

2114212-Council Request for Safety Report Siting an ammunition depot on the SA1 Waterfront

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Council Request for Safety Report: Siting an ammunition depot on
the SA1 Waterfront

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Abstract

This report evaluates a planning application submitted to the City of Swansea Council for the construction of a proposed explosives storage facility comprising five Earth Covered Explosive Storehouses. The assessment applies the International Ammunition Technical Guidelines, relevant UK explosives legislation, and recognised Quantity Distance principles to determine whether the proposed site can safely accommodate the stated Net Explosive Quantities. Independent Quantity Distance calculations demonstrate that the applicant's separation distances (particularly for Hazard Division 1.1) are significantly underestimated. The presence of residential housing at 125m reduces the allowable HD 1.1 to zero, making mass explosive storage non-compliant within the available footprint. Additional concerns include incomplete technical documentation, unclear directional effect assumptions, lack of individual Explosive Storehouses coordinates, and the constraints imposed by nearby vulnerable buildings and maritime users. The analysis concludes that the proposed configuration cannot meet International Ammunition Technical Guidelines safety requirements in its current form and identifies key information gaps requiring clarification by the applicant. Recommendations are provided to the Council to ensure any future proposal is supported by robust, transparent, and fully compliant explosive-safety evidence.

Abbreviations

ES	Exposed Site
AASTP	Allied Ammunition Storage and Transport Publication
ALARP	As Low As Reasonably Practicable
CG	Compatibility Group
DSA	Defence Safety Authority
EED	Electro-Explosive Device
EMR	Electromagnetic Radiation
ES	Exposed Site
ESH	Explosive Storehouse
ESD	Electrostatic Discharge
FFR	Fragmentation-Free Roof
HD	Hazard Division
IBD	Inhabited Building Distance
IED	Improvised Explosive Device
IATG	International Ammunition Technical Guidelines
IAS	Intrusion Alarm System
IEDD	Improvised Explosive Device Disposal
K-Factor	Safety scaling constant used in QD calculations
LPS	Lightning Protection System
MHE	Mechanical Handling Equipment
NEQ	Net Explosive Quantity
OME	Ordnance, Munitions and Explosives
PES	Potential Explosion Site
PTRD	Public Traffic Route Distance
QD	Quantity–Distance
SQEP	Suitably Qualified and Experienced Personnel
TNT EQ	TNT Equivalent
VBD	Vulnerable Building Distance

Terminology

Term	Definition
Explosive Storehouse (ESH)	A purpose-built storage building for ammunition or explosives. Often earth-covered to reduce blast effects in accordance with IATG 05.20.
Potential Explosion Site (PES)	Any location containing explosives that could explode and produce blast, fragments, thermal effects, or debris. The PES is the reference point for all QD calculations.
Exposed Site (ES)	Any building, area, road, infrastructure, or population that could be affected by an explosion at the PES. Includes public buildings, houses, workplaces, and transport routes.
Net Explosive Quantity (NEQ)	The total mass (kg) of the explosive content within a munition or storage unit, excluding packaging and casings. Used to calculate QD.
Quantity Distance (QD)	The mandatory minimum separation distance between a PES and an Exposed Site. Based on NEQ and hazard behaviour as defined in IATG 02.20.
Vulnerable Building Distance (VBD)	QD to sites highly sensitive to blast effects (schools, hospitals, glass-fronted structures). Determined using IATG tables.
Inhabited Building Distance (IBD)	Minimum distance from a PES to any structure regularly occupied by people, ensuring survivability in the event of an explosion.
Public Traffic Route Distance (PTRD)	Required distance between a PES and public roads, railways, footpaths, or areas with regular public movement.
Suitably Qualified and Experienced Person (SQEP)	Individuals who have the necessary qualifications, competence, and practical experience to safely perform tasks and make decisions in specialist areas such as explosives safety.

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1. Introduction

The City and County of Swansea Council has received a planning application from BigBang Storage Solutions, winner of the UK Ministry of Defence (MOD) tender, for an explosives storage facility to be constructed at the highlighted location [Figure 1].



Figure 1 - Proposed location of the explosive's storage facility submitted by BigBang Storage Solutions (Latitude 51.61818°, Longitude -3.91886°)

The proposal submitted to the Council is for the construction of five Explosive Storehouses (ESHs) for the storage of ammunition. The design specifies that no traverses will be used, and that each ESH will be earth covered with directional blast effects, described by the applicant as the "side of the magazine being perpendicular to the direction of the Exposed Site (ES)". In practical terms, this indicates that the magazines are to be oriented such that any upward and lateral venting of blast effects is directed away from surrounding receptors in accordance with IATG siting principles.

The facility is expected to accommodate the following total Net Explosive Quantities (NEQ) across all proposed ESHs:

- HD 1.1: 5,000 kg
- HD 1.2: 500 kg
- HD 1.3: 1,000 kg
- HD 1.4: 1,000 kg

According to BigBang Storage Solutions, each ESH will be designed to store up to 1,000kg of each hazard division, with ammunition stored on pallets stacked three high. Based on this approach, a total of five ESHs arranged in an east to west alignment would meet the stated storage requirements.

