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1. Introduction

1.1. Development Description

This Fire Safety Strategy has been prepared on behalf of Achilles Therapeutics UK Ltd to accompany a S73 application.

Planning permission was granted in November 2020 under application ref. 75918/APP/2020/3171 for the following:

“Installation of mezzanines, external plant compounds, external changes to elevations and associated works”.

Since securing planning permission, Achilles have been progressing the detailed design of Unit B and a number of design changes to the extant scheme are required for operational purposes.

This Fire Safety Strategy demonstrates how the scheme complies with Policy D12 – Fire Safety of the London Plan (2021).

The existing warehouse unit (Hayes 180) was previously sub-divided into two units. The proposed scheme consists of the fitting out of the existing building, (Unit B) Unit 2 illustrated by the burgundy-coloured border in figure 1 below.

The base shell of Unit B / Unit 2 is currently separated into two compartments: a three-storey office block and a large single storey, high bay, storage area. The building is located on the Hayes 180 development at 1-3 Uxbridge Road, Hayes, UB4 0JN.

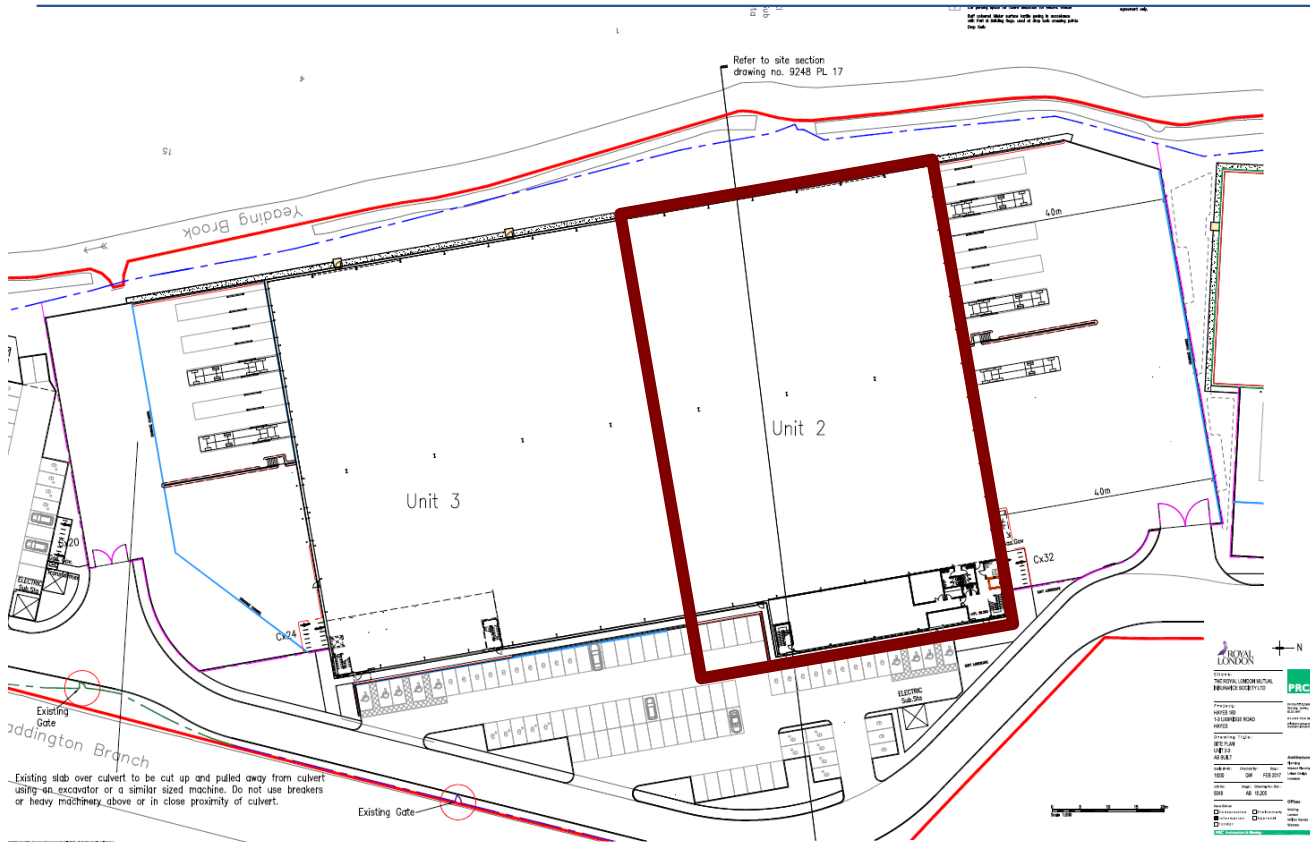


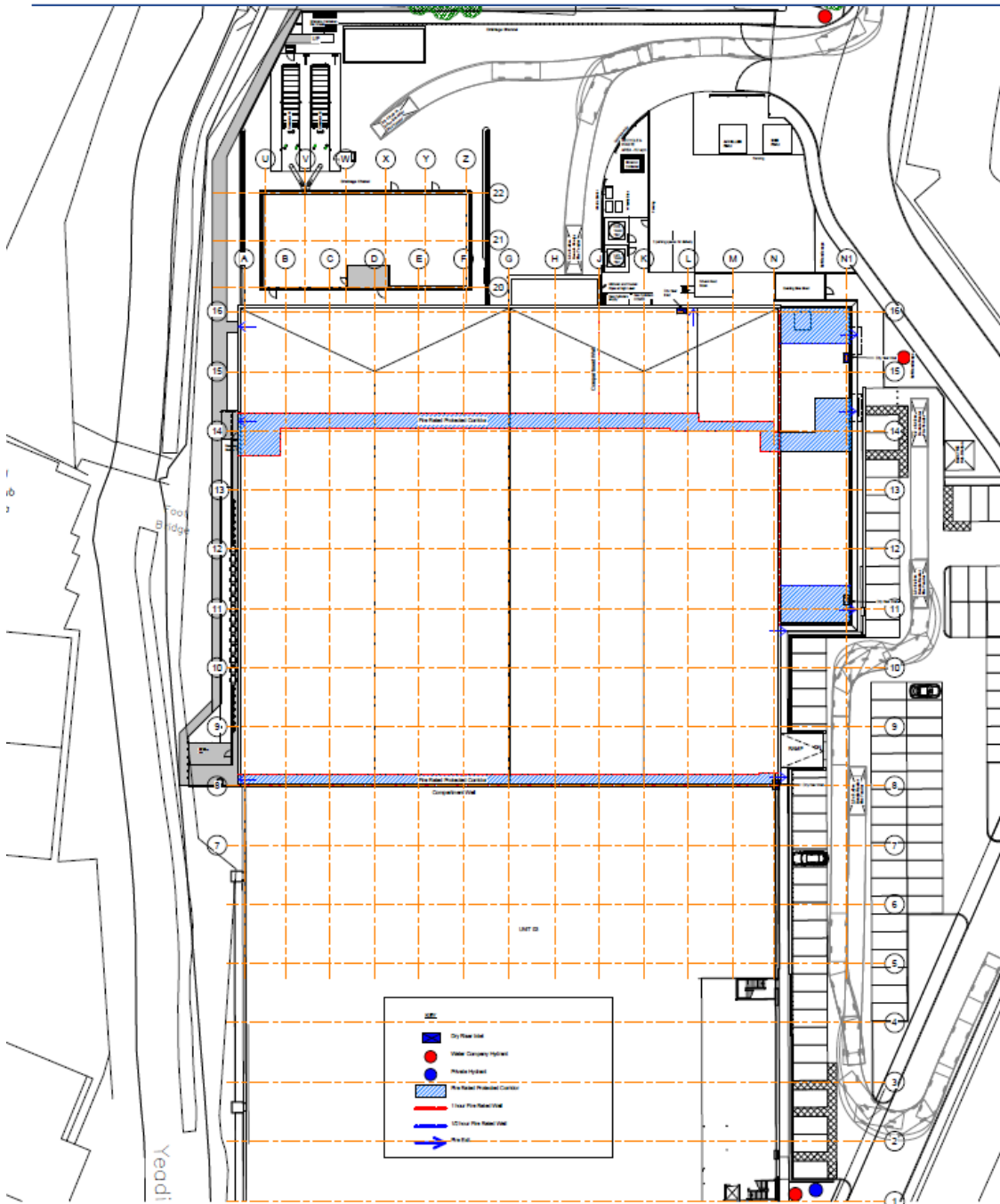
Figure 1: Existing Site Plan

The existing Office Block is remaining structurally unchanged as part of these works and will be fitted out as office and support accommodation. The storage area will be used for pharmaceutical production facilities and will be separated into cleanrooms and laboratories, cold storage, changing rooms and utilities spaces.

There will be one level of mezzanine floor installed over part of the ground floor space adjacent to the compartment wall separating the existing office area from the storage area to provide addition cleanrooms and laboratory accommodation. There will be a plant platform located above the labs and workshop. The ground floor cleanrooms and laboratories will be formed from pre-fabricated pods with their own plant area above. Externally there will be plant and plant building providing services to the facility. It should be noted that the facility will be carrying out laboratory tests and procedures on human tissue (that can not be replaced) and has the potential to be life threatening should the facility stop work. The facility will be in operation 24/7 365 days per year.

1.2. Design Information Referenced

This report is based on information provided by Hasker Architects including; existing and proposed ground floor, first floor, and second floor plans and sections. The detailed design provided by Hasker Architects has been approved by building control and the fire officer.



Any variation to the design may affect the observations, recommendations and conclusion set out later in this fire safety strategy report.



1.3. Approving Bodies

This main building fire safety strategy has been approved by the following stakeholders and in accordance with the Building Regulations process in force at the time of writing.

- Client / Client Representative
- Building Control
- Local Fire Authority / Fire Safety Officer (as part of the Building Regulations Consultation)
- The Building's Insurers (as far as it relates to property protection)

2. Statutory Controls and Regulation Framework

This report is based on the following Statutory Control, Regulations and Guidance set out below and is intended to show a reasonable (compliant) standard of fire safety (life) for the proposed works that are intended to achieve compliance with the relevant statutory controls.

It is noted that the client and/or their insurer may have additional requirements for fire safety in order to preserve property or to enhance business continuity in the event of a fire. These should be treated as supplementary to the recommendations contained within this report.

2.1. Building Regulations 2010 (as amended)

The building works will be subject to control under the Building Regulations 2010 [1] as amended. These are regulations made by HM Government under powers granted in the Building Act 1984 [2]. The purpose of the Building Regulations is to ensure that a reasonable standard of health and safety is maintained for the occupants of the building and any other person who should reasonably be near the building.

2.1.1. Part B – Fire Safety

