energy and other resources. Current international best-practice techniques, including automated combustion controls and advanced flue gas treatment technology will be applied so that air emissions meet stringent emission standards. The moving grate combustion system is a common form of thermal WtE technology in which the waste is fed through the combustion chamber on a travelling grate. This enables efficient and complete combustion of the waste, with primary combustion air introduced from below the grate and secondary combustion air introduced directly into the combustion zone above the grate. Moving grate technology has been used globally for over 100 years, and in that time the technology has been subject to continual improvement responding to regulatory, industry and public demands. There are approximately 500 similar operational examples across Europe alone, the majority of which use the moving grate-type technology being proposed for the MERC.

The Proposal involves the building of all onsite infrastructure required to support the WtE facility, including site utilities, internal roads, weighbridges, parking and hardstand areas, stormwater infrastructure, fencing and landscaping. The Proposal will also include a visitor and education centre to help educate and inform the community on the circular economy, recycling, resource recovery, the benefits of landfill diversion and the WtE process. The intent behind this education is to drive a shift in community thinking and actions around waste management.

The Victorian Waste to Energy Framework (2021) recognises the role of WtE to divert waste from landfills, helping Victoria transition to a circular economy. Recycling Victoria recognises a role for WtE investment and supports WtE facilities where they meet best-practice environment protection requirements. This includes reducing waste to landfill, supporting waste avoidance, reusing and recycling, and demonstrating social license with affected communities. The Victorian Environment Protection Authority (EPA) Energy from Waste Guideline (Publication 1559, 1 July 2017) also notes that efficient recovery of energy from the thermal processing of waste is considered a resource recovery as opposed to a waste disposal option.

The EPA VIC Guideline: Energy from Waste stipulates that 'Proponents of EfW proposals…will be expected to demonstrate that the siting, design, construction and operation of EfW facilities will incorporate best practice measures for the protection of the land, water and air environments as well as for energy efficiency and greenhouse gas emissions management. Facilities should be able to provide evidence of how they minimise and manage emissions (including pollutants, odour, dust, litter, noise and residual waste) in accordance with relevant statutory requirements.'

The WtE facility has been designed to meet the European Industrial Emissions Directive (IED) (2010) and the associated Best Available Techniques Reference (BREF) Document for Waste Incineration published December 2019, which sets the European Union environmental standards for waste incineration. The facility will also comply with the technical criteria set out in the EPA Victoria Guideline: Energy from Waste publication 1559.1.

The purpose of this specialist assessment is to demonstrate compliance with the various authority requirements, develop community support and social license.

1.3 Report structure

The purpose of this report is to address the hazards and risks of the MERC. This assessment is structured as follows:

- Section 1 – provides an overview of the Proposal
- Section 2 – addresses the regulatory framework and state of knowledge from relevant Acts and Regulations. This section outlines the requirements for the management of hazardous substances and industrial hazards with respect to the:
  - *Environment Protection Act 2017*[1]
  - Dangerous Goods (Storage and Handling) Regulations 2022[2]
  - *Occupational Health and Safety Act 2004*[3].
- Section 3 – outlines regulatory outcomes and the identified risks from hazardous substances and industrial hazards to the facility, during the construction and operational phase. Operational risks were identified during a HAZID (hazard identification) workshop with the engineering design team and process design specialists. This section also identifies the key residual risks and mitigation and management measures to be considered.

- Section 4 – provides conclusions and required next steps for Cleanaway in relation to the relevant Regulations.

2. Regulatory framework and state of knowledge

This section sets out the relevant legislation, policy and guidelines applicable to the assessment of hazardous substances and industrial hazards. Together, these documents form the current 'state of knowledge' for hazardous substances and industrial hazards in relation to the Proposal.

2.1 Commonwealth legislation

There is no applicable Commonwealth legislation for hazardous substances and industrial hazards that is relevant to the Proposal.

2.2 State legislation

2.2.1 Environment Protection Act 2017

The *Environment Protection Act 2017* (EP Act) includes the GED that requires a person to eliminate, or otherwise reduce risks of harm to human health and the environment from pollution or waste, so far as is reasonably practicable. The EP Act includes supporting guidance that sets out a risk-based, preventative framework to guide a proponent undertaking an activity (or a proposed activity) in meeting its GED.

Fundamentally, this requires

- Identification of risks; and
- Identification and implementation of suitable controls or safeguards to manage these risks to minimise risk of harm to human health and the environment.

Section 3 of this report outlines the outcomes of the HAZID assessment. The HAZID assessment has identified key risks and proposed controls in relation to management of hazardous substances and industrial hazards associated with the Proposal. Controls are proposed to mitigate risks so far as is reasonably practicable using the current state of knowledge for WtE facilities.

2.2.2 Dangerous Goods Regulations 2022

The Dangerous Goods (Storage and Handling) Regulations 2022 is the relevant Victorian legislation for dangerous goods storage. This assessment will address the following specific regulations:

- Regulation 52: 'Fire protection – premises exceeding relevant Fire Protection Quantity'
- Schedule 2: 'Quantities of dangerous goods'
- Regulation 53: 'Planning for emergencies'.

The Dangerous Goods (Storage and Handling) Regulations 2022 came into effect on 26 November 2022. As the previous Dangerous Goods (Storage and Handling) Regulations 2012 has now been superseded this assessment will comply with the updated 2022 version.

Note: there is no material change in the Schedule 2 'Quantities of dangerous goods', Regulation 52 (originally Regulation 54 of the 2012 Regulations) and Regulation 53 (originally Regulation 55 of the 2012 Regulations).

2.2.2.1 Regulation 52

In accordance with Regulation 52, if the quantity of dangerous goods stored and handled at the premises is in excess of the Fire Protection Quantity (FPQ) in Schedule 2, then the proponent is required to undertake the duties in (a) to (c) below.

The requirement in these duties to 'have regard to' the written advice of the emergency services authority, means the proponent needs to ensure the initial design of the fire protection system, alterations to this design and specified modifications to premises, contain either the components described in the advice or other components that provide an equivalent or better level of safety.

a. Initial design

The occupier must obtain written advice from the emergency services authority in relation to the initial design of the fire protection system and have regard to that written advice when developing the system.

b. Altering design

- *The occupier must obtain written advice from the emergency services and have regard to that written advice before altering the fire protection system.*

c. Modification to premises

The occupier must also obtain written advice from the emergency services authority in relation to any proposed modifications to the:

- *Buildings or structures on the premises*
- *Types or quantities of dangerous goods stored or handled at the premises, or*
- *Plant or processes associated with the storage or handling of dangerous goods on the premises — that will require a review of the risk control measures.*

The proponent must have regard to that written advice when undertaking the proposed modifications.

