

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

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University of Wales Trinity Saint David

Ordnance Munitions & Explosives BEng Apprenticeship

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

OME Safety Management & Law (ACDA 6022)

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Abstract

This report produces an independent technical assessment of a planning application by BigBang Storage Solutions for the Construction of a proposed explosive storage facility. The assessment was conducted to support the City and County of Swansea Council in its role as the local safeguarding authority. The proposal was evaluated against the International Ammunition Technical Guidelines, with particular consideration given to the facility design, quantity distances, environmental conditions, security, emergency preparedness and transport impacts. The assessment suggests that under a worst-case scenario, BigBang Storage Solution's proposed separation distances do not meet the minimum requirements within a standard explosive limit licence. The maritime location introduces additional considerations, including corrosion, long-term ammunition degradation and factors that exacerbate explosive effects. While the proposal is not suitable for approval in its current state, alternative solutions have been identified. Such as a reduced net explosive quantity, supported by formal explosive consequence and cost benefit analyses, which could reduce the risks to a tolerable level in accordance with as low as reasonably practicable practices.

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Terms and Abbreviations

Terms:

Applicant - BigBang Storage Solutions

Council - City and County of Swansea Council

Abbreviations:

CBA – Cost-Benefit Analysis

CG – Compatibility Group

ECA – Explosive Consequence Analysis

ELL – Explosive Limits Licence

ES – Exposed Site

ESH – Explosive Storehouse

HD – Hazard Division

IATG – International Ammunition Technical Guidelines

IBD – Inhabited Building Distance

IQD – Inside Quantity Distance

IMD – Inter-magazine Distance

NA – National Authority

NEQ – Net Explosive Quantity

OME – Ordnance, Munitions and Explosives

OQD – Outside Quantity Distance

PBD – Process Building Distance

PES – Potential Explosion Site

PTRD – Public Traffic Route Distance

QD – Quantity Distance

RRPL – Risk Reduction Process Level

VBD – Vulnerable Building Distance

AI Acknowledgement

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1.0 Introduction

1.1 Purpose of Report

This report serves as an independent technical assessment commissioned by the City and County of Swansea Council (Council) regarding the planning application submitted by BigBang Storage Solutions (Applicant) for the construction of a new explosive storage facility. The role of the Council is limited to providing approval in respect of health and safety considerations [1]. Therefore, identifying local risks and vulnerabilities is necessary to inform the National Authority (NA) whether the proposal is tolerable from a public safety perspective.

The identification of local risks and vulnerabilities, therefore, constitutes the central focus of this assessment. While the NA acts as the licensing and enforcing body for the technical specifications and management of explosives, the Council functions as the safeguarding authority for the surrounding community. Highlighted during the Ordnance, Munitions and Explosives (OME) Safety Management and Legislation lecture (SSO PE Ltd, University of Wales Trinity Saint David, Nov. 2025), absolute safety represents an aspirational objective but is never achievable due to compromises. Therefore, safety is achieved to a tolerable level dictated by a range of components.

Therefore, the information submitted by the Applicant must not only meet minimum regulatory requirements, but also demonstrate alignment with internationally recognised best practices, as defined within the International Ammunition Technical Guidelines (IATG), which provide the following criteria [2]:

- Objective criteria
- Benchmark for development
- Contribute towards a reduction of OME-related events
- Maintenance and enhancement of outstanding safety procedures
- Agreed competencies [3].

1.2 Aims & Objectives

This report examines whether the information submitted by the Applicant complies with the guidance set out in the IATG. The reviewing Council does not possess OME expertise. As a result, an external assessment is required to challenge assumptions and ensure that appropriate due diligence has been carried out.

The overall aim of this report is to assess the suitability of the proposed explosives storage facility from a public safety perspective. To achieve this aim, the following objectives are addressed:

- To interpret relevant explosives legislation and regulatory requirements and assess how they apply to the application.
- To examine and critically evaluate the key safety assumptions and technical aspects of the proposal.
- To review security requirements for the proposal.
- To assess the potential impact of the application on the public.
- Evaluate the impact on the public.

1.4 Legislative and Regulatory Framework

The IATG provide the framework governing the safe, secure and sustainable management of ammunition stockpiles [4]. Developed under the UN SaferGuard programme, the IATG articulates internationally recognised good practices covering design, operation and risk assessment for explosive facilities. As such, the IATG form the regulatory and technical reference for this assessment.