The functional requirements of Part B of Schedule 1 of the Building Regulations 2010 (as amended) relate to fire safety and are divided into five main areas. These are set out below:

- B1 - means of warning and escape;
- B2 - internal fire spread (linings);
- B3 - internal fire spread (structure);
- B4 - external fire spread;
- B5 - access and facilities for the fire service.

Compliance with the requirements of Part B of Schedule 1 of the Building Regulations 2010 (as amended) can be achieved in a number of ways, including meeting the recommendations contained in within approved codes of practice, including Approved Document B [3] or BS 9999 [4], which are approved codes of practice for compliance with the Building Regulations in England. It is noted that these should be used exclusively and (except in very specific circumstances) they should not be combined or 'cherry-picked' in developing a fire safety strategy.

Where it is not possible to meet the recommendations of a suitable approved code of practice due to the size, shape or usage of the building the guidance contained within BS 7974 [5] will be used to demonstrate that a reasonable standard of safety can be maintained for the occupancy and fire service and that the functional requirements of the Building Regulations are met.

It is proposed to adopt BS 9999 as the basis for the design of the life safety aspects of the fire safety strategy.

2.1.2. Regulations 7 – Materials and Workmanship

Regulation 7 covers the materials and workmanship standards expected for a construction project. This regulation is intended to ensure that all materials are of a suitable quality and standard for the specific application and setting / context in which they are to be used. The use and installation of any such materials shall be carried out by a competent person and in a workman like manner. It was also commonly used to ensure that contractors and their personnel were suitably competent. All works should be carried out in accordance with recommendations of BS 8300 "Workmanship on Buildings Sites" [6].

As part of the 2018 review of the Building Regulations an amendment to Regulations 7(2,3,4) was implemented that included specific controls on the reaction to fire performance for external walls / cladding systems used on buildings over 18m in height (measured to the topmost occupied floor level).

2.1.3. Regulations 38 – Information for the Users / Owners

Regulation 38 requires that on completion and handover of a building the contractor passes sufficient information to the client or owner of the building to enable them to effectively manage and maintain the building. This is generally in the form of an operations and maintenance manual (O & M manual).

2.2. Construction Design and Management Regulations 2015

Construction work is regulated under The Construction (Design and Management) Regulations 2015 (CDM Regulations) [7].

The main purpose of the CDM Regulations is to assist in reducing deaths, injuries and ill health as a result of construction work. The main aim of the CDM Regulations is to minimise the likelihood of accidents in the construction industry through improved planning and management of Health and Safety.

The CDM Regulations covers a very broad range of construction activities including building, civil engineering, engineering construction work, demolition, site preparation and site clearance. It is important to note that construction as defined by the CDM Regulations also extends to other less obvious activities including, renovation, redecoration, installation and maintenance.

The CDM Regulations impose legal duties on Clients, Designers and Contractors for all construction projects. The legal duties that are placed on the above are to ensure that health and safety management is effective throughout the work and the designers must endeavour to eliminate hazards and reduce risks from any hazards that may remain.

2.3. Regulatory Reform (Fire Safety) Order 2005

The Regulatory Reform (Fire Safety) Order 2005 [8] came into force on the 1 October 2006. This piece of fire safety legislation was made under the Regulatory Reform Act 2001 [9]. The Regulatory Reform (Fire Safety) Order 2005 replaces the Fire Precautions Act 1971 [10] and the Fire Precautions (Workplace) Regulations 1997 [11] and over 100 other pieces of legislation which relate to fire safety.