Table 1 shows the relevant FPQ thresholds for MERC from Schedule 2 of the Dangerous Goods (Storage and Handling) Regulations 2022. Table 2 provides a description of hazardous substances classes.

Table 1: Relevant Fire Protection Quantity thresholds (Schedule 2, Column 6)

Item (Item numbers refer to the numbering in Schedule 2 column 1)	Dangerous Goods Classes (see Table 3 for description)	Packing Group	Fire Protection Quantity
1	Class 2.1	N/A	5,000L
	Class 2.3	N/A	2,000L
2	Class 3, 4.2, 6.1 or 8	I	2,000L or kg
		II	10,000L or kg
		III	20,000L or kg
7	C1 combustible liquid in bulk stored and handled in isolation from other dangerous goods	N/A	100,000L

Table 2: Description of hazardous substances classes

Dangerous Goods Class	Description
Class 2.1	Flammable gas
Class 2.3	Toxic gas
Class 3	Flammable liquids
Class 4.2	Flammable solids: Substances liable to spontaneous combustion
Class 6.1	Toxic substances
Class 8	Corrosive substances
C1	C1 combustible liquid

2.2.2.2 Regulation 53

If the quantity of dangerous goods stored or handled at the premises exceeds the Manifest Quantity in Schedule 2 of the Dangerous Goods (Storage and Handling) Regulations 2022, the proponent must develop, implement and maintain a written emergency plan which reduces the risk associated with an emergency, so far as is reasonably practicable. The manifest screening process can be found in Table 3 and Table 5 of this report.

When developing the emergency plan, the proponent must request the written advice of the emergency services authority (Fire Rescue Victoria) and have regard to that written advice. The requirement to 'have regard to' the advice of the emergency services authority, means that the plan must contain the components specified in the advice or other components which provide an equivalent or better level of safety.

The emergency plan must clearly describe the location of the manifest.

The proponent should consider including the information identified in (a) to (e) below, in the emergency plan for the MERC.

a. Information on the premises and hazards at the premises

- *Name, address and nature of operations (e.g., manufacturing, warehousing)*
- *Detailed plan of the premises and surrounding area*
- *Inventory of dangerous goods named in Schedule 2 of the Dangerous Goods (Storage and Handling) Regulations 2022*
- *Maximum/minimum number of persons expected on the premises*
- *Infrastructure likely to be affected by an incident*
- *Description of measures in place to control the consequences of each hazard and major incident (e.g., fire barriers, separation distances, drainage tanks).*

b. Information on the command structure and personnel at the premises

- *Details of workers to contact in the event of an emergency (e.g., Fire Wardens, First Aiders)*
- *Roles and responsibilities of workers for implementing the plan.*

c. Information on procedures for the premises

- *Procedures for raising the alarm in the event of an emergency*
- *Procedures for safe evacuation and accounting for personnel*
- *Details of isolation points for essential services (e.g., the locations where the gas and electricity for the premises can be turned off)*
- *Procedures for containment of any incident*

- *Procedures for decontamination following an incident.*

d. Information on notifications and reporting for the premises

- *Details of on-site communication systems (e.g., phones, radios)*
- *Arrangements for 'mutual emergency assistance' between adjacent facilities*
- *Triggers for reporting the incident to the emergency services authority*
- *Contact details for the emergency services authority and other relevant entities (e.g., water, gas and electricity providers)*
- *Details of onsite and offsite warning systems (e.g., fire alarms, evacuation alarms).*

e. Information on resources at the premises

- *Details of emergency resources on site (e.g., the location of fire extinguishers)*
- *Arrangements for obtaining additional external resources.*

Emergency plans must be reviewed and revised whenever there is a change of circumstances on or off the premises and consequently the plan no longer reduces the risk associated with an emergency, so far as reasonably practicable.

At a minimum, emergency plans must be reviewed at intervals of not more than five years from the date the plan was developed or last reviewed.

The thresholds for manifest quantities as outlined in Schedule 2 of the Dangerous Goods (Storage and Handling) Regulations 2022 is outlined in Table 3.

Table 3: Relevant Dangerous Goods manifest quantities (Schedule 2, Column 5)

Item (Item numbers refer to the numbering in Schedule 2)	Description of Dangerous Goods	Packing Group	Manifest Quantity
1	UN Class 2.1	N/A	2,000L
	UN Class 2.3	N/A	500L
2	UN Class 3, 4.1, 4.2, 4.3, 5.1, 5.2, 6.1 or 8	I	500L or kg
		II	2,500L or kg
		III	10,000L or kg
7	C1 combustible liquids in bulk stored and handled in isolation from other dangerous goods	N/A	100,000L

2.2.3 *Occupational Health and Safety Act 2004*

The *Occupational Health and Safety Act 2004* (OHS Act) has been developed with the principles of shared responsibility and accountability. Duty holders (including (but not limited to) designers, operators, manufacturers and suppliers) have an obligation to ensure the safety of workers and others in relation to workplaces and work activities.

Section 28 of the OHS Act specifies the duties of designers. It states "(1) 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."

3. Risk assessment

This section outlines the outcomes from relevant regulatory requirements and the key risks identified for MERC, relevant to hazardous substances and industrial hazards for both the construction and operational phases of the Proposal.

3.1 Regulatory outcomes

3.1.1 Regulation 52: Fire protection quantities

Table 4 below outlines the storage of dangerous goods required on-site for MERC and the assessment against the FPQ (Schedule 2).