BigBang has also provided the following proposed Quantity Distance (QD) parameters for each ESH:

- Vulnerable Building Distance (VBD): 300m
- Inhabited Building Distance (IBD): 125m
- Public Traffic Route Distance (PTRD): 270m

The applicant further states that the following explosives allocation is composed of:

HD 1.1	HD 1.2	Additional
HD 1.1B: 50 kg	HD 1.2C: 350 kg	HD 1.3C: 1,000 kg
HD 1.1D: 3,200 kg	HD 1.2D: 100 kg	HD 1.4S: 1,000 kg
HD 1.1E: 1,250 kg	HD 1.2F: 50 kg	
HD 1.1F: 500 kg		

Table 1 - Explosive Types

The council does not possess internal Ordnance, Munitions and Explosives (OME) expertise to fully assess the implications of the proposed facility. As such, this report has been prepared to provide an independent technical evaluation of the planning application, with particular focus on International Ammunition Technical Guidelines (IATG) compliance, public safety considerations, and potential issues related to the storage and movement of explosives at the site.

1. Background

1.1. International Ammunition Technical Guidelines

The International Ammunition Technical Guidelines (IATG) are the primary governing framework applied to this assessment. Developed in 2011 under the UN SaferGuard Programme, the IATG provides an internationally recognised, standardised approach for the safe, secure, and sustainable management of ammunition. The guidelines cover all aspects of explosives storage, transport, and facility design, including Quantity Distance (QD) criteria, construction requirements, hazard classification, and risk reduction principles [1] [2].

Although other regulatory bodies exist such as the UK Defence Safety Authority (DSA), specifically DSA03 OME Part 2 [3] and the Explosives Regulations 2014 (ER2014) [4], these frameworks are not used in this report.

1.2. Hazard Divisions and Compatibility Groups

The IATG module on explosive hazard classification (IATG 01.50) uses a two-tier system for conventional OME which is Hazard Divisions and Compatibility Groups [5]. Hazard Divisions (e.g. 1.1, 1.2, 1.3, 1.4) reflect the nature of the explosive hazard as shown in Table 2. Whereas Compatibility Groups (A, B, C, D, E, F, etc.) provide a second layer and classifies the type and sensitivity of the OME, to determine what can be safely stored or transported together.

In an explosive's storage context, both Hazard Division and Compatibility Group determine the overall risk, and IATG requires that the highest hazard item present governs all safety assessments. This means QD calculations and storage design must be based on the most severe explosive, in this case HD 1.1, regardless of the presence of lower hazard items such as 1.3C and 1.4S. Incompatible or highly sensitive items (e.g. detonators) must also be segregated to prevent sympathetic initiation.

The compatibility group table is a matrix used to determine which types of explosives can be safely stored together in the same magazine or transport unit. Each letter (A, B, C, D, etc) represents a group of explosives with similar sensitivity and behaviour.

Compatibility Group	A	B	C	D	E	F	G	H	J	K	L	N	S
A	X												
B		X	X (1)	X (1)	X (1)	X (1)	X (1)						X
C			X (1)	X	X	X (2)	X (3)					X (4)	X
D			X (1)	X	X	X (2)	X (3)					X (4)	X
E			X (1)	X	X	X (2)	X (3)					X (4)	X
F			X (1)	X (2)	X (2)	X	X (2,3)						X
G			X (1)	X (3)	X (3)	X (2,3)	X						X
H								X					X
J									X				X
K										X			
L											(5)		
N			X (4)	X (4)	X (4)							X (6)	X (7)
S		X	X	X	X	X	X	X	X			X (7)	X

Table 2 - IATG Compatibility Group table

- **Green cells** - Combinations that may be stored together without additional restrictions.
- **Yellow cells** - Storage allowed under specific conditions.
- **Red cells** - Combinations that must not be stored together (sympathetic reaction/increased risk).

The purpose of this system is to prevent a situation where a sensitive or highly reactive explosive (e.g. CG B detonators) initiates a larger, more powerful explosive (e.g. CG D high explosive), causing a mass explosion.

HD / CG	Description	Behaviour / Hazard Characteristics	Typical Examples
HD 1.1	Mass explosion hazard	Ammunition that has a mass explosion hazard.	High explosives, warheads, large quantity detonators.
HD 1.1B	Mass explosion – very sensitive items	Extremely sensitive items that detonate readily. May function with relatively low stimulus.	Primary explosives, certain detonator compositions.
HD 1.1D	Mass explosion – insensitive items	Items that will detonate as a mass but are comparatively less sensitive. Usually require a detonator.	Bulk high explosives (RDX, TNT), demolition charges, warheads.
HD 1.1E	Mass explosion – articles containing explosives	Munitions containing, HE in casings; mass explosion if one item functions.	Artillery shells, mortar bombs, some missiles.
HD 1.1F	Mass explosion – propulsion items	Articles containing propellants with explosive components that can result in a mass explosion.	Rocket motors, rocket propelled grenade
HD 1.2C	Projection hazard – sensitive items	Items that produce fragments/projectiles but may also be more sensitive than 1.2D.	Some detonators, small explosive charges.
HD 1.2D	Projection hazard – articles containing explosives	Significant projection hazard with limited blast; no mass explosion.	Fuzes, certain submunitions, explosive bolts.
HD 1.2F	Projection hazard – propulsion articles	Propulsive items producing hazardous fragments upon functioning.	Small rocket motors, pyrotechnic separation devices.
HD 1.3C	Fire hazard with minor blast/projection	Vigorous burning, possible individual explosions; no mass explosion.	Propellants, flares, pyrotechnic compositions.
HD 1.4S	Very low hazard – "S" classification	Packaging ensures effects remain inside container; minimal risk.	Small arms ammunition in robust packaging, safety cartridges.

