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1 Preliminary Fire Risk Assessment

2.1 Introduction

This development will comprise 6 no data storage buildings comprising two stories of data storage rooms and ancillary office accommodation. The buildings are identified on the site plan submitted as part of the planning application as D1 – D6. This report has been prepared to demonstrate the proposed compliance with Part B of the Building Regulations – (as the building is not yet constructed management has not been considered).

The Fire Engineering proposals have been developed in an interactive process between Fire Engineer, the Architects and other members of the design team. In order to obtain the optimum and most compliant solution, the Fire Safety Engineering proposals are developed through liaising with the Architect. The Fire Safety Engineer initially carries out a design appraisal of the Architectural design scheme and issues a report on all the fire safety engineering issues relevant to the scheme. These issues were discussed and the optimum fire strategy was agreed.

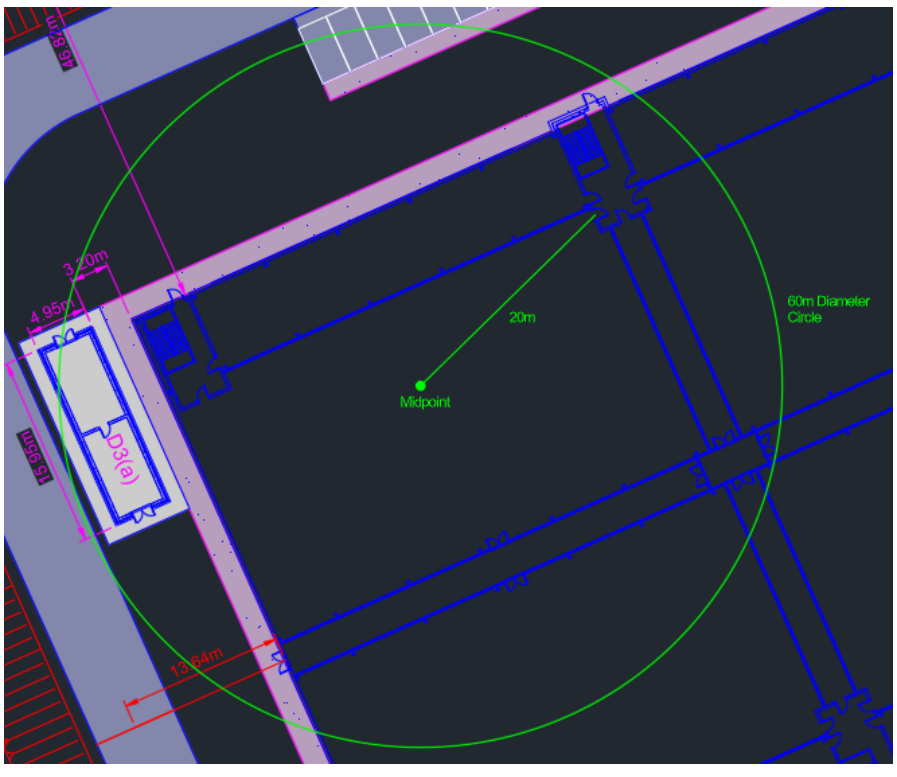
The fire safety strategy for the means of escape from the buildings will be based on the recommendations of Technical Guidance Document B, 2024.

1.1 Means of Escape

Purpose Group

Storage – Normal risk – Purpose group 7 (a)
Office – Purpose ground 3
The maximum travel distance permitted:

- 18m in a single direction of escape (12m direct)
- 45 m in more than one direction (30m direct)



An assessment has been carried out as outlined above and these will not be exceeded.
Normal risk is considered acceptable as the height of the storage in each of the compartments will be less than 7m.
Hose reels are required. 1 hose reel is required per 500sqm. These will be provided on a pro rata basis.
A fire detection and alarm system will be provided to achieve at least and L2 / L3 standard.
Emergency lighting will be provided throughout all defined escape routes. All wiring and electrical installations will comply with IS EN 10101 + A1 2020.