Table 4: Dangerous Goods identified for MERC and the Fire Protection Quantity threshold screening

Dangerous Good	Use Onsite / By-product	UN Number[1]	Class	Subsidiary Risk[2]	Packing Group[3]	Quantity Held Onsite	Fire Protection Quantity (see Table 1)	Exceeded Quantity?
Hydraulic oil	Hydraulic and lubrication oils are necessary consumables for the ongoing operation and lubrication of the grate, cranes, turbine and other mechanical equipment used at the facility	TBC	3	N/A	III	~1t	20,000L or kg	No
Lubrication oil		TBC	3	N/A	III	~1t	20,000L or kg	No
Activated carbon	Added to the flue gas where it absorbs dioxins and furans, gaseous mercury, and other components	1362	4.2	N/A	III	$15m^3$	20,000L or kg	No
Ammonia (ammonium hydroxide, <25% concentration) (if used)	Used in the Selective Non-Catalytic Reduction (SNCR) process where ammonia is injected into the boiler to reduce nitrogen oxide emissions in the combustion process	2972	8	N/A	III	<20t for Anhydrous Ammonia or up to ~80t for 25wt% Aqueous Ammonia Solution	20,000L or kg	Yes if 25% Aqueous Ammonia Solution if used
Propane/Acetylene	Necessary for welding repairs during maintenance operations	1978/3374	2.1	N/A	N/A	<100kg	5,000L	No
Phosphine	Associated with the incineration of phosphorous-rich waste, such as bone meal. The formation is slow and is usually avoided through proper ventilation of the IBA storage bays. This is a rare issue and has only been recorded in energy recovery facilities that contain an animal crematorium.	2199	2.3	2.1	N/A	~350mg/hr	2,000L	No

[1] UN numbers are a four-digit number that identifies hazardous substances, and articles in the framework of international trade and transport. Some hazardous substances have their own UN number, while sometimes groups of chemicals or products with similar properties receive a common UN number.

[2] Many dangerous goods present the hazards of more than one Class. Such goods are assigned to a Class according to their primary hazard. The other hazard or hazards are referred to as Subsidiary Risks.

[3] Packing Groups are a number (I, II or III) assigned to specific dangerous goods based on the individual SDS: 'I' being a substance presenting high danger to 'III' being a substance presenting low danger.

Dangerous Good	Use Onsite / By-product	UN Number[1]	Class	Subsidiary Risk[2]	Packing Group[3]	Quantity Held Onsite	Fire Protection Quantity (see Table 1)	Exceeded Quantity?
	This facility will not have an animal crematorium.							
Hydrogen (gaseous)	Created from a reaction between IBA and the water used to cool IBA and prevent dust generation. This is due to the presence of aluminium and its reaction with regenerated water.	1049	2.1	N/A	N/A	1.5kg/hr	5,000L	No
Sodium hydroxide	pH adjustment in process water	1823	8	N/A	II	700kg	10,000L or kg	No
Hydrochloric acid	Used in water treatment regeneration.	1789	8	N/A	II	700kg	10,000L or kg	No
APCr Note: not transporting as treatment will occur at the site. Once treated and immobilised onsite APCr will be transported in solidified form offsite	APCr is a combination of boiler ash (from the hoppers below the convection section of the boiler), spent flue gas treatment reagent and acid gas removal reaction products, spent activated carbon adsorbent and the residual entrained ash within the flue gases that did not become deposited in the boiler section.	2811	6.1	N/A	N/A	175t	20,000L or kg	Yes
Diesel	While diesel is not classified as a dangerous good, it can add to the fuel load if in fire, and hence must be considered when assessing the site.	1202	N/A – not a dangerous good but is a C1 combustible liquid			140t or ~120kL	100,000L	Yes

There are up to three hazardous substances identified for the MERC which exceed the FPQ thresholds. These are:

- 25% Aqueous Ammonia: if used, the Proposal will have up to ~80t onsite, which exceeds the threshold of 20t. However, the Proposal intends to utilise either Urea solution (non-hazardous), which does not have a FPQ threshold
- APCr: the Proposal will have ~175t onsite, which exceeds the screening limit of 20t
- Diesel: the Proposal will have 120kL, which will exceed the threshold of 100kL.

Due to the above exceedances, and in accordance with the Dangerous Goods (Storage and Handling) Regulations 2022, the proponent is required to submit an Application for Written Advice for the emergency services authority (Fire Rescue Victoria), in accordance with Regulation 52.

3.1.2 Regulation 53: Manifest quantities

Table 5 shows the dangerous goods identified for MERC that exceed these manifest quantities.

Table 5: Dangerous Goods manifest quantities identified for MERC and Manifest Quantity threshold screening

Dangerous Good	Class	Subsidiary Risk	Packing Group	Quantity	Manifest Quantity (see Table 1)	Exceeded Quantity?
Hydraulic oil	3	N/A	III	~1t	10,000L or kg	No
Lubrication oil	3	N/A	III	~1t	10,000L or kg	No
Activated carbon	4.2	N/A	III	15m^3	10,000L or kg	No
Ammonia[4] (ammonium hydroxide, <25% concentration) **(if used)**	8	N/A	III	<20t for Anhydrous Ammonia or up to ~80t for 25wt% Aqueous Ammonia Solution	10,000L or kg	Yes
Propane/Acetylene	2.1	N/A	N/A	<100kg	5,000L	No
Phosphine	2.3	2.1	N/A	~350mg/hr	500L	No
Hydrogen (gaseous)	2.1	N/A	N/A	1.5kg/hr	5,000L	No
Sodium hydroxide	8	N/A	II	700kg	2,500L or kg	No
Hydrochloric acid*	8	N/A	II	700kg	2,500L or kg	No
APCr	6.1	N/A	N/A	175t	10,000L or kg	Yes

3.1.2.1 Regulation Summary

Under the Dangerous Goods Regulations 2022, the following actions must be completed by Cleanaway:

- In accordance with Regulation 52, an Application for Written Advice to FRV must be made, as the FPQ quantities for activated carbon, ammonia, APCr and diesel are exceeded
- In accordance with Regulation 53, a written emergency plan must be developed, implemented and maintained to reduce the risk associated with an emergency, so far as is reasonably practicable. This too must be provided to Fire Rescue Victoria, written advice sort and due regard given to that advice.

[4] The Proposal intends to utilise either Urea solution (non-hazardous) or aqueous ammonia solution (25% ammonia in water). Urea solution does not have a manifest quantity threshold.

3.1.3 Occupational Health and Safety Act 2004

The HAZID workshop outlined in Section 3.3.1 is the first phase in achieving compliance with the OHS Act. In the FEED stage of design, the HAZID process has identified the hazards and the design controls to be implemented during detailed design. A Safety in Design (SiD) process will need to be conducted during detailed design. The SiD process integrates the hazards and controls, including those identified in the HAZID, and assess the risk profile over the lifecycle of the design including the operational risks.