Table 3 - Proposed Hazard Divisions and Compatibility Groups

2. Description of the Proposed Facility

The planning application for an explosive's facility must be assessed with rigorous attention to detail. Every element from structural design to electrical systems contributes to the overall safety. This report addresses the assessment solely from an explosive's safety perspective. However, other specialist evaluations must be undertaken by Suitably Qualified and Experienced Personnel (SQEP).

2.1. Overview of the Proposed Development

For obvious reasons, OME storage sites are rarely located in the centre of a town or city. Such facilities are typically sited on the outskirts or in remote areas to maximise separation from the public. Where explosives sites do appear in central locations, this is almost always the result of subsequent urban expansion enveloping previously isolated depots in which these sites are usually relocated and repurposed. Establishing a new OME storage site within a city of approximately 250,000 people would not be considered good practice. Furthermore, the proposed site in Swansea is relatively small compared to the typical footprint required for a PES.

Most UK OME storage sites fall between 70-200 hectares, with many being around 100-150 hectares. This footprint is typically large enough to accommodate multiple magazines, mandatory QD safety distances, internal roads and other buildings like administrative and security. IATG does not specify a minimum size for an ammunition depot but has infrastructure they would expect to see. Swansea dock site is approximately 3.5 hectares, making it a considerably small site.

2.2. Required Net Explosive Quantities

BigBang Ltd have proposed a NEQ of 7500kg. More specifically:

- HD 1.1 – 5000 kg
- HD 1.2 – 500 kg
- HD 1.3 – 1000 kg
- HD 1.4 – 1000 kg

An NEQ of approximately 7,500kg HD 1.1 is characteristic of a small to medium ammunition storage site, equivalent to a UN IATG “Model Small Depot”.

2.3. Proposed Design of Explosives Store House

In accordance with the BigBang Ltd customer requirements, earth covered ESHs have been assessed. Their proposal did not mention anything about traverses between the ESHs which may raise concerns with IATG principles. A traverse acts as a protective barrier that prevents direct fragment and blast transmission between PES, thereby reducing the risk of sympathetic detonation and containing the effects of an internal explosion. However, earth covered ESHs are specifically supported by IATG as a cost effective, robust and scalable protective measure, and their use enables the site to maintain safe segregation between magazines even where internal QD spacing is limited. As the site is constrained, the adoption of earth covered traverses would be recommended to enhance the resilience of the storage layout and align fully with international relevant good practice [6] [7] [8].

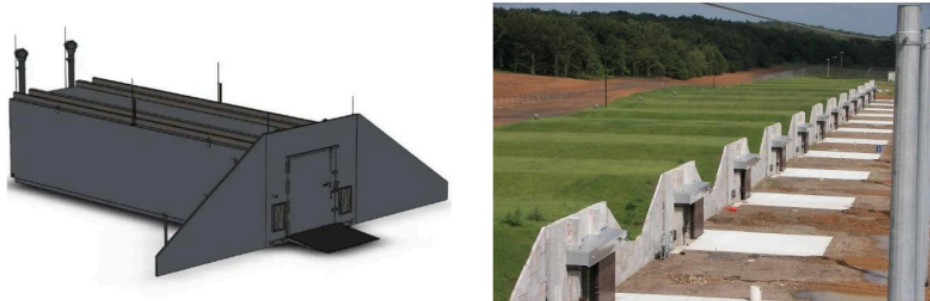


Figure 2 - Earth Covered Explosive Store House

Earth covered buildings and earth embankment traverses provide effective blast and fragmentation mitigation but require proper management. IATG guidance [9] mandates strict vegetation control around PES, as uncontrolled growth can increase fire risk and impair drainage. A three-zone approach is recommended: no vegetation within 1m of a PES (other than low grass on earth covered roofs) and vegetation within 5m kept very short (<50mm) with cuttings removed immediately [10].

2.4. ESH Spacing and Site Layout Considerations

The available site area is approximately 35,000m² (355m long). Going by the average width of an earth covered ESH, the expected external footprint is 8-10m, accounting

for walls and earth covering, with an internal usable width of 6-8m [11]. Installing five ESHs, each approximately 8m wide, requires a total building width of 4m. Applying typical separation guidance with widths of 4x ESHs results in 128m, giving a combined requirement of approximately 188m [12] [13].



Table 4 - Site Layout Concept with 5 ESH

The remaining margin also enables accommodation of essential support infrastructure, such as a site office, guard post, and packing/inspection facility positioned outside the PES [14].

3. Quantity Distance Assessment

3.1. Overview

IBD is the minimum separation distance required between a PES and any building that is regularly occupied by the public.

VBD is the minimum distance required between a PES and buildings susceptible to blast effects, (e.g. hospitals, schools, thin-walled structures).