In order to meet the requirements of the Regulatory Reform (Fire Safety) Order 2005 it will be necessary for the owner/occupier of the building to identify the 'responsible person' to take responsibility for the day-to-day fire safety management within the building. This will generally be the owner or employer within the building. They will also be responsible for undertaking and maintaining a fire safety risk assessment. The fire safety risk assessment must take account of all persons who may reasonably be in and around the building. The 'responsible person' will also be required to collate a document pack (Fire Safety Manual) setting out the fire safety strategy and management policy and procedures for the building. If the 'responsible person' does not have the knowledge to carry out these tasks they should appoint a 'competent person(s)' to assist them. The 'competent person(s)' may be an employee or fire safety consultant. It is also recommended that records of the design and maintenance of all fire safety systems are kept in the document pack.

The Fire Safety Strategy should be used as the basis of the evacuation plan and fire risk assessment. A preliminary fire risk assessment must be carried out as part of the production of the Fire Safety Strategy report.

The Local Fire Authority is responsible for policing/enforcing the Regulatory Reform (Fire Safety) Order 2005 for occupied buildings and have powers of enforcement where they consider the fire safety arrangements and/or information retained in the Fire Safety Manual to be inadequate.



N.B. The Health and Safety Executive is responsible for policing/enforcing the Regulatory Reform (Fire Safety) Order 2005 on construction sites.

2.4. The Fire Safety (Employees' Capability) (England) Regulations 2010

The Fire Safety (Employees Capability) (England) Regulations 2010 [12] are regulations made under article 24 of the Regulatory Reform (Fire Safety) Order 2005. The purpose of these regulations is to ensure that when an employer delegates a task to a member of their staff or any other person they must ensure, so far as is reasonably practicable, that that person is capable of performing the task asked of them as they relate to fire safety.

2.5. Equality Act 2010

The Equality Act 2010 [13] came into force in April 2011 and has replaced a number of key pieces of legislation. Its aim is to simplify, strengthen and harmonise current legislation to provide a new discrimination law which protects individuals from unfair treatment and promotes a fair and more equal society.

Equality law recognises that bringing about equality for disabled people may mean making sure the premises is accessible to disabled people. This may require reasonable adjustments to be made to existing buildings or suitable measures to be designed into new buildings. The design must make sure that disabled people are able to use the services offered as far as is reasonable and to the same standard as non-disabled people. Reasonable provision must be included within the design to accommodate the needs of people with a range of impairments which might reasonably include; people with a visual impairment, a hearing impairment, a mobility impairment and/or learning disability.

3. Means of Escape

Requirement of the Regulation

Part B1 of Schedule 1: "The building shall be designed and constructed so that there are appropriate provisions for the early warning of fire, and appropriate means of escape in case of fire from the building to a place of safety outside the building capable of being safely and effectively used at all material times." (Building Regulations 2010)

Aim of the Regulation

The aim of Part B1 is to ensure that a suitable provision is made to give warning/alarm and ensure a satisfactory standard of escape provision for all persons in the building in the event of a fire occurring.

3.1. General - Evacuation Strategy

The buildings will be treated as three separate compartment for the purpose of the evacuation strategy: Office, Warehouse, and cleanroom and laboratories. Each compartment / evacuation zone will be a separate fire compartments and shall be capable of being evacuated separately or simultaneously subject to the operational needs of the building at the relevant time. Evacuation will be possible either directly to outside or into a safe adjacent compartment. It is not anticipated that occupants shall remain in the building (in a safe adjacent compartment) in the event of a confirmed fire.

Each compartment / evacuation zone shall be evacuated on detection (double-knock) in the fire affected area. The use of a double-knock detection system is intended to reduce the risk of unwanted activations of the detection system causing disruption to the process with the cleanrooms and laboratories. The rest of the buildings will be evacuated in the event of a confirmed fire.

3.2. Risk Profile Selection

Table 1: Risk Profile

	Occupancy Characteristic		Fire Growth Rate		Risk Profile
Offices	A	Occupants who are awake and familiar with their surroundings	2	Medium Fire growth rate, low to medium fire load of mixed combustibility	A2
Cleanrooms and Laboratories/ Plant Room/Mezzanine/Cold Storage/ PD Laboratory/Workshop	A	Occupants who are awake and familiar with their surroundings	3	Fast Fire growth rate, stacked combustibles	A3

The main area of the building will consist of cleanrooms and laboratories in which the contents are assumed to be pharmaceutical equipment, samples and the chemicals needed to carry out the process and cleaning (including solvents in small quantities). These could potentially result in a fast fire growth rate. The occupants of this area of the building are assumed to be awake and familiar with the layout and to be alert in the case of a fire. The cleanroom and laboratory compartment is considered to be an A3 risk profile.

The Warehouse / Cold Storage, Workshop, Plant Room and Mezzanine Floor are considered to have a similar risk profile as they will either be used to store the products used in the laboratories or will be interconnected. They have therefore been assigned an A3 risk profile.

The Office area is staffed by occupants who are assumed to be awake and familiar with their surroundings or visits that are accompanied by a staff member. The contents of an office in general has a low to medium fire growth rate and so has been assigned an A2 risk profile.

3.3. Automatic Fire Detection and Alarm

To support the proposed evacuation strategy an enhanced standard of fire detection and alarm system will be provided based on an L1 standard of fire / smoke detection (BS 5839 part 1).

This is a higher standard than the minimum recommendation of BS 9999 for a compartment having an A3 risk profile (minimum level L2).

3.4. Estimated Occupancy

The maximum estimated occupancy of the facility is based on the advised number of workstations within the different types of cleanrooms and laboratories and floor-space-factors where the predicted occupancy is not known.

Table 2: Estimated Occupancies for the Cleanrooms and laboratories area at ground level

Location	Estimated Occupancy per Pod	Number of Pods	Total Occupancy (people)
cNet cleanrooms and lab	4	16	64
Central Buffer prep/Central Buffer prep	2	2	4
Ancillary Offices and Storage to central labs and cleanrooms	7	-	7
Peptides cleanrooms and Labs	4	7	28
Ancillary Offices and Storage to west Labs and clean rooms	7	-	7
Training cleanrooms and lab	4	1	4
Process Development Labs	4	2	8
Total Cleanroom and laboratory Compartments			122

The occupancy of each room in the main cleanrooms and laboratory areas does not exceed 60 and therefore only needs one exit is required from each room.

The corridor which serves the Cleanrooms and laboratories will service an occupancy greater then 60 (at least 122) and therefore requires two exits, one at either end of the corridor.

Table 3: Estimated Occupancy for Cold Store/ Mezzanine/ Office

Location	Estimated Floor Area (m ²)	Floor Space Factor	Occupancy (people)
Cold Store/ Warehouse	582	30	20
Ancillary Offices to Warehouse	67	6	12
Workshop/Training Laboratory/Document Store	165	10	17
Office: Ground Floor	178	6	30
Office: First Floor	288	6	48
Office: Second Floor	340	6	57

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Mezzaniane Laboratories	395	10	40
Mezzanine Storage	155	30	6
Mezzanine Offices	80	6	14

3.5. Door Widths

Doors should have a minimum clear width of 800mm (or 850mm if accommodating a wheelchair).