3.2 Construction

The majority of hazards and risks occur primarily during the operation of the proposal. However, there are potential hazards and risks during construction. These include:

- Spills of dangerous goods during construction that are required for operation, as listed in Table 6
- Construction vehicle or machinery incidents, that either could result in the spillage of dangerous goods or injury to person(s).

A Construction Environmental Management Plan (CEMP) should be prepared in accordance with the requirements of EPA Publication 1834 Chapter 7, to include measures to avoid these hazards and risks during construction. Factors and their mitigations to be considered include:

- Transport of dangerous goods: Verification that transport vehicles meet the legislative requirements of *Dangerous Goods (Transport by Road and Rail) Regulations 2018*
- Storage of dangerous goods: Verification that bunded storage is provided and that separation distances are maintained for the storage area.

The CEMP should be completed during detailed design, and prior to the commencement of construction.

3.3 Operation

3.3.1 HAZID workshop

A HAZID workshop was undertaken on 20 September 2022 to identify relevant risks and mitigation measures in relation to hazardous substances and industrial hazards for the MERC. This workshop included a multi-disciplinary team of specialists from Arup, Ramboll and Cleanaway. The workshop involved systematically reviewing the WtE process and questioning potential risks, causes and consequences. For those identified risks, the design team outlined mitigation measures to be implemented to eliminate or reduce this risk, as far as reasonably practicable. This process was completed for the operational phase of the MERC only.

This systematic process identified hazards and risks associated with the proposal so far as reasonably practicable, and the subsequent mitigation against. The hazards and risks are typically mitigated and/or managed by complying with the relevant standards of design for individual systems, goods, and processes. While there will be dangerous goods stored onsite which could be subject to fire, explosion, or toxic release, these dangerous goods are well-understood and there are industry standards e.g., AS3780-2008 *The storage and handling of corrosive substances,* AS1940 *The storage and handling of flammable and combustible liquids*, and (if applicable) AS/NZS 2022 *Anhydrous Ammonia – Storage and Handling*, for storing and managing these goods which will be applied as part of the proposal.

Five hazards were identified as having potential to pose significant risks to the Proposal. Table 6 outlines these hazards and potential mitigation measures to reduce the risk, as well as residual risks. The full results of the HAZID workshop are documented in Appendix A.

Table 6: Significant hazards, mitigation measures and residual risks identified for MERC

Item No.	Hazard	Mitigation Measures	Residual Risk
1	Fire in the waste bunker	To reduce the risk of a fire in the bunker, thermal monitoring of hot spots within the waste bunker should be adopted. The bunker should be scanned (via infrared) continuously at various levels of detection. Each level should determine if a new action from water cannons (semi-automatic) is required. Crane operator/control room will be alerted if a fire is ignited and can take control of water cannons. In the event that the operators in control room are alerted to the presence of hot spots or smouldering or burning waste in the waste bunker, they can interject and move the material into the furnace feed hopper using the grab crane, as required. To ensure that the mitigation measure of using water cannons is successful, the water cannons should be charged in the pipework ready for operation at all times. In the event that the biogas from the decomposition of waste ignites / explodes, this will be contained within the concrete lined and fully enclosed waste bunker, equipped with water cannons. In addition, the waste bunker operates under slight negative air pressure, which means that any biogas would be preferentially drawn into the operating furnaces along with the primary combustion air. Decomposition of waste is a slow process and as such the bunker should be regularly emptied to ensure that waste is not kept within the bunker for long enough to allow decomposition to occur. To prevent and/or reduce the likelihood of a fire in the shredder leading to a fire in the bunker, potential mitigation measures include: • Ensuring firefighting equipment is installed, including water cannons. Note, the shredder can withstand a deluge of firewater if required during an ignition event • Supervised loading and selective feeding to prevent ignition. This process would prevent a fire in the shredder. Where practicable crane drivers will feed the furnace on a 'first-in, first-out' basis to minimise the residence time of any given waste material. The configuration of firefighting equipment in the waste bunker area will be determined during detailed design, to ensure that the shredder and its output is adequately covered by the fire suppression system(s).	There remains a residual risk of a fire in the waste bunker. The operators will be responsible for maintaining and firing the water cannons and using the crane to remove hot spots to contain small fires.
2	Hazardous materials i.e., 9kg LPG canisters, unintentionally received by the facility.	Visual inspections will be undertaken by employees of the facility while the feedstock is in the bunker to identify any hazardous materials and remove these from the process. The potential for explosions and any mitigations will be explored with the technology provider during detailed design, in the Hazard and Operability Study (HAZOP) workshop, as part of Safety in Design. Explosions will result in a sudden reduction in flue gas oxygen content and the potential for temporary upset to combustion air flows. The change in flue gas oxygen content will be observed by the EMS.	There remains a residual risk that any hazardous materials are missed by the visual inspection procedures resulting in the material entering the facility. In addition, not all truckloads will be individually inspected. The furnace allows for explosions to occur inside if hazardous materials, such as LPG