PTRD aims to prevent fatalities or serious injuries to travellers from fragmentation, blast, or vehicle loss of control resulting from an explosive event. The acceptable risk threshold is higher than for IBD/VBD, as people are exposed only momentarily.

There are several vulnerable buildings located in proximity to the proposed site. The distances from the closest ESH are as follows:

- University (~300m)
- Hotel (~300m)
- Hospital (~450m)
- Houses (~125m)

3.2. Evaluation of Distances Provided by Applicant

The applicant has provided the following QD values:

- **VBD:** 300m
- **IBD:** 125m
- **PTRD:** 270m

Using IATG criteria and the maximum stated NEQ for HD 1.1, the independently calculated QD values are:

- **VBD:** 445m
- **IBD:** 400m
- **PTRD:** 270m



Figure 3 - Separation distances (IBD, VBD, PTRD) measured from the Potential Explosion Site.

A clear discrepancy exists between the applicant's VBD and IBD values and those derived from IATG tables. The VBD differs by 145m, and the IBD differs by 275m,

representing a substantial underestimation by the applicant. These differences are significant because VBD and IBD are designed to ensure survivability and structural integrity for the most sensitive receptors.

The PTRD is the only value that matches, suggesting either a coincidental alignment or that the applicant used a different methodology for PTRD compared to VBD and IBD.

Potential reasons for the applicant's reduced distances may include:

- Use of directional effects without demonstrating that the ESH design fully meets IATG criteria.
- Application of lower K-factors than those recommended for HD 1.1.
- Assuming reduced NEQ per ESH despite the stated maximum stock levels.
- Incorrect hazard division weighting or reliance on HD 1.2/1.3 values rather than HD 1.1.

Without full calculation records from the applicant, their reduced QD values cannot be validated. Given the proximity of housing, public buildings, and the marina, the highest hazard (HD 1.1) must govern all separation distances; therefore, the independently calculated values of 445m (VBD) and 400m (IBD) should be applied unless the applicant provides robust, compliant justification for any reduction.

The application also provides only a single coordinate point, whereas each ESH will have its own location and therefore its own QD arcs. This means the vulnerable buildings for one ESH may differ from another. While in theory this could allow some stores to achieve greater distances and potentially higher permissible NEQ, this is unlikely in practice.

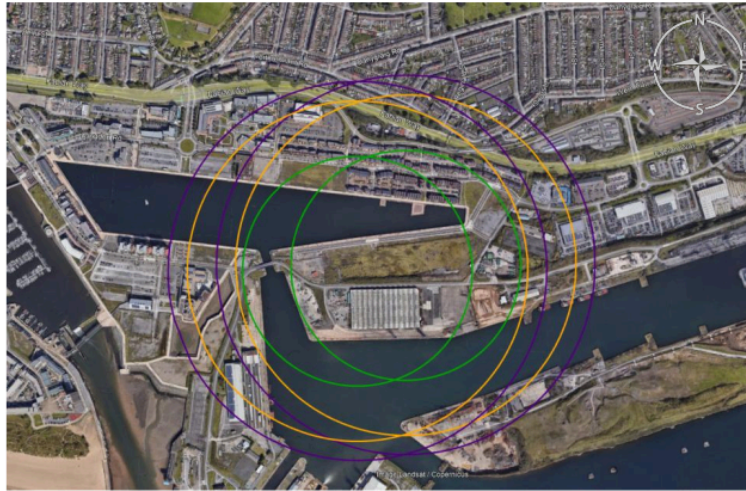


Figure 4 - Separation distances (IBD, VBD, PTRD) measured from Further West Potential Explosion Site.

3.3. Limitations of Quantity Distance Boundaries

The QD boundary is a geometrical circle, this means the circle is mathematically perfect (i.e. no distortions, no adjustments, just an ideal radius applied equally in all directions). Therefore, the circular boundary may not reflect site-specific obstacles or geometries. A better method would be to replace the idealised circle with a context sensitive boundary that reflects the actual site geometry.



Figure 5 - Circular QD boundary intersecting the hotel.

In contrast, the idealised IBD only intersects a portion of the Village Hotel, which contains 116 rooms. It is unrealistic to assume that only part of the building would be impacted. The same issue arises with nearby housing, where the model implies that a resident's neighbour may not be at risk despite being within the same structure or

immediate vicinity. However, there is also a risk that continually refining the boundary could lead to a much larger affected area than is warranted.



Figure 6 - Circular QD boundary just outside university.

The pink outline in Figure 7 provides a far more realistic representation of the affected area, as it accounts for the actual site geometry and surrounding structures like the University and Hotel.

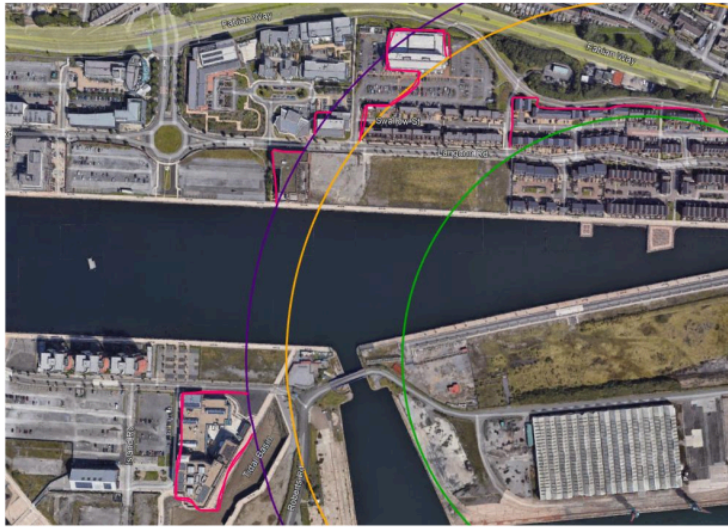


Figure 7 – Pink QD arc covering nearby infrastructure, demonstrating potential unnoticed impact on surrounding buildings.