If the door width is less than 1050mm the number of persons safely accommodated by the exit is:

- 108 people for an A3 profile, increasing to 121 people with a 15% for the alarm system and 30% for the 10m height ceiling enhancement,
- 138 people for a A2 profile, increasing to 163 people with a 15% enhancement for detection.

Table 4: Door Width Occupancy

Risk Profile	Maximum number of people per Door (mm/persons)	
	Not Enhanced	Enhanced 15%
A2	3.6	3.06
A3	4.6	3.91

*Note: Value of Minimum door width/person is limited (Table 16 BS 9999:2017)

The doors along the north/south corridors are used by an occupancy of 122 people therefore the doors should have a clear width of at least 1050mm, A door with a clear width of 1050mm serving an A3 risk profile area has exit capacity for up to 268 people ($1050/3.91=268.5$) this is considered adequate to serve the maximum estimated occupancy of the lab areas plus an allowance for other people that may escape via this area.

The occupancies for the Cold Store, Office floors, Mezzanine and New Plant compound do not exceed 108 and therefore doors with a clear width of 850mm are considered sufficient, subject to being not more than 150mm narrower than the corridor they are located within.

3.6. Stairs and Final Exits

3.6.1. Office

The existing stairs in the office have a width of 1200mm which can accommodate 315 people for the office (A2 risk profile) area and 260 people for the Mezzanine (A3) floor. The combined occupancy of the offices and mezzanine does not exceed 260 therefore the stairs are of sufficient width.

The final exit doors from the stairs area estimated to have a clear width of 950mm. This is narrower than the stairs but is an existing condition and the fit-out works are not considered to make the situation any worse than the shell design consideration. A door with a clear width of 950mm has exit capacity for 310 people for an A2 risk profile area and 243 people for A3. This is considered to be sufficient for the estimated occupancy of the areas that might use these stairs.

3.6.2. Cleanroom and Laboratory Process Areas

The final exit at grid point A-14 should have a clear width of at least 1200mm. However, as this stair is only

serving the plant level which would have an occupancy of not more than 6 people at any one time it is considered reasonable to size the door for the ground floor occupancy that would normally use this door and oversize it to allow for the additional occupancy of the plant level. This door shall have a clear width of at least 1050mm

The exits from the cold storage area and the exits from the escape corridor along grid line 8 have a clear width of 850mm which is sufficient for the occupancy.

3.7. Escape Routes and Corridors

All corridors or escape routes should be at least 1200mm in width and no less than the width of the exit door. The doors and final exit doors from an escape route or corridor must not be more than 150mm narrower than the width of the corridor or escape route.

The fire doors in the escape corridors do not satisfy this last recommendation and are more than 150mm narrower than the corridor. It is recommended the doors be widened to the appropriate width. Any dead-end portions of corridor will be minimised and shall be fire rated to at least 30 minutes if they are greater than 2m in length.

A corridor of more than 12 meters in length which give access to two escape routes should be subdivided with a self-closing fire door positioned approximately halfway along the corridor.

All final exit doors should open in the direction of escape. Intercompartment exit doors should open in the direction favouring the largest occupancy and in any case where the occupancy of the rooms / space on either side exceeds 60, for example in an escape corridor, the doors may need to open in both directions.

The external means of escape away from the buildings at grid points N-11 and N1-11 have a groundworks feature (retaining wall) that acts as a restriction to occupants moving away from the building, it is therefore necessary for occupants to pass along the façade when escaping from the compartment. However, as there are two routes of escape along the façade that straddle two separate compartments it should not be necessary to protect the façade.

It is recommended that the external escape ladder situated in the south west corner which leads from the walk-on pod area, should be a distance of 1800mm from the west façade. If it is within 1800mm then any part of the wall within 1800mm of the ladder will require protection. As the ladder height does not exceed 6m in vertical extent it does not require weather protection, however it is recommended that it is protected. The door at the top of the ladder does not require protecting as there is only one exit from the building onto the top landing.

The external escape route which runs along the West side of the building should be a distance from the façade by no less than 1800mm. If it is within this distance then the façade may require protection.

3.8. Mobility Impaired and Disabled Egress

It is beneficial for wheelchair users to have a zoned or phased evacuation system. This enables them to be helped from the building or a compartment in the first stage. The evacuation strategy mentioned above recommended a progressive horizontal approach, however if there is sufficient need this should take wheelchair users into consideration and perhaps allow them to move to the protected compartment in the first instance. The use of an evacuation lift with a back-up power supply or the allocation of refuge points within the protected stair should also be considered if there is the need for vertical evacuation. A refuge point should be 900mm x 1400mm minimum to allow for a wheelchair user to manoeuvre without difficulty.

Ramps will generally need to comply with the requirements detailed in Approved Document M [14], however it has been confirmed that wheelchair users will be restricted to the offices due the nature of the work and essential cleanliness, therefore the ramps in the escape corridor along grid line 8 and the ramps within the pod corridors and not constrained to the health and safety matters detailed in Approved Document M.

The ramp at the vehicular door entrance will be customised to have a gradient of 1:12 in order to comply with the recommendations.

3.9. Travel Distance

Travel distance should be measured from the furthest location within any room to the nearest protected exit or to outside the building. The maximum travel distance is dependent on the risk profile and can be enhanced if there are certain building features like high ceilings or automatic detection systems.

Table 5: Maximum Allowable / Recommended Travel Distances

Two or more directions of escape

Risk Profile	Actual Distance (m)			Direct Distance (m)		
	Base Value	Enhanced 15%	Enhanced 45%	Base Value	Enhanced 15%	Enhanced 45%
A2	55	63	n/a	37	42	n/a
A3	45	51	60 *	30	34	43

*Note: Maximum travel distance is limited to 60m.

Single directions of escape

Risk Profile	Actual Distance (m)			Direct Distance (m)		
	Base Value	Enhanced 15%	Enhanced 45%	Base Value	Enhanced 15%	Enhanced 45%
A2	22	25.3	n/a	15	17.25	n/a
A3	18	20.7	22 *	12	13.8	17.4

*Note: Maximum travel distance is limited to 22m.

Note: Base values taken from Table 11 BS 9999:2017

3.9.1. Office Areas

The office space has a risk profile of A2 and with two means of escape gives a maximum travel distance of 63m for two-way direct travel, 42m where the fit-out is not known or the space is to be used as open plan.

Generally there are two direction of escape from all areas within the office area, except the reception space at ground level. The travel distances in the office area are within the recommendations set out in Table 6 above.

3.9.2. Cleanroom and laboratory Process Areas – Mezzanine Level

The cleanroom and laboratory mezzanine has three means of escape, two through office and one through the compartment wall across the plant space to the stair on grid line 14/A. It has an A3 risk profile with an allowed travel distance of up to 51m. Generally there are at least two directions of escape from all areas and the travel distances are within the recommendations.