Stairs

Each building will be served by 9 stairs. The entry doors will be FD 60S and the stairs will be provided with 1SQM Vent at the upper landing level. The stairs will comply with the requirements of Part B, K and M of the regulations. The width of the stairs will be at least 1000mm. Disabled refuges will be provided to comply with BS 5588: Part 8.

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1.2 Internal Fire Spread (Linings)

Surface linings will meet the following:

Location	Surface Spread of Flame Classification
Common stairs / Corridors	Class 0 (national) or Class B – s3, d2 (European)
Storage rooms	Class 0 (national) or Class B – s3, d2 (European)
Rooms	Class 1 (national) or Class c – s3, d2 (European)
Toilets	Class 3 (national) or Class D – s3, d2 (European)

These will be achieved by a plastered wall or cladding system.

1.3 Internal Fire Spread (Structure)

The minimum period of fire resistance for the elements of structure in this building is 60 minutes in accordance with Tables 31 and 32 of Technical Guidance Document B.

Area of Compartment

Each storage unit will form it's own fire compartment. The admin section of the building will form it's own compartment.

The area and volume of each of the compartments will be weil within the limitations of those permitted in TGD B 2024.

Construction

All compartment walls will achieve 90 minutes fire resistance on the basis that the current proposal is the floor / ceiling heights exceed 5m. A pre-active sprinkler system is proposed for the protection of the Data buildings albeit not a requirement of the regulations. Compartment walls will be constructed from either stud or blockwork construction or approved tested equivalent.

The floor / ceiling combination will achieve 90 minutes fire resistance. This will be achieve by concrete construction. All cavity barriers will achieve 30 minutes fire resistance.
All compartment walls will be carried up to the underside of the roof compartment floor over.
All walls enclosing the stairs will be carried up to the underside of the roof and fire stopped.
Area of each compartment is well within compartment size of 4000sqm.
No compartment will exceed 4000sqm i.e. no ventilation is required.

Provision of Cavity barriers

External walls if constructed of cavity block wall construction will comply with Diagram 17 or alternatively cavity barriers will be provided in accordance with Diagram 16 such that cavity barriers are provided at the junction of compartment walls with the external wall and fire resisting barriers and the external wall.
All corridors that are subdivided, will comply with Diagram 20 of Technical Guidance Document B.

Cavity barriers will comply with the recommendations set out in Diagram 53 of Technical Guidance B

- Every fire barrier will be constructed to achieve 30 minutes fire resistance.
- Cavity barriers will be tightly fitted to rigid construction and mechanically fixed in position wherever possible, where this is not possible the junction will be fire stopped.
- Cavity barriers will be fixed so that performance is unlikely to be made ineffective by:
    1. Movement of the building.
    2. Collapse in a fire of any services penetrating them.
    3. Failure in a fire of their fixings.
    4. Failure in a fire of any material or construction which they abut.

Fire Stopping

Pipes which pass through a compartment wall or floor or any other designated fire barrier will meet the appropriated provision of alternatives A, B or C in Technical Guidance Document B 2024 i.e.

- Enclosed in protected shaft and proprietary seals as services penetrated the walls of the shafts.
- Fire Stopping on a floor by floor basis.

All openings for services, joints/imperfections of fit in or between the designated fire barriers will be fire stopped in accordance with the relevant parts of Technical Guidance Document B 2024 so as to ensure the fire resistance of the element is not impaired.

Pipes passing through a compartment wall or floor will be fire stopped in accordance with the provisions of Table 3.4. Pipes penetrating compartment floors and walls which have a nominal internal diameter not greater than 40mm will be fire stopped around the pipe, keeping the opening as small as possible. Any pipes greater than this diameter will be provided with proprietary seals, which have been shown by tests to maintain the fire resistance of the barrier they penetrate.