The IATG establishes a systematic and transparent approach to explosive safety, recognising that ammunition stockpiles pose inherent hazards to communities. Historical evidence demonstrates the consequences of inadequately managed stockpiles. Since 1979, more than 623 recorded unplanned explosions at ammunition sites have resulted in a significant loss of life and major infrastructure damage [2] [5] [6] [7]. More recently, an incident at an ammunition process facility in Tennessee resulted in sixteen fatalities and extensive damage to infrastructure following the detonation of 10-12 tonnes of explosives, underscoring the importance of understanding both operational tasks and the risks associated [8].

To address these risks, the IATG applies an integrated risk-management process that reduces hazards and mitigates their consequences through controls [9]. However, the absence of OME expertise within the reviewing Council limits its capacity to assess claims, fully understand hazards, or robustly challenge the assumptions made by the Applicant. Incorporating external OME expertise is therefore essential to support informed, transparent and accountable decision-making.

Central to the IATG framework is the application of formal risk-reduction methodologies, which require the consideration of potential failure modes, the likelihood of accidental events and the consequences for personnel, infrastructure, and the wider public [10].

The IATG classify ammunition stockpile management activities according to three Risk Reduction Process Levels (RRPLs), reflecting the extent to which risk controls are implemented and effective [11]. These levels, summarised in Table 1, provide a useful benchmark for evaluating the robustness of proposed safety arrangements.

Table 1 - RRPL Levels [11].

RRPL Level	Description
1 (Basic)	This is the minimum acceptable standard, ensuring significant risk reduction through basic control measures. Level 1 sites often rely on distance as the primary safety barrier.
2 (Intermediate)	This level introduces infrastructure, such as traverses and more robust storehouse construction.
3 (Advanced)	Organisations should strive to achieve RRPL 3, which reflects a developed, safe and secure ammunition stockpile management.

In reviewing, the Council should consider which RRPL the Applicant intends to achieve. Given the semi-urban nature of the surrounding area, a target of RRPL 2 or 3 would be expected to reduce risks to the public to a tolerable level.

1.5 Principles of Explosives Safety and Quantity-Distance

To comprehensively assess the Applicant's proposal, the Council must have a working understanding of the fundamental principles governing the consequences of an unintended explosion. The safety distances discussed later in this report are calculated zones derived from survivability criteria and well-established OME principles, laws and equations.

A key parameter in safety assessments is the Net Explosive Quantity (NEQ), which represents the total explosive mass of OME items. Where explosives are stored without adequate separation, NEQ can accumulate across neighbouring Explosive Storehouses (ESHs), resulting in a significant increase in the consequences of an event and consequently an expansion of the required safety distances. Therefore, the facility must provide sufficient separation between ESHs to prevent unintended NEQ aggregation.

The primary hazard associated with each explosive article is identified through its Hazard Division (HD) classification. The six IATG HD are summarised in Table 2 [12]:

Table 2 - Hazard Division Definitions [12].

Hazard Division	Pictogram	Definition
1.1		Ammunition which has a mass explosion hazard.
1.2		Ammunition which has a serious projectile hazard.
1.3		Ammunition which has a fire hazard or a minor projection hazard.
1.4		Ammunition that presents no significant hazard.

1.5		Very insensitive substances, which have a mass explosion hazard
1.6		Extremely insensitive articles which do not have a mass explosion hazard.

For this assessment, it is assumed that the facility will be licensed for HD-1.1, as this provides the most conservative planning approach. An HD-1.1 facility can safely store lower HD (e.g. 1.2 or 1.3), whereas the reverse is not permissible.

When an explosive event occurs, chemical energy is rapidly released, producing high-temperature, high-pressure gases [13]. This energy release generates a shock front that propagates outwards as a blast wave and causes the high-velocity fragmentation of surrounding materials, including casings and buildings. The damage resulting from these effects decreases with distance from the Potential Explosion Site (PES). At short distances, reinforced concrete is shattered, whereas at greater distances the dominant hazard is glass failure, which occurs at distances of kilometres from the PES [14].