There is only one direction of escape from Peptides QC Lab. The travel distance from the rear of this areas is estimated to be 23.5m to the protected corridor, from where there are two direction of escape. This exceeds

the recommendations of Table 6 above (20.7m) for an area with an A3 risk profile. However it is noted that the last 6m of the escape route is via a circulation space (the Lab Lobby) and this area is considered to be a low fire risk as it is access and circulation rather than generally occupied space. It is also noted that, while not a designated escape route, the Waste route from the QC lab could be used as an alternative escape route and this would reduce the travel distance to 17.5m to the protected corridor.

The Sample Receiving room is accessed from the Peptides QC cleanroom and laboratory only and is therefore designated an inner room.

Inner Rooms shall have the following additional safety measures:

- The occupancy shall not exceed 60 people.
- A vision panel shall be installed with a clear view of the outer room
- There shall be automatic fire detection and alarm to inform the people inside the inner room in the case of a fire. (BS 5839-1:2013).
- The access room cannot be a place of special fire hazard.
- The travel distance shall not exceed the single direction limit (21m) from the furthest reach of the inner room to the escape route in the lobby.

3.9.3. Plant Platform

The plant platform is considered ancillary to the main cleanroom and laboratories, the estimated travel distance within this area is up to 60m. There are three means of escape excluding a ladder. The travel distances are considered to be within the recommendations set out above.

The walk on ceiling over the pod area has at least two means of escape by either a stair or ladder. The travel distance allowed is 60m. It is within the recommendations.

The proposed external plant building is assumed to have an A2 profile with an allowed travel distance of 100m. This should be sufficient but is subject to review pending the updated drawings.

3.9.4. Warehouse Areas

The warehouse racking area including the ancillary offices have an enhanced travel distance of 59m.

The quarantine room, cold storage, flammable store, changing rooms and PD Laboratories have 51m travel distance and are therefore within the recommendations.

3.9.5. Cleanroom and laboratory Process Areas – Ground Floor Level

Generally the travel distance within each lab pod is up to 18m in one direction leading back to a corridor from which there are two directions of escape. The travel distance is measured to a compartment wall and are within the recommendations set out in Table 6 above.

Drawings showing the travel distances have been submitted to Building control and London Fire through the building regulations process and approved by both parties.

4. Internal Fire Spread (Linings)

Requirement of the Regulation

Part B2 of Schedule 1: "To inhibit the spread of fire within the building, the internal linings shall: (a) adequately resist the spread of flame over their surface; and (b) have, if ignited, a rate of heat release or a rate of fire growth, which is reasonable in the circumstances."

Aim of the Regulation

The aim of Part B2 is to ensure that a fire does not spread disproportionately over the internal linings of the walls or ceilings.

4.1. General

In order to meet the requirements of BS 9999:2017 [4] the finishes applied to internal walls and ceilings in functional rooms should be made up of materials that are unlikely to rapidly propagate fire either by sustaining burning or by dropping flaming materials that are able to spread a fire from one location to any other. There are currently two testing systems permitted within the Building Regulations in England and Wales for determining the surface spread of flame and heat release rate of wall and ceiling lining materials, these are:

- European classifications in accordance with BS EN 13501-1:2018 [15].
- UK National classifications, in accordance with BS 476 [16].

Table 6: Surface Classifications *

Location	National Classification	European Classification
Small rooms not more than 30m ² in area (non-residential)	3	D-s3, d2
Other rooms	1	C-s3, d2
Circulation spaces & common areas	0	B-s3, d2

Note 1: When a classification includes 's3, d2' this means that there is no limit on the production of smoke or flaming droplets/particles.

Note 2: A product achieving a classification 'A' achieves a higher standard than the minimum classifications set out in the table above. Class '0' has the highest resistance to the surface spread of flame.

Note *: The following variations and exceptions may be applicable, these include: parts of the wall or ceiling lining finish of any single room may have a lower standard provided that it does not exceed 50% of the floor area or 60m² (whichever is the greater) and the material is Class 3 or Class D-s3, d2 or better.

5. Internal Fire Spread (Structure)

Requirement of the Regulation

Part B3 of Schedule 1: "(1) The building shall be designed and constructed so that, in the event of a fire, its stability will be maintained for a reasonable period. (2) A wall common to two or more buildings shall be designed and constructed so that it adequately resists the spread of fire between those buildings... (3) Where reasonably necessary to inhibit the spread of fire within the building, measures shall be taken, to an extent appropriate to the size and intended use of the building, comprising either or both of the following: (a) sub-division of the building with fire-resisting construction; (b)

installation of suitable automatic fire suppression systems. (4) The building shall be designed and constructed so that the unseen spread of fire and smoke within concealed spaces in its structure and fabric is inhibited.

Aim of the Regulation

The aim of Part B3 is to ensure the stability of the building is maintained in the event of a fire. It also aims to ensure that there is a sufficient degree of fire separation within the building and between adjoining buildings and that there is fire suppression where appropriate. Finally it aims to ensure that smoke and fire cannot spread unseen through concealed voids within the building.

5.1. General

Any elements that are required to provide fire resistance in order to sub-divide the buildings will achieve that fire resistance when testing in accordance with the relevant sections of BS 476 [16], BS EN 1363 [17], BS EN 1364 [18], BS EN 1365 [19] [20], and/or BS EN 1366 [21].

Any structure that only supports the roof of a building does not need to be fire resisting or fire protected. However if the roof is critical to the stability of any part of the building that is fire resisting or acts as a floor in terms of escape routes, or if it the structure supports a compartment or fire area separating wall then the structure should be fire protected to the same standard of fire resistance as the wall or floor it supports.

The existing structure of the shell of the main warehouse area is not fire protected as it only supports the roof of the building. It is not proposed to make any changes to the fire protection of the existing structure within the main warehouse area.

The structure that supports the floors in the office block is fire protected as they support the floors. It is not proposed to make any changes to the fire protection of the existing structure within the office area unless this is required to facilitate the new opening. Where any modifications are made the new structure will achieve at least 60 minutes fire resistance and any connections and modification to existing will be made good the same standard as the existing or 60 minutes fire resistance whichever is the greater.

The compartment wall that separates the office from the main warehouse is considered to provide at least 60 minutes fire resistance. Any modification to this wall be carried out in such a manner that the fire separation was maintained.

The compartment wall the separates the two warehouse units (Unit 2 and Unit 3) is understood the provide at least 60 minutes fire resistance. We have not undertaken a detailed inspection of this wall to confirm its condition or fire rating.

5.2. Penetrations through fire resisting walls

All penetrations through fire resisting walls should be fire stopped using a suitable method of fire stopping, or damper or other proprietary means appropriate to the wall construction and media passing through the wall.

All ductwork that passes through a fire resisting wall should be supported such that in the event of fire it does not cause premature failure of the wall or the fire damper.

5.3. Structural Element Fire Resistance

The fire resistance of structurally supporting elements is dependent on the buildings use, the height of the structure.

Table 7: Recommended Period of Fire Resistance

Risk Profile	Height of Top Storey Below, (m)	Protection Required (Minutes)
A2	5	30
	18	60
A3	5	60
	18	90

The existing office area has a storey above 5m and therefore the structurally supporting elements require 60 minutes fire resistance.