All openings for pipes, ducts, conduits or cables which pass through any part of a fire barrier will be:

- Kept as few in number as possible.
- Kept as small as practicable.
- Fire stopped in accordance with Item 3.4.5 of Technical Guidance Document B 2024.

The following materials may be used for fire stopping purposes at joints.

- cement or lime mortar
- intumescent mastics
- gypsum based plaster

All fire stopping materials and products will be assessed for suitability of application and demonstration of the appropriate tests to BS EN 13501 will be required prior to installation. The fire engineer will inspect fire stopping on a regular basis.
All fire stopping will be marked on a drawings tagged and photo'd by a specialist contractor.

It should also be noted that all ventilation ductwork will comply with BS 9999 i.e. dampers or encased in fire resisting ductwork or fire resisting construction. No ventilation ductwork will penetrate the protected entrance halls. All dampers will be installed as per manufacturers specifications and will be suitably restrained.

2.5 External Fire Spread

Space separation has been considered between each building on the basis that each storage unit forms a separate fire compartment and the external walls achieve 90 minutes fire resistance i..e the only unprotected openings are those for windows / doors.

The minimum distance required to the boundaries i.e. notional between buildings / site / notional to the centreline of the road is 23m between buildings or 11.5m to the centreline of the road.

External walls will be constructed using insulated metal cladding sheets.
Internal walls will be constructed using 215mm solid blockwork or Gyproc Fireline partition walls.
First floor will be constructed of a steel deck concrete floor
Roof construction will comprise of a Kingspan or approved equivalent achieving a Broof t4

2.6 Fire Fighting Facilities

Water supply to the hydrants will be provided to deliver 75 litres / sec over 120 minutes at one hydrant. This will be provided by connecting the the existing fire main in conjunction with a dedicated 2000m³ fire water tank. 1 no. hydrant will be provided per 1000sqm of ground floor area. The locations of the hydrants will be provided on a watermain drawing and submitted to the local authority

The buildings are less than 10m in height above the adjacent ground level. Therefore, access for pump appliance to 50% of the perimeter is required, which is achieved. This is adequately achieved for all the buildings.
All fire appliance access routes will be a minimum of 3.7m wide. To comply with the TGD B, any dead ends greater than 20m in length will be provided with a turning facility (e.g. hammerhead).

The escape stairs will be provided with an openable window at the upper landing level or a 1sqm AOV.

Fire Hazards Identification

- **Thermal Runaway in Lithium-ion Batteries:**
  Lithium-ion battery cells inherently carry the risk of thermal runaway, a rapid, uncontrolled release of heat and gas caused by internal cell failure or external damage. This may lead to smoke, fire, and potentially explosions within battery modules.

- **Propagation Risk:**
  Without adequate thermal insulation and fire suppression, thermal runaway propagation between cells or modules can escalate a localized fire into a container-wide or site-wide incident.

- **Gas Emissions:**
  Venting of flammable and toxic gases such as hydrogen and electrolyte vapors during thermal runaway events creates explosion and health hazards, necessitating active ventilation and gas detection systems.

- **Electrical Faults:**
  Internal electrical faults—including short circuits, over-temperature conditions, and arc faults—may trigger or amplify fire incidents.

- **Cooling System Failures:**
  HVAC failure or blockage may cause abnormal temperature increases, elevating the risk of cell thermal incidents.

Likelihood and Consequences of Fire Events

- **Localized Thermal Runaway:**
  A failure of a single battery cell or module can initiate a thermal runaway event. The likelihood of occurrence is low due to robust cell manufacturing standards, battery management systems (BMS), and thermal insulation. However, if initiated, the consequences include heat generation, toxic gas release, and potential spread to adjacent cells or racks.

- **Container-Level Fire:**

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Inadequate detection or suppression inside a container could allow a fire to escalate to a full container event. The presence of aerosol suppression and active ventilation significantly reduces this risk. Consequences include damage to battery modules, container structure, and potential gas emissions affecting adjacent containers.