The NA has the legal responsibility to ensure that the risks associated with the storage and handling of ammunition are reduced to a level As Low As Reasonably Practicable (ALARP) [15]. This requirement is achieved through the application of Quantity Distance (QD) criteria, based upon trial data and subject to refinement as additional evidence becomes available [16]. The underlying basis of QD methodology is the Hopkinson-Cranz Scaling Law, which relates the explosive mass to distance for equivalent damage effects, as shown in Equation 1 [16] [17] [18].

Equation 1

$$R_1 R_2 = (W_1 W_2)^{\frac{1}{3}}$$

$$R = Z W^{\frac{1}{3}}$$

Where R is the range in meters, W is the explosive weight in kilograms, and Z is the constant of proportionality. In QD work, this constant is expressed through a QD

coefficient (Q), which defines different safety distances according to exposure type.
The Q values relevant to this assessment are summarised in Table 3.

Table 3 – Quantity Distance Coefficients [15].

Q	QD	Purpose
3.6	Inter-magazine Distance (IMD)	The minimum separation required between two PES containing explosives is such that the effects of a credible explosive event at one site do not result in sympathetic detonation at the adjacent site.
8.0	Process Building Distance (PBD)	Applies to buildings in which explosives are manufactured, processed, or handled. PBD is intended to ensure that the effects of a potential explosive event are limited such that personnel safety and the integrity of adjacent exposed sites are maintained.
14.8	Public Traffic Route Distance (PRTD)	Distances apply to roads, pavements and routes used by transient populations. PTR distances are to ensure members of the public are not exposed to blast waves or dangerous debris during periods of brief exposure.
22.2	Inhabited Building Distance (IBD)	Applies to all structures routinely occupied by people, including residential, commercial and industrial buildings. Its purpose is to ensure blast effects to the building are at a level unlikely to cause serious injuries
44.4	Vulnerable Building Distance (VBD)	Protects buildings at risk from blast effects, such as schools, hospitals and

		hotels, where glass failure and reduced mobility increase risk [18].
4.5	Human Defeat Distance (Blast)	Defines the distance at which blast overpressure is reduced to a level below that expected to cause fatal or serious injury to exposed, unprotected personnel.
14.0	Human Defeat Distance (Fragmentation)	Defines the distance at which primary and secondary fragments generated by an explosive event are unlikely to cause fatal or serious injury to exposed, unprotected personnel.

For regulatory purposes, QD are further grouped into two overarching categories, depending on whether the exposed site lies within or outside the licensed explosives area. These groupings are summarised in Table 4 [15].

Table 4 - QD Types [15].

QD Type	Applicability	QD Sub-Types
Inside Quantity Distance (IQD)	Inside the explosives area.	PBD
		IMD
Outside Quantity Distance (OQD)	Outside the designated explosives area.	PTRD
		IBD
		VBD

The above principles form the basis for the QD assessment discussed later in this report, where site-specific distances are calculated and compared against IATG guidance.

2.0 Proposal Summary

2.1 Location and Local Environment

Information presented in this section has been extracted from the Applicant's proposal, provided in Appendix 1. The proposed PES is located at latitude 51.61818 and longitude -3.91886, within a dockland area on the outer eastern edge of Swansea, as shown in Figure 1. The environment is characterised by a temperate maritime climate, with consistently high relative humidity, typically in the range of 87% [19], and regular exposure to sea spray due to proximity to the coast. Average annual temperatures are approximately 10-11°C [20].

Prevailing south-westerly winds dominate the area, which brings moist sea air to the facility, contributing to damp conditions [21]. These environmental factors are relevant to the application, as they may influence corrosion rates, material degradation and long-term infrastructure resilience.



Figure 1 - Potential Explosion Site.

2.2 Proposed Infrastructure

The Applicant wishes to construct five ESH without traverse for the storage of explosives. The total quantities of ammunition to be stored on site are expressed as NEQ by HD and are presented in Table 5.

Table 5 – Storage facility requirements.

Hazard Division	NEQ (kg)
1.1	5000
1.2	500
1.3	1000
1.4	1000

The Applicant has stated that each ESH will be capable of accommodating up to 1,000 kg NEQ of each HD, with ammunition stacked up to three pallets high where required. The proposed ESHs are arranged east-to-west on the PES in Figure 1.