Item No.	Hazard	Mitigation Measures	Residual Risk
			canisters or aerosols, pass through the bunker. This will be managed operationally by the proponent and through boiler inspections to determine if any repairs to refractory lining are required.
3	Activated carbon dust explosion	Powdered activated carbon is a combustible dust and weakly explosive. Typical material safety requirements include storage in a dry, cool, well-ventilated area, away from strong oxidizers, strong acids, ignition sources, combustible materials, and heat. An adequate air gap between packages is recommended to reduce propagation in the case of fire. As with all finely divided materials, all transfer, blending, and dust collecting equipment shall be grounded to prevent static discharge. Permanent nitrogen blanketing of the storage silo is to be adopted. Practice good housekeeping to prevent the accumulation of dust or dusty conditions in areas associated with activated carbon handling and storage. Where dust is unavoidable, dust-proof boxes and regular electrical line maintenance are recommended. Appropriate standard operating procedures will be developed by the proponent for maintenance and use. A hazard assessment shall be carried out during detailed design. Hazardous Area Classification as required by AS/NZS 60079.10.2:2016 *Explosive atmospheres Part 10.2: Classification of areas – Explosive dust atmospheres,* including around the storage area and equipment. Dusts are hazardous because when they are dispersed in air (by any means) they may form potentially explosive atmospheres. This standard gives guidance on the identification and classification of areas where such hazards from dust can arise. It sets out the essential criteria against which the ignition hazards can be assessed and gives guidance on the design and control parameters which can be used in order to reduce such a hazard.	There remains a residual risk that permanent nitrogen blanket is non-functional or does not work as intended. This will be maintained by the proponent.
4	Diesel spill and bund fire	The design of the facility will comply with AS1940-2017 *The storage and handling of flammable and combustible liquids*. This will be done during detailed design The diesel used for facility should be stored outside and storage should conform to the requirements of AS1940. The emergency response plan to be developed by the proponent must address diesel spill, bund fire and the appropriate firefighting infrastructure and systems to be provided	Diesel has the potential for offsite impacts. FRV may advise different approaches to the fire protection systems when Written Advice is provided. Thus, when this application is made, the design will need to have flexibility to address any advice.
5	Release of ammonium hydroxide (if applicable. Urea solution is also being considered. Urea is not a dangerous good)	If applicable, the design of the facility should comply with AS/NZS 2022 *Anhydrous Ammonia – Storage and Handling* and AS3780-2008 *The storage and handling of corrosive substances.* The controls around ammonia are well known. Ammonia should be stored outside to prevent release of toxins resulting in irritation / burns to the skin, throat, lungs and eyes. A provisional location has been determined within the outside tank farm in a separate bund. The level in the tank will be monitored to prevent any overflow.	Uncertainty if ammonia or urea will be used for SNCR – to be confirmed in detailed design.

Item No.	Hazard	Mitigation Measures	Residual Risk
		Ammonia may have offsite impacts due to its toxicity. If ammonia is used: • It will be stored in a separate bunded area outside • Water sprays will be included around the bunded area. In the event of release, the spray traps the ammonia in the water, thus reducing the offsite risk from ammonia vapour being carried in the air. Tank venting is required during operation (e.g. during tank filling). The venting pipe design shall be high enough so as not to affect people. The vent and overflow lines will require ammonia absorption protection. This could be achieved with water seals to absorb the vapours or a scrubber.	

3.3.2 GED

To assist Cleanaway in understanding and discharging its GED, the HAZID assessment allowed for identification and evaluation of potential risks to human health and the environment from pollution and waste. For the purpose of this assessment, ‘waste’ refers to waste produced by the facility, not waste material the facility uses as part of the WtE process.

Table 7 summarises specific risks relating to pollution and waste hazards, including proposed mitigation measures to reduce / eliminate potential impact so far as reasonably practicable.

Table 7: Potential risks of harm to human health and the environment from specific pollution and waste hazards

Item	Risk	Potential impact	Mitigation Measures
1	Uncontrolled release of APCr into the environment. APCr is a combination of boiler ash, spent flue gas treatment reagents and reaction products and leftover entrained ash within the flue gases that did not become deposited in the boiler section.	APCr contain a variety of elements, heavy metals and toxins. The composition of APCr depends on the incoming waste, however it often includes heavy metals such as lead, zinc and tin. Given its composition includes heavy metals it is classified as a Class 6.1 toxic substance. An uncontrolled release of APCr could have hazardous impacts to human health.	Boiler ash and bag filter residue is conveyed to a temporary APCr storage silo via fully enclosed pipework or ductwork. APCr is mixed with cement and water to create a concrete-like slurry and bagged in batches to be transported to another area onsite to allow the mixture to cure and harden like concrete. APCr is not transported without first being treated.
2	Hydrogen formed as a by-product of the reaction between elemental aluminium in the IBA and the water used to cool IBA and prevent dust generation. This process only produces very small quantities of hydrogen.	Hydrogen build-up as a by-product of reaction between elemental aluminium in IBA and water can explode if ignited.	Raw IBA is not stored within the WtE process plant area. Hydrogen is very light (lighter than air) and therefore dissipates into the atmosphere quickly. The design of the materials handling system (i.e. IBA discharger, IBA conveyor) for raw IBA shall ensure good ventilation. The IBA extraction hall shall include mechanical ventilation. The IBA vapour extraction system will be connected to the emergency diesel generator. Raw IBA will be stored in the open air during maturation, prior to processing to recover recyclable metals, including aluminium. The rate of generation of hydrogen is low with no risk of a flammable concentration being evolved from IBA materials handling and processing. Hydrogen detection to be located in potential confined spaces in building areas where raw IBA is being handled.

4. Conclusions

This report has identified risks and mitigation measures in relation to hazardous substances and industrial hazards associated with the construction and operation of the MERC. This includes identification of risks (and mitigation measures) from pollution or waste to help Cleanaway discharge its GED under the EP Act.

The key risk and mitigations measures identified for the MERC are:

- **Fire in the waste bunker**: Mitigation measures to eliminate or reduce a potential waste bunker fire includes continuous thermal monitoring, water cannons, remote crane operated removal of hot spots in the bunker, negative air pressure, supervised loading and selective feeding.
- **Hazardous waste materials unintentionally received by the facility**: The furnace design allows for explosions to occur if items such as pressurised LPG containers were fed into the furnace without prior removal by the operators.
- **Activated carbon dust explosion**: A permanent nitrogen blanket will be adopted at all times. This helps minimise oxidation by reducing the oxygen content in the surrounding environment. Typical material safety requirements include storage in a dry, cool, well-ventilated area, away from strong oxidizers, strong acids, ignition sources, combustible materials, and heat. An adequate air gap between packages is recommended to reduce propagation in the case of fire. As with all finely divided materials, all transfer, blending, and dust collecting equipment shall be grounded to prevent static discharge. Good housekeeping practices will prevent the accumulation of dust or dusty conditions in areas associated with activated carbon handling and storage. Where dust is unavoidable, dust-proof boxes and regular electrical line maintenance are recommended. Hazardous Area Classification as required by AS/NZS 60079.10.2:2016 Explosive atmospheres Part 10.2: Classification of areas – Explosive dust atmospheres, including around the storage area and equipment. Appropriate standard operating procedures will be developed by the proponent for maintenance and use.
- **Offsite impacts from a diesel fire**: The design of the diesel storage area will comply with AS1940 and consideration will be given to the advice obtained in response to the Application for Written Advice to FRV, to address potential offsite impacts that FRV may identify.
- **Uncertainty if ammonia or urea will be used for the SNCR process**: The controls around ammonia and urea are well known. If ammonia is used a placeholder location has been identified. It will be in a separate bund outside, away from incompatible substances, with water sprays around the bunded area. Unlike ammonia, urea is not classified as a dangerous good.