- **Inter-Container Fire Propagation:**
  Insufficient spacing or failure of fire barriers may permit fire spread between containers, risking a multi-container incident. The site's layout and fire compartmentalization measures reduce this likelihood.

- **Environmental and Community Impact:**
  Fires releasing smoke, toxic gases, or firewater runoff pose potential consequences to nearby residents, local ecosystems and site workers.

Risk Rating

Risk Scenario	Likelihood	Consequence	Risk Rating	Comments
Single Cell Thermal Runaway	Low	Moderate	Medium	Mitigated by BMS, insulation, and suppression systems.
Full Container Fire	Very Low	High	Medium-High	Aerosol suppression and detection reduce event escalation.
Fire Spread Between Containers	Very Low	Very High	Medium-High	Fire separation and spacing designed to prevent propagation.
MV/LV Electrical Fault Fire	Low to Medium	High	Medium-High	Maintenance and engineering controls mitigate occurrence and impact.
Rack-Level Fire	Low	High	Medium-High	Early detection and automatic system shutdown reduce fire growth potential.
Environmental Contamination	Very Low	High	Medium	Firewater containment systems limit environmental risks.

2.7 BESS

No fixed location of a BESS has been proposed as of yet. However, once a location and a BESS supplier has been engaged the following general criteria will be followed:

BESS Fire Safety System

Battery Pack Fire Suppression System
The design of the module helps prevent overheating that could lead to thermal runaway in the cells. Two key mitigating features include:

1. A plastic (polypropylene) casing that limits the amount of oxygen available to fuel combustion.
2. Liquid cooling tubes within the module that draw heat away from the battery cells through a cooling cycle.

The fire suppression system consists of a network of pipes capable of extinguishing fires within the battery rack or cabinet. In the event of a fire, the system will automatically release aerosols and send a signal to the control panel when the internal temperature reaches 74°C (162°F).

Emergency Stop Button (DC and LV Isolation)
An Emergency Stop button, located on the front side of the battery connection panel, will disconnect the battery cells from the inverter when pressed, preventing power from reaching the factory. This button also cuts off the low-voltage (LV) supply to all BESS auxiliaries.

UL 9540 Testing
The battery manufacturer will comply with UL9540 standards, and the battery modules for the proposed development will undergo the UL9540A burn test. This test ensures that, in the event of thermal runaway within a module, propagation does not occur. The UL 9540A Test Method is referenced in UL 9540, the Standard for Energy Storage Systems and Equipment, as well as the American and Canadian National Standards for Safety of Energy Storage Systems and Equipment, the International Code Council (ICC) International Fire Code (IFC), and the National Fire Protection Association (NFPA) 855, which provides the Standard for the Installation of Stationary Energy Storage Systems.

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Fire Fighting Facilities
Static storage and appropriate ring main with hydrants will be installed around the facility which will comply with the requirements of B5 of Technical Guidance Document B and BS 9990 2015.

- Hydrants serving the adjoining data centers will serve the BESS. Fire Brigade access signage to be provided to the entry point to the site. All hydrants in the vicinity are to be marked.

- Hand held extinguishers of a class appropriate for the particular fire risk present in the battery energy storage units should be provided within each container. Employees must receive appropriate training in the use of the extinguishers. Fire extinguishers will be provided to the requirements of IS EN 3-7 and IS 291.

General Lithium Ion Safety
The battery energy storage system incorporates the following general Li-ion safety features:

- Functional Safety System
  All battery management systems (BMS) can detect problems using cell and module voltage measurements and select temperature measurements within the batteries. Automatic disconnect of the batteries will occur if any unusual parameters are measured.

- Electrical Abuse Prevention
  The BMS maintains strict control of charging and discharging of the batteries. Voltage, current, temperature and state of charge are all measured and controlled to ensure safe charging and discharging.

- Physical Abuse Prevention
  Energy storage racks are designed without the ultra-high space limitations of a mobile phone. Mechanical stability is designed into every module.