The Pod laboratories are not considered to be places of special fire hazard and therefore are not deemed to need fire resistance to the enclosure, however any flammable substances should be stored in a fire rated cabinet. This should be reviewed with the users based on the operational process within the Pods.

The ceiling above the quarantine cold store and the access routes only along the walk on ceiling to the pod plant rooms should have at least 30 minutes fire resistance as they comprise part of the escape routes. Note the lab pod ceilings will not have any dedicated fire rating to the ceilings as these are ceilings that are only accessible for maintenance and are considered to be part of the plant.

The second floor mezzanine which is the ceiling for the laboratories is not required to be fire resistant except where it forms part of the escape corridor on the first floor. The fire resistance should be 30 minutes.

Any areas where a dead-end corridor is greater than 2m in length should be constructed as a protected corridor and have at least 30 minutes fire resistance.

The proposed external plant building has an assumed risk profile of A2 and therefore requires 30 minutes structural protection.

5.4. Compartmentation

It is our understanding based on the shell Buildings Regulations approval that the wall separating the office from the main warehouse was constructed to provide at least 60 minutes fire resistance for the integrity and insulations (a compartment wall).

The existing plant room on the ground floor of the office block has 60 minutes of protection.

A compartment wall should separate the cleanroom and laboratory area from the warehouse and changing rooms. This allows for an escape corridor between the two different functional area which reduces travel distances so that they meet the recommendations set out above.

The walls forming the compartment boundaries shall achieve at least 60 minutes. This includes the floor of the cleanroom and laboratory mezzanine and plant room mezzanine, the wall of the mezzanine which overlooks the pod area and the walk on ceilings/ lid over the escape corridors. However, it is proposed to treat the plant on the top of the cleanrooms and laboratories as part of the lab and therefore no fire resisting separation will be provided between these areas.

5.4.1. Cavity Barriers

All floor, wall and ceiling cavities are required to have a cavity barrier in place to close off any open edges at a wall junction or at floor level. They are also required to divide large spaces. A large space is defined as 10m from any exposed surface unless the surface is a Class 0 or 1 material in which case the maximum distance is 20m. The space under a roof is also limited to 20m.

The cavity barrier should have a 30 minute integrity (resistance to burning) and a 15 minute insulation (resistance to heat transfer) at a minimum unless it forms part of a compartment boundary in which case it should have the same standard of fire resistance as the compartment wall / floor, in this case 60 minutes integrity and insulation.

The area under the raised floor within the pod area forms cavities which would require cavity barriers this includes the area under the access ramps from the waste corridors.

Drawings showing the fire walls and compartmentation and fire doors and fire exits have been submitted to Building control and London Fire through the building regulations process and approved by both parties.

5.5. Fire Doors

Doors within a compartment wall (as specified in BS 9999 32.1) should be designated as fire doors and require the same level of fire resistance as the wall in which they are fitted (generally FD60S / E60S in this case). In order to accommodate the intercompartment escape strategy the doors within the compartment wall should also be self-closing and smoke sealed.

The fire doors which form part of a protected stair enclosure should have a minimum of 30 minutes fire resistance (FD30S / E30S).

The suffix 'S' indicates that the fire door is required to resist the passage of smoke and have a leakage rate not exceeding $3 \text{ m}^3/\text{h}$ per meter when subjected to 25 Pa.

It is recommended that doors along an escape route have vision panels installed so that people escaping along the route can see whether fire has spread to the connecting corridor and see whether someone is coming the other way.

All final exit doors shall have simple push to operate door furniture / locks. Internal fire doors that are mechanically locked shall have push to operate or thumb turn single action lock release mechanisms. Any electromagnetically locked doors shall release on activation of the fire alarm in the affected compartment and shall have green break glass units adjacent that interrupt the power to the lock. While locks shall de-activate, doors shall not automatically open in the event of fire they shall require a direct human intervention in to open the door.

5.6. Lifts

Lift shaft which pass through a compartment floor should be protected shafts with the same level of fire resistance as the floor. Therefore, the goods lift shaft which passes through the mezzanine floor should be protected.

5.7. Glazed Elements

Where applicable glass in fire resisting elements should conform to BS 5234 [23] and glazed elements should be tested to the standards in BS 476-22 [24] or classified in accordance with BS EN 13501-2 [25].



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Where a glazed element forms part of a protected escape corridor and extends below 1100mm above finished floor level it shall provide the required period of fire resistance for integrity and insulation.

The windows in the office compartment wall which look into the laboratories in the mezzanine area require the same level of fire resistance as the wall at 60 minutes integrity and insulation.

5.8. Places of Special Hazard

The electrical switch room and hazardous flammable store in warehouse area shall have at least 60 minutes protection and the existing plant room and electrical room in the office block are indicated on Drawing No AB 30.200 by PRC to have 60 minutes protection.

Places where flammable liquids are commonly stored shall have 30 minutes fire resistance.

6. External Fire Spread

Requirement of the Regulation

Part B4 of Schedule 1: (1) the external walls of the building shall adequately resist the spread of fire over the walls and from one building to another, having regard to the height, use and position of the building. (2) The roof of the building shall adequately resist the spread of fire over the roof and from one building to another, having regard to the use and position of the building.

Aim of the Regulation

The aim of Part B4 is to ensure that the external walls and roof have adequate resistance to the spread of fire over the external envelope of the building and minimise the risk of the spread of fire from one building to its neighbours.

6.1. General

It is our understanding, based on information relating to the Building Regulations approval for the shell of the buildings that the west façade overlooking Yeading Brook is provided with fire protection to 50% of the length (south western section) in order to provide protection against external fire spread to the adjacent buildings.

The existing construction of the structure and external walling with 'Unit 2' the proposed site has no visible fire protection. This is in line with the information received relating to protection of the facades against external fire spread.

The proposed fit-out works are not considered to make the existing situation any worst in terms of the risk of external fire spread. The following summary assessment has been undertaken to confirm the conditions are with the recommendations set out in BR187.

6.2. Roof

Where a compartment wall is taken to the underside of the roof a band of roof construction 1.5m wide either side of the wall should have a covering designation of AA, AB, or AC or B_{roof}(t4) to the European Classification and incorporate non-combustible insulation. This is intended to inhibit the risk of fire passing from one compartment to the neighbouring compartment.

The existing roof is constructed from Euroclad Elite trapezoidal metal roofing with insulation installed. This is in compliance with Part B of the building regulations for the surface spread of flame.

BR 187 (External Fire Spread 2nd Edition) the percentage unprotected area allowed is calculated to be 100%.

The new external plant building has a width of 28m, a height of 5.5m and is 25m from the relevant boundary. The allowable unprotected area is therefore 100%.

The external generators are 15m wide, are to be assumed 2.6m high and are at a distance of 19m from the relevant boundary. They are not required to be protected.

The walls are constructed of mostly Euroclad Microrib panel or Euro clad elite trapezoidal metal sheeting with insulation which are in compliance with Part B of the building regulations for the surface spread of flame.