This assessment has also included identification of risks (and mitigation measures) from pollution or waste to help Cleanaway discharge its GED under the EP Act. The residual risks that could pose harm to human health and the environment will be managed operationally by Cleanaway.

The next steps required by Cleanaway as dictated by the legislative requirements includes:

- Making an Application for Written Advice to FRV in accordance with Regulation 52 of the Dangerous Goods (Storage and Handling) Regulations 2022, as the Fire Protection quantities for a number of dangerous goods are exceeded. This Application for Written Advice shall cover the potential high risks that were identified in the HAZID. These include fire in the waste bunker, activated carbon dust explosion, diesel spill and bund fire and the release of ammonium hydroxide (if used). This application will need to discuss what appropriate firefighting infrastructure and systems have been provided to address the potential hazard and relevant emergency response.
- To develop, implement, and maintain a written emergency plan which reduces the risk associated with an emergency, so far as is reasonably practicable, in accordance with Regulation 53. This too must be provided to Fire Rescue Victoria, written advice sort and due regard given to that advice.

- A range of additional actions are recommended to be undertaken in the subsequent phase of the Project to manage risks posed by this report, including implementing SiD.

5. References

[1] *Environment Protection Act 2017*, Victoria, Australia.

[2] Dangerous Goods (Storage and Handling) Regulations 2022, Victoria, Australia.

[3] *Occupational Health and Safety Act 2004*, Victoria, Australia.

Appendix A

HAZID register

Table 8: HAZID workshop results

ID	Area (if applicable)	Property	Guideword	Cause	Consequence	Safeguard	Recommendations
1	Tipping hall	Fire	Waste	Waste that has a smouldering load (most common source for a truck fire is a lead acid battery)	Fire inside a truck	The operational response is for employees to physically observe the smoke. The response is to stop and tip the load on concrete or a sealed area not in the building. A fire hose/hydrant will be nearby.	Emergency procedures to be identified in the Emergency Management Plan
2		Fire	Waste	Truck breaks down/catches fire	Fire inside a truck	The operational response is for employees to physically observe the smoke. The response is to stop and tip the load on concrete or a sealed area not in the building. A fire hose/hydrant will be nearby.	Emergency procedures to be identified in the Emergency Management Plan
3		Fire	Combustible material	Fire in bunker comes back into tipping hall	Fire spread through building	Vehicles are the only combustible materials within tipping hall. There are no other combustible materials. The design management of this risk includes fire detection and sprinklers.	Emergency procedures to be identified in the Emergency Management Plan
4		Crash	Truck	High frequency of movements in tipping hall	Fire inside a truck	Vehicles are the only combustible materials within tipping hall. There are no other combustible materials. The design management of this risk includes fire detection and sprinklers.	Emergency procedures to be identified in the Emergency Management Plan
5		Crash	Truck	Fuel spill	Fuel ignites	Flame detection, firefighting equipment including appropriate extinguishers (trucks carry foam extinguishers) to be provided. Fire detection and sprinklers are to be provided within the tipping hall.	Emergency procedures to be identified in the Emergency Management Plan
6	Bunker	Fire	Waste	Hot ash / disposal of hot waste / self- heating	Fire in waste	Thermal detection of waste, full water cannons, bunker is scanned (infrared) continuously at various levels of detection. Each level determines a new action from water cannons (semi-automatic). Crane operator/control room will be alerted and can take control of water cannons. In the event that the operators in control room are alerted to the presence of hot spots or smouldering or burning waste in the waste bunker, they can interject and move the	N/A

ID	Area (if applicable)	Property	Guideword	Cause	Consequence	Safeguard	Recommendations
						material into the furnace feed hopper using the grab crane, as required.	
7		Flammable gas	In waste	Decomposition of waste	Biogas catches fire/explodes	Negative air pressure in the waste bunker caused by drawing combustion air from that area would carry biogas into furnace along with the combustion air. Decomposition of waste is too slow compared to the normal residence time of waste in the waste bunker. The bunker would be emptied in sections so that waste is not kept in the bunker for long enough for decomposition to occur.	Establish operating procedures for moving waste from bunker to furnace to avoid waste being in the bunker for too long (first in, first out)
8		Recovery	Confined	Confined space access	Operational continuity	People cannot physically enter the waste bunker.	Operational Management Plan to outline procedures around confined spaces and lifting equipment for people for activities such as waste bunker concrete inspections. To be developed during detailed design.
9							
10		Fire	Shredder	Shredder generates sparks that initiates a bunker fire	Fire in bunker	Firefighting equipment including water cannons will be used. The shredder can withstand a deluge of firewater if required.	In the event of a major fire, thorough inspections of the shredder including the bearings is required to be implemented
11		Fire	Shredder	Shredder shredding items that are flammable, combustible or can generate sparks	Fire in bunker	Supervised loading and selective feeding. Design does not allow for fire to stay in shredder. The shredder has a wide opening and material falls out of the shredder back into the waste bunker. Therefore, any material that is on fire would not stay in the shredder	The configuration of firefighting equipment in the waste bunker area will be determined during detailed design, to ensure that the shredder and its output is adequately covered by the fire suppression system(s).
12	Furnace	Flow	High	Backfire from furnace into chute.	Fire from furnace comes back into chute.	During operation, the feed chute is typically kept full of waste by the crane operator. Feed chute level monitoring alerts the operator and/or the combustion	N/A