3.4. Storage Configuration

The proposed storage facility will accommodate a range of OME in different compatibility groups. To ensure safe and compliant storage, the storage configuration of the OME must follow the IATG compatibility principles outlined in IATG 01.50 [5].

The submitted stock profile includes the following compatibility groups:

- **CG B:** 1.1B (50 kg)
- **CG C:** 1.2C (350 kg), 1.3C (1,000 kg)
- **CG D:** 1.1D (3,200 kg), 1.2D (100 kg)
- **CG E:** 1.1E (1,250 kg)
- **CG F:** 1.1F (500 kg), 1.2F (50 kg)
- **CG S:** 1.4S (1,000 kg)

Under IATG compatibility requirements, CG B is the only group that is recommended to be segregated from all others, as it contains highly sensitive initiating devices capable of causing immediate sympathetic detonation. Accordingly, CG B items are recommended to be stored in a separate ESH or dedicated secure compartment, with no co-storage alongside the main high-explosive or propellant inventory even in its relatively low amount of 50kg. Technically, CG B can be stored with the proposed OME under IATG rules as highlighted in Table 5 and Table 6, but segregation is strongly preferred.

Compatibility Group	A	B	C	D	E	F	G	H	J	K	L	N	S
A	X												
B		X	X (1)	X (1)	X (1)	X (1)	X (1)						X
C		X (1)	X	X	X	X (2)	X (3)					X (4)	X
D		X (1)	X	X	X	X (2)	X (3)					X (4)	X
E		X (1)	X	X	X	X (2)	X (3)					X (4)	X
F		X (1)	X (2)	X (2)	X (2)	X	X (2,3)						X
G		X (1)	X (3)	X (3)	X (3)	X (2,3)	X						X
H								X					X
J									X				X
K										X			X
L											(5)		X
N			X (4)	X (4)	X (4)							X (6)	X (7)
S		X	X	X	X	X	X	X	X	X		X (7)	X

Table 5 - Compatibility Group Matrix Highlighted

Compatibility Group	B	C	D	E	F	S
B						
C						
D						
E						
F						
S						

Table 6 - Compatibility Group Matrix Simplified

The remaining groups (C, D, E, F, S) are compatible with one another (limited to 1,000kg per ESH), subject to the footnoted conditions in the IATG matrix (e.g. packaging integrity, internal separation distances, correct stacking)

3.4.1. Stacking

Pallets stacked three high may be acceptable if supported by an appropriate structure and compliance with IATG 05.20 [13] requirements for access, clearance, and safe handling. IATG guidance notes that storage buildings may accommodate pallet stacks up to five tiers where the floor loading capacity is sufficient, typically up to 50 kN/m², provided that all safety, stability, and inspection criteria are met.

4. Safety Precautions

4.1. Environmental and Geographical Risks

The proposed site's dockside location introduces several environmental and geographical risks that must be addressed in accordance with IATG 06.10 [9]. Proximity to tidal waters increases the potential for flooding, storm surge, and water ingress into structures, all of which may compromise the integrity of OME. Adequate drainage systems, ground grading, and sealed structures are recommended. The exposed coastal environment increases wind loading, salt-spray corrosion, and general weathering, which can degrade structures, doors, locks, and security fixtures, requiring corrosion resistant design.

4.2. Fire Safety and Emergency Response

A dedicated on-site fire station is unrealistic with the size of the site. However, it is not mandatory for all OME storage facilities. Instead, legislation and standards such as

IATG 06.10 [9] and IATG 05.20 [13] [15] require that an appropriate level of fire response capability is available, which may be provided either by the local fire service or by a specialised on-site team depending on site size and NEQ.

4.3. Electrostatic Discharge Assessment

To ensure compliance with IATG requirements, the risk of Electrostatic Discharge (ESD) must be strictly controlled around PES. In accordance with IATG 05.40 [16], PEDs shall not be permitted within the designated safety distance of the PES as they can introduce uncontrolled electrical energy. This restriction includes any device capable of transmitting a signal (e.g. mobile phones, Bluetooth devices, smart watches, wireless headphones and medical implants).

A SQEP electrician should undertake all electrical work, as enhanced care is required for lighting, switching, wiring shielding, enclosures, and bonded panels [16] [17]. Swansea does not have any major EMR sources capable of posing a hazard to explosives within the ESH. Although the Kilvey Hill transmitting station is visible from the dockside, it is approximately 1.8 miles distant and produces field strengths orders of magnitude below those of concern for electronic explosive devices [18] [19].