6.3. Façade

6.3.1. North Facade

The North façade is a distance of 42m from the relevant boundary (the edge of the service yard) and stands at a height of 15.62m. Using the tables in BR 187 (External Fire Spread 2nd Edition) the percentage unprotected area allowed is calculated to be 100%.

The new external plant building has a width of 28m, a height of 5.5m and is 25m from the relevant boundary. The allowable unprotected areas is therefore 100%.

The external generators are 15m wide, are to be assumed 2.6m high and are at a distance of 19m from the relevant boundary. They are not required to be protected.

6.3.2. East Facade

The East side is 46m from the centre of the Grand Union Canal which can be taken as the notional boundary. The height is also 13.65m and the width is 64m. The percentage unprotected area is also 100%.

6.3.3. West Facade

Information relating to the Building Regulations approval for the shell of the buildings indicates that the relevant boundary was assumed to be the far side of Yeading Brook and was calculated to be 50% unprotected area. It is our understanding that half the west façade of the building was protected, however the protection was applied to the south west portion of the warehouse.

There is no proposed change to the external façade and therefore it is suggested that the analysis is still valid.

The West side of the new external plant building has a width of 13.5, a height of 5.5m and is 18m from the far side of Yeading Brook. No protection is required.

Table 8: External Fire Spread

Side	Area	Height(m)	Width (m)	Distance to Boundary (m)	%Unprotected Area
North		15.62	82	42	100
	New Plant Building	15.62	16	25	100
East		13.65	64	46	100
West		13.65	64	20.5	60
	New Plant Building	13.65	20	13.65	100

The new foot path forming part of the escape route along the west elevation will be located at least 1800mm away from the external wall. It is therefore not considered necessary to provide any additional fire resistant to the external wall.

The external escape ladder leading down from the plant level is approximately 3750mm away from the buildings and is considered to be adequately separated from the façade. Therefore no additional fire protection will be provided to the external wall in this area.

7. Access and Facilities for the Fire Service

Requirement of the Regulation

Part B5 of Schedule 1: (1) The building shall be designed and constructed so as to provide reasonable facilities to assist firefighters in the protection of life. (2) Reasonable provision shall be made within the site of the building to enable fire appliances to gain access to the building.

Aim of the Regulation

The aim of Part B5 is to ensure that adequate access is provided for fire service appliances up to the building and adequate provision of facilities within the building to assist firefighters in the saving of lives of the people in and around the buildings.

7.1. General

Access should be provided to the buildings to enable fire service vehicles to be brought within reasonable proximity of the building. This is typically assessed based on the amount of perimeter access available to the building as a proportion of the total floor area of the building (Table 19 BS9999:2017).

The existing building shell has access to approximately 70% of the projected perimeter of the building. This is achieved via the car park and vehicle loading yard. There is no vehicular access to the rear of the building adjacent to the brook.

The proposed fit-out works do not significantly reduce this access. However the introduction of the new plant buildings in the service yard does prevent access to this area of the façade. It is noted that while access is reduced to this area there are no personnel doors in this section of the façade and therefore access into the buildings is not detrimentally affected.

7.2. Perimeter Access

The existing warehouse, including the offices, has a total floor area of 8323 m² which means that 50% of the perimeter should be accessible to a fire appliance. Based on a projected perimeter length of 220m and an accessible length of 160m there is 70% perimeter access to the shell of the building.

The introduction of the plant building in the delivery yard will reduce the perimeter access but this should still exceed 50%. It is also noted that there are no personnel doors in the delivery yard due to the profile of the ground in the loading docks. Therefore while the actual perimeter access is reduced the effective, useable part of the perimeter – areas where there are external doors giving access into the building – has not changed.

The new plant compound has at least 15% perimeter access and therefore it is within the recommendations.

7.3. Access within the Building and Hose Laying Distance

It is recommended that all areas within the building should be accessible for firefighting within 45m along a route suitable for laying out a fire hose.

Due to the size and layout of the proposed fit-out not all areas are accessible within 45m along a route suitable for laying out a hose.

It is proposed to introduce dry fire mains in the protected escape corridors and staircases to reduce the hose laying distance into the body of the buildings and to the plant area fire hose inlets will be provided to the east elevation to each of the stair wells and near to the junction with the attached unit and also in the service yard to the north.

7.4. Fire Hydrant

There are three hydrants located on site shown in the figure below. At one location there were two hydrants which suggests that one belongs to the water company and one is private.

It is considered that the existing fire hydrants provide adequate coverage to serve the shell of the buildings and will be suitable for the buildings post fit-out.