ID	Area (if applicable)	Property	Guideword	Cause	Consequence	Safeguard	Recommendations
						control system to adjust the feed rate accordingly. There is also a fire damper inside the chute, to keep the feed chute sealed and prevent the uncontrolled ingress of combustion air into the furnace via the feed chute. In addition, the furnaces operate under slight vacuum conditions, which means that hot flue gases preferentially flow up into the heat recovery boiler, rather than back out the feed chute. Fire damper between bunker and boiler hall. The automatic combustion control system controls how much waste is on the conveyor, ramp feeder into furnace.	
13		Air flow	Zero	Emergency or planned	Gasification in furnace combustion chamber	Emergency diesel generators provides electricity to critical fans. Auxiliary burners have a burner management system and uninterrupted power supply (UPS) to ensure combustible gases in the flue gas are fully combusted before entering the boiler and flue gas treatment system.	N/A
14		Flammable gas	In waste	Gas canister	Explosion in furnace	Operationally, these items if visually seen by the grab crane operators will be removed. Additionally, the furnace design allows for explosions.	N/A - part of typical design of furnace
15	Boiler	Leak	Steam	Instantaneous release of steam from pipework, potential for injury	Shutdown of line	Contained within boiler. No external pipework exposed to flue gas. Boiler and pressure vessels designed to AS1210 (or allowable international boiler code). Mandatory (regulatory) inspections of boiler. Operationally, regular maintenance, continuous emissions monitoring systems (CEMS) (for monitoring moisture content) .	N/A
16		Leak	Water	Flue gas is extremely corrosive, corrodes the inside of the boiler	Shutdown of line	Contained within boiler. No external pipework exposed to flue gas. Designed to AS1210 (or allowable international boiler	N/A

ID	Area (if applicable)	Property	Guideword	Cause	Consequence	Safeguard	Recommendations
						code). Mandatory (regulatory) inspections of boiler. Operationally, regular maintenance, CEMS (for monitoring moisture content) .	
17	Ammonia (if applicable) storage area	Loss of material	Ammonia/ urea	Leak in storage or pipes	People exposed to ammonia or urea (options being considered)	• Urea (if used) stored inside (not outside due to temperature and to prevent crystallisation) with ~82m3 tank (if 40% urea solution is used). • Anhydrous ammonia (if used) to be stored outside (~33m3). Location to be determined - provisional location for ammonia tank outside in a separate bund.	Confirm if urea or ammonia will be used during detailed design. If ammonia is used, confirm location. Separate bund will be required if it is located within the tank farm.
18		Pressure	High	Ammonia tank (if applicable) needs to be vented	People near venting pipe exposed to ammonia	Tank venting is required during operation e.g. during tank filling. The venting pipe design shall be high enough so as not to affect people. The vent and overflow lines will require ammonia absorption protection. This can be achieved with water seals to absorb the vapours or a scrubber.	N/A
19		Tank level	High	Over delivery of ammonia (if applicable)	Overflow of ammonia	Monitoring of the tank level guage during filling. Tank secondary containment to be provided. Ammonia storage to be designed to AS3780 and AS/NZS 2022. Water sprays will be included around the bunded area. In the event of release, the spray traps the ammonia in the water, thus reducing the offsite risk from ammonia vapour being carried in the air.	N/A
20	IBA	Maturation	Hydrogen	Water reacting with elemental aluminium in IBA	Explosion of hydrogen	Release quantities are very small. Raw IBA will not be stored within a building or unventilated area. The gas will dissipate in the atmosphere	N/A
21		Maturation	Phosphine	Bonemeal in waste producing phosphine	Explosion of phosphine in IBA	Unlikely to have a lot of bonemeal in incoming waste. The MERC draft Waste Acceptance Protocol classifies medical waste, vet waste, and bodies as unacceptable waste and such waste shall not be accepted for processing at the MERC.	N/A

ID	Area (if applicable)	Property	Guideword	Cause	Consequence	Safeguard	Recommendations
22		Explosion	Dust	Ignition source	Dust generated by IBA process explodes	IBA is maintained in a moist condition with 15-20% moisture. IBA sorting and processing will occur in a fully enclosed area with appropriate ventilation and dust extraction. IBA has very low unburnt carbon content (<3% total organic carbon) and is therefore inert. Matured and processed IBA aggregate (IBAA) will be stored outdoors with appropriate dust suppression. Loading into vehicles for transport off-site will also occur outdoors.	N/A
23		Loss	Water supply	IBA is not cooled	IBA causes fire/explosion/ dust explosion	Duty standby on water supply to water bath on ash discharger. IBA is essentially inert, with very low unburnt carbon content (<3% total organic carbon).	N/A
24		Failure	Extraction system or conveyor	Loss of power or mechanical failure	Accumulation of hydrogen gas	ID fan and IBA vapour extraction fans are connected to the emergency diesel generator. Mechanical ventilation for IBA extraction hall to be provided. IBA conveyor enclosure to be ventilated. Hydrogen detection monitors to be located in high points where hydrogen gas could potentially accumulate.	N/A
25	Baghouse	Fire	Baghouse	Heat from flue gas or external fire source	Fire in baghouse	The filter bags are typically covered by filter cake (a layer of lime and activated carbon), that ultimately becomes APCr. Low/negligible risk of fire/explosion due to the low concentration of activated carbon. Choice of bag materials to be considered in detailed design. Economiser cools flue gas upstream of a semi-dry scrubber inclusive of a water quench, which further cools and moistens the flue gas upstream of the baghouse filter.	N/A
26		Loss of feed bags	Control	Catastrophic failure of baghouse bags	Catastrophic failure of feed bags	Isolate and replace bag. A CEMS will be implemented to continuously monitor flue gas dust concentration and alert the operators to take action in the event of a filter bag failure.	N/A

ID	Area (if applicable)	Property	Guideword	Cause	Consequence	Safeguard	Recommendations
27	N/A	Explosion	Activated carbon	Storage of activated carbon is an explosion risk	Dust explosion	Typical material safety requirements include storage in a dry, cool, well-ventilated area, away from strong oxidizers, strong acids, ignition sources, combustible materials, and heat. An adequate air gap between packages is recommended to reduce propagation in the case of fire. As with all finely divided materials, all transfer, blending, and dust collecting equipment shall be grounded to prevent static discharge. Good housekeeping practices will prevent the accumulation of dust or dusty conditions in areas associated with activated carbon handling and storage. Permanent nitrogen blanketing of the storage silo is to be adopted. Where dust is unavoidable, dust-proof boxes and regular electrical line maintenance are recommended. Hazardous Area Classification as required by AS/NZS 60079.10.2:2016. Appropriate standard operating procedures will be developed by the proponent for maintenance and use.	N/A
28	N/A	Loss of emissions	FGT	Pipe burst or leaking valve of APCr	Uncontrolled release of emissions	APCr storage and handling is indoors. APCr is a fine solid (powder) which may generate some dust in the unlikely event of an uncontrolled release. APCr consists of alkaline salts which can be removed to prevent dust accumulation. Operators to wear appropriate PPE while attending to any release of APCr and corrective maintenance to address the point of release.	Review makeup to determine potential hazard (acute or long-term chronic health issues)
29	APCr storage area	Storage	APCr	APCr silos out of action	Small spillage of APCr	APCr mixed with cement and water to create concrete slurry and bagged prior to batch transport to another area for curing. Raw APCr will not be transported offsite without being treated. If the transfer pipe cracks/breaks, the screw conveyors are used. Two APCr storage silos provide redundancy.	N/A