- Thermal Abuse Prevention
  Sophisticated thermal management systems maintain cells at optimal temperature and will automatically trigger foldback of power if safe temperature ranges are exceeded.

- Automatic Fire Detection and Suppression
- Built-in automated system will react and extinguish incipient fires before they can develop.

Treatment of Power Generation Devices / BESS Units by Fire & Rescue Service

The proposed development includes renewable energy generation equipment (wind and solar) and Battery Energy Storage System (BESS) units. These installations will be treated by the Fire & Rescue Service as specialist high-energy electrical hazards, rather than conventional plant or machinery.

At this stage, the following principles are assumed and will be confirmed at detailed design and operational planning stages:

- **Defensive firefighting strategy:**
  In the event of a BESS fire or thermal runaway incident, the primary response is expected to be defensive, focused on life safety, exclusion zones, and preventing fire spread, rather than internal fire attack.

- **Electrical isolation:**
  All BESS units and associated power generation equipment will be provided with clearly identified emergency shutdown and isolation arrangements, enabling the Fire & Rescue Service to place the system into a safe condition where practicable.

- **Limited direct intervention:**
  Fire & Rescue Service personnel would not be expected to directly extinguish a battery fire. Cooling, monitoring, and containment measures may be adopted as appropriate, in accordance with Fire Service guidance and operational risk assessment.

- **Hazard information and site familiarisation:**
  The site will be provided with appropriate hazard signage, site layout information, and emergency response information, clearly identifying:
  - BESS locations
  - Renewable generation areas
  - Electrical hazards
  - Recommended firefighting approach

- **Coordination with Fire Authority:**
  The final emergency response strategy, including access routes, water availability, and tactical approach to BESS and renewable assets, will be developed in consultation with the Fire & Rescue Service prior to commissioning.

CO2 Suppression system.

There will be no CO2 suppression system in the building. The CO2 is provided in a separate standalone building.
Carbon dioxide (CO_2) generated by the fuel cell system will be recovered and purified within a dedicated CO_2 process building and the resulting liquid CO_2 will be stored temporarily on site prior to being transported off-site for beneficial use. Liquid CO_2 will be transferred to a bank of sixteen vertical, vacuum-insulated storage vessels with an internal design pressure of 22 bar and arranged in rows on a reinforced concrete plinth. Over-pressure protection is provided by dual relief valves, and the storage system will be designed, installed, operated and maintained in accordance with the Pressure Equipment Directive (PED) 2014/68/EU.

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Operational management will include routine inspection, maintenance and integrity testing of the vessels, pipework and associated equipment by competent personnel, together with standard operating and emergency procedures for isolation and controlled shutdown in the event of abnormal conditions. With these measures in place, and as assessed in the EIAR, the proposed CO_2 storage arrangements will not give rise to significant adverse effects on the environment.

1.7 Fire Safety Certificate

As outlined in the introduction, the fire safety engineering design process involved the fire engineer undertaking an initial review of the proposed layouts in order to advise on compliance with statutory legislation and propose alternative solutions in order to achieve compliance.

After the initial review was undertaken and circulated, the preferred strategy was decided upon for submission to the Local Authority for approval by way of a Fire Safety Certificate.

Once the application is submitted to the local authority, the fire safety engineer will liaise with the Fire Officer dealing with the application to discuss the technical details. The Fire Officer may request clarification on a number of items throughout the course of the application, which is dealt with by way of additional information, until such time that a grant is issued.

The fire engineer will monitor that compliance with the Fire Safety Certificate grant takes place on site. This will be done through a series of site inspections during construction and attendance at relevant site meetings.

A final inspection will be carried out at practical completion stage and following review of the various fire safety systems certificates, the fire engineer will issue an opinion of compliance with the Building Regulations Part B and will provide ancillary certificate of completion as required in accordance with the Building Control Amendment Regulations 2014