4.3.1. Control Measures

It is recommended that additional emphasis be placed on incorporating the following measures into the facility design, in accordance with IATG 05.40 [16]:

Category	Control Measure	Description / Justification
Essential	Non-conductive or controlled-resistance flooring	Required to prevent static build-up and ensure safe dissipation of charge within PES.
Essential	Lightning Protection System (LPS)	Mandatory for all explosive buildings; provides protection against lightning-induced surges and ignition sources.
Essential	Bonding and earthing of electrical systems	Ensures all metalwork, panels, and conduits are at equal potential to prevent spark discharge.
Essential	PED restrictions (ban on mobile phones, radios, smart devices)	IATG requirement to avoid unintended ignition sources near explosives.
Essential	Humidity control (typically 40–60% RH)	Prevents static build-up in dry environments and reduces ESD risk.
Essential	ESD-safe or bonded equipment (e.g., trolleys, hand tools)	Reduces spark potential during material handling and movement.
Recommended	NOMEX or anti-static clothing	Not mandatory for storage-only sites but improves safety for personnel handling packaged explosives.
Recommended	HAPTM (Hazardous Area Portable Test Meter)	Useful for verifying floor resistance, bonding integrity, and ESD control effectiveness.
Recommended	Bonding straps for mobile equipment	Reduces static during movement of trolleys or carts; beneficial where friction is generated.
Recommended	Anti-static coatings or floor treatments	Helps maintain long-term resistance values and performance of ESD flooring.
Recommended	ESD signage and zoning	Improves operator awareness and defines controlled areas inside PES buildings.
Conditional	Personnel grounding straps	Only required where exposed energetics are handled. Not essential for BigBang.
Conditional	Static-dissipative shelving/racking	Applicable if unpackaged or loose items are stored, not required for palletised loads.
Conditional	Air ionisation units	Optional in very dry environments. Unlikely to be required at Swansea docks.
Conditional	Specialised grounding footwear	Beneficial in high risk handling areas but not mandatory for basic storage operations like BigBang.

Table 7 - Control Measures

4.4. Logistics

Explosives represent the dominant hazard, but it is important that planning does not focus solely on the explosive risk. The site must also be assessed in the same manner as any other development from a logistical and operational perspective, including considerations such as traffic flow, access routes, parking, service vehicle movements, and interaction with surrounding infrastructure. These non-explosive factors play a critical role in ensuring the site functions safely and efficiently alongside its explosive safety requirements [20].

4.5. Security Requirements

IATG 09.10 [14] emphasises a layered security (defence-in-depth) approach for ammunition storage sites. This includes 24/7 surveillance, secure perimeter fencing (minimum 2.4m high), a controlled entry point, continuous CCTV and lighting, and a clear 6-10m vegetation free zones along the fence line to maintain visibility. Each ESH must incorporate high-security locks, intrusion detection, and strict key-control procedures. IATG also requires a documented security risk assessment covering criminal, terrorist, insider, and environmental threats. Given the constrained footprint of the proposed site and its proximity to public areas, these security measures are particularly significant and may impact the final site layout.

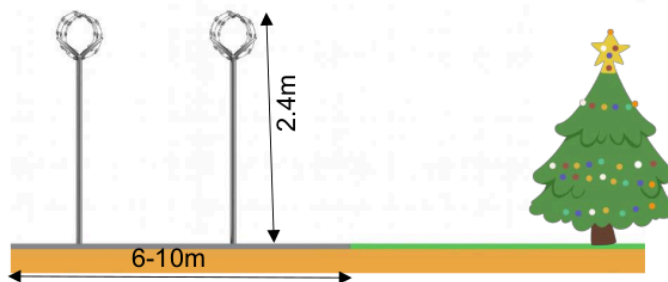


Figure 8 - Diagram of Fence with non-vegetation zone

4.6. Impact on Maritime Users

The proposed BigBang explosives facility located on the only remaining operational commercial dock in Swansea which presents several considerations for maritime users operating within the marina and adjacent waterways. While the site is land based, the proximity of vessels carrying members of the public, means that explosive

safety planning must account for the presence of boats transiting or mooring near the facility. PTRD defined in IATG 02.20 [21] apply equally to navigable water channels, and it must be ensured that no part of the marina or harbour approaches fall within the minimum standoff distances required for the stored NEQ. Additional factors include the potential for blast overpressure reflection from the water surface, vessel congestion during peak periods, and the need for clear communication protocols should an emergency arise. As such, the facility operator must engage with harbour authorities to establish exclusion zones, update navigation notices, and ensure that maritime users are fully informed of any operational restrictions required to maintain public safety.

5. Conclusion

This assessment shows that the proposed explosives storage facility at Swansea dockside does not meet the minimum safety requirements defined in the IATG. The applicant's submitted QD are significantly lower than those derived from IATG compliant calculations, particularly for HD 1.1, which requires substantially greater separation from vulnerable buildings. The presence of residential housing at 125m results in a permitted NEQ of 0kg for HD 1.1, meaning that mass-explosive storage cannot be safely accommodated at this location.

Additionally, the information provided by the applicant is incomplete. The absence of calculation sheets, detailed design data, and individual ESH coordinates prevents verification of their assumptions or confidence in the reduced distances presented. The environmental, geographical, and logistical constraints of the site further limit the feasibility of accommodating the stated NEQ and hazard divisions within the available footprint.