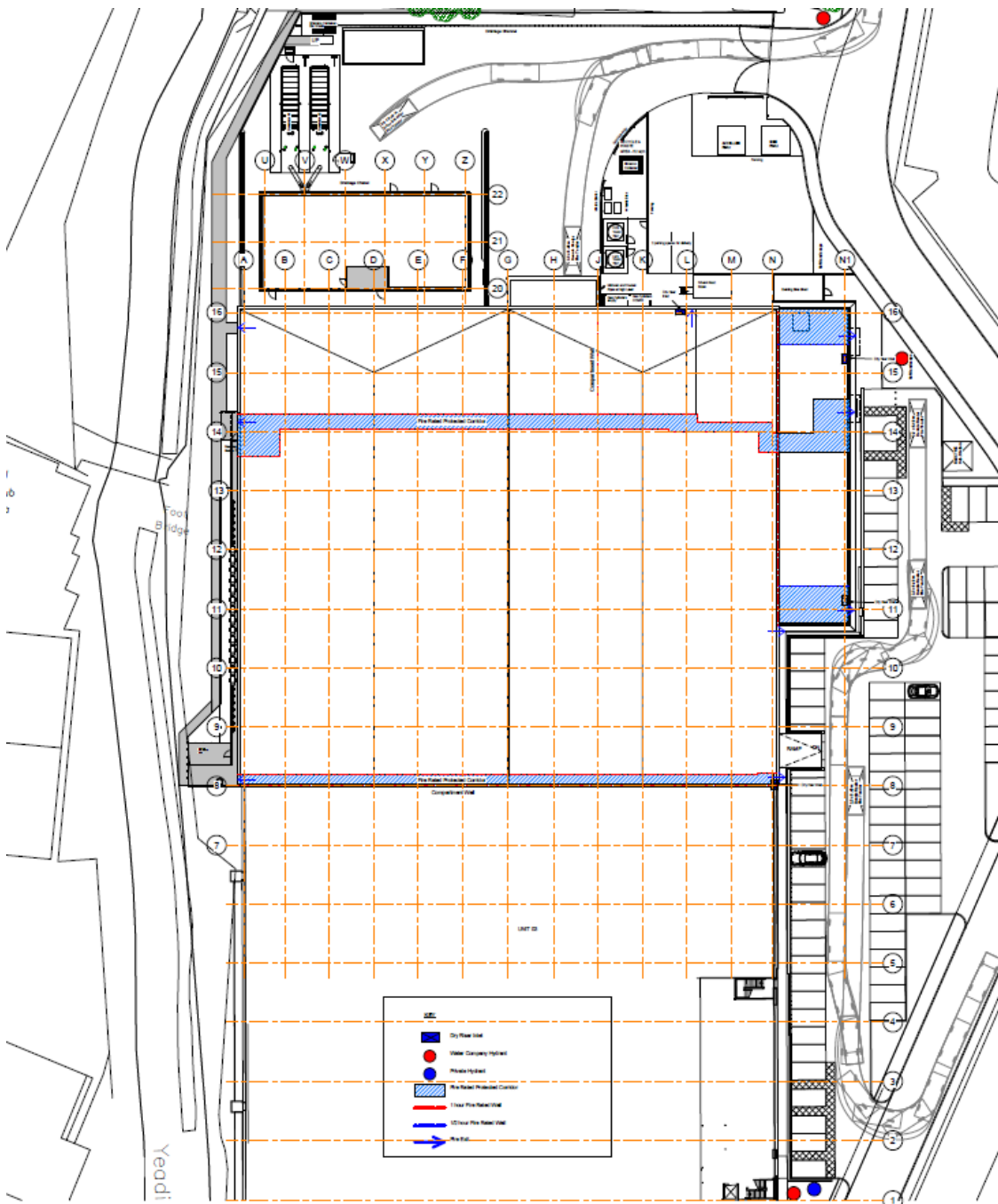


Figure 2: Site Plan Indicating Existing Fire Hydrant Locations

8. Other Fire Safety Systems

8.1. Automatic Detection and Alarm

The automatic fire detection and alarm system shall be designed to meet the recommendations of BS 5829 part 1 and to provide an L1 standard of detection. Visual and audible warning, as appropriate, shall be provided throughout the buildings to provide early warning to occupants. Where there is a risk of conflicting signals being given by cleanroom and laboratory/ process equipment consideration shall be given to the type of sounder used. Sound pressure levels from the fire alarm system shall be at least 65dBA. Where the level of background noise is high the sound pressure level shall be designed to provide at least 5dBA above ambient.

The automatic fire detection and alarm system should be based on a two stage (double knock / coincident) detector activation to reduce the risk of unwanted alarms.

The cause and effect for the alarm system will need careful consideration to avoid the risk of shutting down plant and equipment which may compromise safety of operatives in the event that pressure balance and containment fails.

It is recommended that this be based on industrial grade air sampling detection at high level in the warehouse area and above the pods / plant area and high-quality point type detection within the rooms at ground floor.

Note: as noted in table 7 of BS 9999 the minimum standard of fire detection and alarm in an area having an A3 risk profile should be L2 and in an area having an A2 risk profile should be M, based on the coverage categories set out in BS 5839 part 1. Therefore the proposal to provide an L1 standard of detection coverage to all areas, rooms and significant voids is considered to provide an enhancement to the minimum recommendations. It is noted that L2 leaves a degree of scope for determine which rooms would have detection coverage and this could lead to some areas not having the benefit of early warning.

8.2. Emergency Lighting

Suitable emergency escape lighting shall be provided in all areas of the building to enable the safe movement of personnel to escape routes and areas of safety. The system shall be designed and installed in accordance with BS 5266 [26]

8.3. Wayfinding Escape Signage

All doors that form part of an escape route must be marked by an exit sign in accordance with BS ISO 3864-1:2011 [27] and shall comply with the Health and Safety (signs and signals) Regulations 1996 [28]. Signage should be of sufficient size that it can be clearly interpreted.

8.4. Firefighting equipment

Fire extinguishers will be located at key points of entry and exist to the laboratories and to all other areas outside of the laboratories. Firefighting equipment cannot be located in clean areas as this will potentially contaminate the human tissue and the cleanroom and laboratory process. The fire risk assessment referred to below will identify what and where suitable fire fighting equipment will be located.

9. Fire Safety Management

9.1. Fire Safety Training

It is assumed that the operator of the building and site will ensure that all staff working in the building will have undergone fire safety training in accordance with the operator's policy, either as part of their induction or basic training package. This training should cover the basic elements of fire prevention, methods of raising the alarm in the event of discovering a fire and the appropriate evacuation procedures, including locations of escape routes and assembly points and appropriate response upon hearing the fire alarm and be updated regularly to suit the needs of the occupants.

It is also understood that the operator will put in place a suitable management policy (including training, where appropriate) to ensure that the corridors, circulation routes and escape stairs, access gantries and ladders are kept clear and free from obstruction when not in use in accordance with the operator's procedures and policies.

All the electrical and mechanical systems installed to provide a reasonable standard of safety for occupants as part of the fire safety strategy should be maintained in accordance with the manufacturers recommendations through the working life of the building.

9.2. Fire Risk Assessment

It is assumed that the operator will carry out a fire risk assessment of the facility in accordance with the Regulatory Reform (Fire Safety) Order 2005 [8] and put in place such measures or mitigation as are identified by the fire risk assessment to maintain a suitable standard of safety for the occupants within the building. Any significant findings or risks identified should be shared with other affected parties. This fire safety strategy should form part of the basis for the fire risk assessment.

9.3. Evacuation Management

It shall be the responsibility of the building operator to ensure that all escape routes and equipment provided to assist with evacuation of occupants are maintained and available for use at all times. The operator shall also be responsible for ensuring that a sufficient number of staff have been trained in the use of any special evacuation aids and process shut down techniques.

There is sufficient external space to locate muster point of safety in the service yard and in the car park that need to be away from the access routes for the fire fighters.

Additionally an evacuation management plan based on the recommendations contained in this fire safety strategy should be developed and implemented and tested and if needed reviewed and updated following each subsequent test. Regular evacuation drills and tests should be carried out to ensure that staff and other occupants understand and can follow the procedure.

N.B. Generally local fire and rescue services will only carry out rescue if a person's life is in imminent danger. It is for the owner and occupier to ensure that reasonable provision is made to ensure that all persons likely to be in the building can safely escape or be evacuated.

9.4. First-aid Firefighting

Staff that normally work within the building will need to undergo dedicated first aid firefighting training to ensure that they can safely use the tools and equipment provided without putting themselves or others in danger subject to the fire risk assessment. Generally, cleanroom and laboratory operatives should consider their safety and evacuate from the work areas.



10. Conclusions and Recommendations

This report sets out the proposed fire safety strategy for the fit-out of the existing warehouse building at Hayes 180 to provide cleanroom and laboratory and supporting facilities for Achilles Pharmaceutical.

This basic principle of this fire safety strategy is that the standard of safety in case of fire provided by the shell of the buildings shall not be reduced as part of the fit-out works and as far as reasonably practicable to works shall meet the recommendations set out in BS 9999:2017 as the method of demonstrating compliance with the functional requirements of the Building Regulations.

The escape strategy is based on a staged horizontal evacuation and the buildings has been sub-divided into three main compartments to enable the travel distance with the different functional areas to meet the recommendations of BS 9999:2017.

The perimeter access firefighting is limited to 36% of the projected perimeter and it is therefore proposed that dry firefighting mains and riser will be provided within the protected escape corridors to improve the hose coverage within the building.

Due to the size and function of the buildings it is not possible to meet the all the recommendations set out in BS 9999 however it is considered that the proposed fire safety strategy provides a reasonable standard of safety to life for the occupants of the buildings and to firefighters.

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