ID	Area (if applicable)	Property	Guideword	Cause	Consequence	Safeguard	Recommendations
30	N/A	APCr	APCr	Corrosion	Leak in pipe	material selection in accordance to industry best practice.	Consider if fibreglass pipework would perform better during detailed design
31	N/A	Storage	Activated carbon	High temperature in silo	Dust explosion	Typical material safety requirements include storage in a dry, cool, well-ventilated area, away from strong oxidizers, strong acids, ignition sources, combustible materials, and heat. An adequate air gap between packages is recommended to reduce propagation in the case of fire. As with all finely divided materials, all transfer, blending, and dust collecting equipment shall be grounded to prevent static discharge. Good housekeeping practices will prevent the accumulation of dust or dusty conditions in areas associated with activated carbon handling and storage. Permanent nitrogen blanketing of the storage silo is to be adopted. Where dust is unavoidable, dust-proof boxes and regular electrical line maintenance are recommended. Hazardous Area Classification as required by AS/NZS 60079.10.2:2016. Appropriate standard operating procedures will be developed by the proponent for maintenance and use.	N/A
32	N/A	Storage	Hydrochloric acid	Pipe burst	Leakage near equipment and flanges	Design to AS3780	N/A
33	N/A	Storage	Sodium hydroxide	Pipe burst	Leakage near equipment and flanges	Design to AS3780	N/A
34	N/A	Storage	Ammonium hydroxide (if used)	Pipe burst	Leakage near equipment and flanges	Design to AS3780	N/A
35	Water Treatment	Loss of	Control	Storage of sodium hydroxide and	Interaction of acid and base	Design to AS3780. Segregation of storage areas for incompatible substances.	N/A

ID	Area (if applicable)	Property	Guideword	Cause	Consequence	Safeguard	Recommendations
				hydrochloric acid together			
36	Transformer	Fire	Bund	Oil filled transformer	Transformer explosion	Design to AS2067 and AS/NZS60076 series	Let the fire burn out if an event occurs
37	UPS	UPS batteries	UPS batteries	Lead acid batteries	Hydrogen production	Design to appropriate standards	N/A
38	UPS	UPS batteries	UPS batteries	Lithium	Overloaded and creating a fire	Design to appropriate standards	N/A
39	N/A	Storage	Activated carbon	Brought in as a powder and blown into the silo, hose bursts	Dust explosion	Typical material safety requirements include storage in a dry, cool, well-ventilated area, away from strong oxidizers, strong acids, ignition sources, combustible materials, and heat. An adequate air gap between packages is recommended to reduce propagation in the case of fire. As with all finely divided materials, all transfer, blending, and dust collecting equipment shall be grounded to prevent static discharge. Good housekeeping practices will prevent the accumulation of dust or dusty conditions in areas associated with activated carbon handling and storage. Permanent nitrogen blanketing of the storage silo is to be adopted. Where dust is unavoidable, dust-proof boxes and regular electrical line maintenance are recommended. Hazardous Area Classification as required by AS/NZS 60079.10.2:2016. Appropriate standard operating procedures will be developed by the proponent for maintenance and use.	N/A
40	N/A	Storage	Activated carbon	Explosion from spark / self-heating	Explosion / fire	Typical material safety requirements include storage in a dry, cool, well-ventilated area, away from strong oxidizers, strong acids, ignition sources, combustible materials, and heat. An adequate air gap between packages is recommended to reduce propagation in the case of fire. As with all finely divided materials, all transfer, blending, and dust collecting	N/A

ID	Area (if applicable)	Property	Guideword	Cause	Consequence	Safeguard	Recommendations
						equipment shall be grounded to prevent static discharge. Good housekeeping practices will prevent the accumulation of dust or dusty conditions in areas associated with activated carbon handling and storage. Permanent nitrogen blanketing of the storage silo is to be adopted. Where dust is unavoidable, dust-proof boxes and regular electrical line maintenance are recommended. Hazardous Area Classification as required by AS/NZS 60079.10.2:2016. Appropriate standard operating procedures will be developed by the proponent for maintenance and use.	
41	Site	Weather	Extreme rainfall	Extreme rainfall	Flooding	Main waste to energy (WtE) facility and visitor centre will be located above the 1 in a 100-year event plus a freeboard. The Site's stormwater network will be designed in accordance with local regulations and will shed overland flows away from the buildings.	N/A
42		Weather	Wind	Weather	Damage to facility	Design to AS/NZS1170.2	N/A
43		Weather	Lighting	Extreme weather event	Lightning hits stack	Provide local lightning protection as per regulations	N/A
44		Sabotage	Sabotage	Environmental activists and theft of materials	Mostly vocal. Risk during construction if protestor is injured	Construction site to be secured. Building is secure outside of hours and has security system in place during operation.	N/A
45		Fire	Bund	100 000L of diesel	Diesel ignition	Design to AS1940	N/A
46		Separation	Transformer	Transformer	Domino effect for transformers	Design to AS2067 and AS/NZS60076 series	N/A
47	Turbine Hall	Fire	Bund	Turbine lube oil storage	Fire	Design in accordance with Australian Standards and industry best practice (deluge system)	N/A

ID	Area (if applicable)	Property	Guideword	Cause	Consequence	Safeguard	Recommendations
48	MCC	Fire	Electrical equipment	Loose connections, equipment damage, overheating	Fire	Design in accordance with Australian Standards and industry best practice	N/A
49	N/A	Storage	Lime	Pipe burst	Leakage near equipment and flanges	Design to AS3780	N/A