Overall, based on the site layout, surrounding population density, documented separation distances, and the required safety criteria, the proposed configuration cannot meet IATG standards in its current form.

6. Recommendations to the Council

Given the current deficiencies in the submission, approval should be conditional upon the applicant resolving the recommendation as follows:

1. The application should not be approved in its current form

The proposed storage quantities (particularly HD 1.1) cannot be safely accommodated within the available site footprint. The presence of residential housing at 125m reduces the permissible NEQ for HD 1.1 to 0 kg, making mass explosive storage non-compliant with IATG QD requirements.

2. Require full and transparent QD calculations from the applicant

The applicant must supply:

- Calculation sheets used to derive VBD, IBD and PTRD
- K-factors applied
- Directional-effect assumptions with engineering justification
- The exact NEQ allocated per ESH
- Coordinates for each individual ESH, not a single site coordinate

Without this, their reduced distances cannot be validated.

3. Request detailed design drawings demonstrating IATG compliance

Including:

- Earth-covered ESH cross-sections and structural details
- Door and headwall rating (BAR resistance)
- Drainage provisions
- LPS, bonding and electrical design
- Vegetation-control measures
- Site access routes and emergency arrangements

4. Require a revised storage proposal with reduced NEQ or altered HD mix

If the applicant wishes to proceed, they must present a configuration that:

- Removes HD 1.1 entirely, or
- Moves HD 1.1 to a compliant off-site location
- Reduces NEQ to meet QD limits for the nearest houses

5. Commission an independent explosives-safety review

Given the complexity of QD and the proximity of vulnerable buildings, an independent SQEP (outside BigBang Storage Solutions) should verify all assumptions, drawings, and calculations.

6. Require a maritime-impact assessment

Due to the site's proximity to the marina and harbour:

- Marine exclusion zones, operational windows, or vessel restrictions may be required
- Emergency response plans must explicitly account for maritime users

7. Require a full security plan

Including:

- Perimeter fencing (dual-fence where necessary)
- Controlled entry point with armed or unarmed security
- CCTV and IDS
- 24/7 monitoring arrangements
- Cybersecurity requirements for EED-sensitive stock

8. Environmental controls must be demonstrated

Evidence is required for:

- Flood resilience (tidal risk at the dockside)
- Corrosion protection (salt-spray environment)
- Controlled drainage
- Stormwater management

9. Emergency planning must be developed with local responders

Including:

- South Wales Fire and Rescue
- Ambulance services
- Port authority & harbour master

10. References

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- [19] Ministry of Defence, "JSP 482 Chapter 24 - Hazards of Electromagnetic Radiation to Ordnance (HERO)," Ministry of Defence, London, 2019.
- [20] IATG, "IATG 01.35 - Organisational capabilities," IATG, NYC, USA, 2021.
- [21] IATG, "IATG 02.20 - Quantity and separation distances," IATG, NYC, USA, 2021.

Appendix 1 - Questions for BigBang Storage Solutions

1. What engineering assumptions were used to derive your proposed QD values?
2. What is the justification for selecting this specific location for an explosive's storage facility?
3. Will the operation require maritime transport or handling of ammunition via the dockside?
4. Have alternative, less densely populated locations been assessed, and what factors ruled them out?
5. Is the stated NEQ requirement essential for operations, or is it a conservative estimate that could be reduced?
6. What specific ammunition types and configurations are intended for storage?

Appendix 2 - Explosive Limits License

Explosives Limit Licensing - Supplementary Matrix												
											IATG Form 02.30E	
UNIT	Explosives Storage Facility Swansea Dockside							LICENCE No	To be assigned			
SITE No / NAME	Proposed Big Bang Storage Facility (SA1)		FOR USE AS	Storage of HD 1.1, 1.2, 1.3 and 1.4 ammunition in 5x Earth Covered ESHs				ADEQUATE FIRE FIGHTING	YES			
ELECTRICAL STANDARD		LIGHTNING PROTECTION		AREA PLAN No				SAFEGUARD MAP No				
CAT. B		YES		To be assigned				To be assigned				
CONSTRUCTION DETAILS												
HEADWALL & DOOR		TYPE OF FLOOR		TYPE OF HEATING				IAS	SITE DRAWING No			
7 BAR		Reinforced concrete slab, compliant with IATG floor loading guidance.		Minimal electric heating				YES	Figure 8			
TRAVERSE DETAILS		Earth covered magazines without external traverses. Directional venting perpendicular to ES as per IATG 05.20.										
QUANTITY DISTANCES (METRES)												
ES →												
PES ↓												
	University	Hotel	Hospital	Houses								
	300	300	450	125								
NET EXPLOSIVE QUANTITY (IN UNITS OR DECIMAL FRACTIONS OF 1000 KILOGRAMS)												
HD 1.1	0.31	0.31	1.04	0.00								
HD 1.21	No Limit	No Limit	No Limit	No Limit								
HD 1.22	No Limit	No Limit	No Limit	No Limit								
HD 1.31	103.00	103.00	250.00	7.45								
HD 1.32	103.00	103.00	250.00	7.45								
MAXIMUM NEQ PERMITTED BY QUANTITY DISTANCE									LICENSING AUTHORITY UNIT STAMP			
HD 1.1	0kg	or HD 1.21	No Limit	or HD 1.22	No Limit	or HD 1.31	7450kg	or HD 1.32	7450kg			
ANY COMBINATION OF HD NOT EXCEEDING ONE OF THESE FIGURES WHEN MIXED IN ACCORDANCE WITH IATG 01.50									and/or HD 1.4 to capacity			
AVAILABLE UNITS OF SPACE									5x Earth Covered ESH			

Table 8 - Explosives Limit Licensing - Supplementary Matrix

Figure 8 - Diagram of Fence with non-vegetation zone
Figure 8 is the maximum allowable NEQ for each Hazard Division based on the distances to nearby vulnerable buildings (University, Hotel, Hospital and Houses) using IATG QD criteria:

- HD 1.1 - Only 310kg is allowed at 300m, 1,040kg at 450m, and 0kg at 125m.
- HD 1.2 - No QD imposed limit.
- HD 1.3 - Up to 103,000kg is allowed at 300m, 250,000kg at 450m and 7,450kg at 125 m.
- HD 1.4 - To capacity.

Based on IATG separation distance criteria, the presence of housing at 125m means HD 1.1 cannot be stored at this site without breaching QD requirements. Any departure from this would require a formal waiver by the national competent explosives authority (e.g. MoD explosives authority/national regulator) to accept of higher residual risk at a very high level and cannot be justified within normal IATG compliant design practice.

2114212-Council Request for Safety Report Siting an ammunition depot on the SA1 Waterfront

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

64/100

Engagement with Literature Skills 6/10

A good number of references were used throughout the assignment to support arguments and information given. References were up-to-date and mostly published within the last five years. Referencing technique was mostly correct and consistent, however there are some instances where IATG is referred to in general and a specific guideline is not referenced. For further marks, tools introduced in the lectures such as the United Nations SaferGuard toolset could have been used and images should also be referenced as an in-text citation (even if from an IATG). Finally, consider using a wider range of references, not just the guidelines and standards for example scholarly articles to help substantiate key points.

Knowledge and Understanding Skills 21/30

The student has demonstrated detailed understanding and knowledge of the basic underlying principles, explaining the hazard division and compatibility groups systems. The student has considered multiple safety precautions and factors for consideration in erecting an explosives facility in the location given, demonstrating knowledge of the safety requirements associated with siting an ammunition depot. For further marks, greater detail could be given into how the explosives could be stored to further demonstrate understanding of compatibility. Ensure all parts of assignment are answered, for example including advice to the maritime users should the proposal be approved. The student has considered the mixing rules for compatibility groups in some detail but has not considered the somewhat ambiguous statement made in the BBSS solution, i.e. that "Each ESH will be able to hold up 1000 kg of each type of hazard division". Given the use of the compatibility matrix in Table 5, an explanation of the Notes relevant to their

argument should have been provided.

This could be taken at face value to mean that in each ESH, the operator could store 1000kg of HD 1.1 plus 1000kg of HD 1.2 plus 1000kg of HD 1.3, ignoring HD1.4 as the NEQ of this HD is not considered for explosives licensing within the IATG, allowing a maximum NEQ per ESH of 3000kg.

The alternative, recognised and safer alternative is to apply the aggregation rules for storage of explosives by HD. By this method, any missing of HD would be impossible because the proposal allows only 1000kg of each HD per ESH, requiring 5 ESH for HD 1.1, which would need 5x ESH for the proposed HD1.1 alone, then a further 2x ESH for HD 1.2 and HD 1.3.

The student has mentioned a number of facilities that are essential for the safe and effective running of an explosives storage area, including a packing/inspection facility. Unfortunately, they did not explain that this would also require an explosives licence and would be regarded as both a PES and an ES.

Cognitive and Intellectual Skills 12/20

The student has been able to demonstrate a sound critical analysis of the given solution from BBSS. The student is able to make valid judgements based on the analysis completed in their work, providing a clear and succinct conclusion. For further marks, the student should apply critical assessment of what a correct solution might look like.

The student has brought together many of the concepts and principles taught from the IATG to provide a coherent argument that incorporates different risks that must be considered by the client. That said, some of the Control Measures suggested in section 4.3.1 are more appropriate to explosives processing than storage.

The assignment requires consideration of the impact on maritime users. They have considered marina and harbour in very general terms, as these are not specifically covered in IATG. For additional marks, they could have mentioned specific legislation relating to the storage and handling of explosives in ports.

Practical Application Skills 18/30

The student has successfully identified holes within the proposal given by BBSS, identifying low QDs and requesting assumptions made as part of their safety questions for risk reduction. For further marks, the student should offer more extensive justifications regarding storage configuration in terms of explosive compatibility. Furthermore, providing consideration for increasing the number of ESH needed and the implications of this may help to provide depth.

In accordance with the assignment guidance for Practical Application, the student has worked within the precepts of the International Ammunition Technical Guidelines. There was an expectation that the IATG Implementation Tool would be used to provide draft Explosives Limits Licences to support the arguments made.

Transferable Skills for Life and Professional Practice 7/10

The report is well structured and generally coherent throughout, with minor grammatical errors. Recommendations to the council and questions for risk reduction are clearly stated and communicated. Section in the end of Appendix 2 is slightly out of context – unsure if this has been misplaced.

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