The HDs listed above are further subdivided into Compatibility Groups (CG). The proposed breakdown of NEQ by CG is shown in Table 6.

Table 6 -Big Bang Storage Solutions compatibility group breakdown.

Hazard Division	Compatibility Group	NEQ (kg)
1.1	B	50
	D	3200
	E	1250
	F	500
1.2	C	350
	D	100
	F	50
1.3	C	1000
1.4	S	1000

2.3 Quantity Distances

For the proposed PES, the Applicant has provided QDs based on their stated NEQ split between the five ESH. The declared distances are summarised as follows:

- The Vulnerable Building Distance (VBD) is no more than 300 m for each ESH.

- The Inhabited Building Distance (IBD) is no more than 125 m for each ESH.
- The Public Traffic Route (PTR) is 270 m for each ESH.

These distances serve as the basis for the subsequent assessment of compliance with the IATG guidelines and evaluation of possible impacts on surrounding Exposed Sites (ES).

3.0 Technical Assessment

3.1 Facility Design and Location

As outlined in section 2.1, the proposed facility is located within a harsh coastal environment characterised by strong prevailing winds, high relative humidity and regular exposure to moist sea air. These conditions contribute to a persistent dampness and elevated corrosion rates, which present an increased hazard during external handling and movement tasks where OME is exposed. Corrosion-related degradation has the potential to compromise packaging integrity and, if unmanaged, may influence the safety and reliability of stored ammunition.

In addition, the local climatic conditions increase the likelihood of long-term OME degradation. To mitigate this risk, storage facilities would require environmental controls, including humidity regulation (50-60%) and temperature control (20-25°C). Such conditions are necessary to prevent the degradation affecting sensitive materials, including propellants containing nitrate esters or nitroglycerine and to preserve stabiliser content over time [22].

As part of the wider facility layout, the site will require administrative and support areas to allow activities to be conducted outside of explosive storehouses. These buildings constitute internal ES and must therefore be incorporated into the IQD assessment. Adequate IMD between each ESH, as well as separation from non-explosive facilities, are necessary to bring risks to a tolerable level.

A detailed review of the surrounding area has identified a few features that may be affected by blast effects, fragmentation, thermal radiation or ground shock resulting from an accident at the PES. This assessment, illustrated in Figure 2 **Error! Reference source not found.**, identified twenty-eight points of interest classified as ES. These include vulnerable buildings, inhabited structures, and public traffic routes, all of which have the potential to influence the allowable NEQ of each ESH. Vessels have not been included at this stage due to the need for more current and location-specific information before classification as ES. The identified ES are detailed in Table 7.



Figure 2 – Potential Explosion Site and Identified Exposed Sites.

Table 7 – Identified Points of Interest.

Point of Interest N°	Description	IATG Classification	Distance From PES
1	Appletree Nursery	Vulnerable Building	870 m
2	VRM Swansea	Inhabited Building	790 m
3	Premier Inn	Vulnerable Building	720 m
4	Driver and Vehicle Standards Agency	Vulnerable Building	780 m
5	HMT Sancta Maria Hospital	Vulnerable Building	600 m
6	Multistorey Accommodation (Harbour Quay)	Inhabited Building	460 m
7	Village	Vulnerable Building	420 m

8	Low-density housing (SA1 8GT)	Inhabited Building	400 m
9	Multistorey accommodation (Langdon Road)	Inhabited Building	260 m
10	Multistorey accommodation (SA1 8RD)	Inhabited Building	160 m
11	Brig South Wales	Inhabited Building	380 m
12	Ibis Swansea	Vulnerable Building	470 m
13	Swansea Driving Test Centre	Inhabited Building	290 m
14	Swansea Volkswagen	Inhabited Building	400 m
15	Mercedes-Benz of Swansea	Inhabited Building	530 m
16	Swansea Audi	Inhabited Building	720 m
17	Seras Energy	Inhabited Building	200 m
18	Storage Warehouse (SA1 8QY)	Inhabited Building	270 m
19	7Steel UK Recycling (Industrial Site)	Inhabited Building	380 m
20	Storage Warehouse (51.6113086, -3.920003)	Inhabited Building	550 m
21	Swansea Drydocks	Inhabited Building	570 m
22	WB Power Services Swansea	Inhabited Building	470 m
23	UWTSD SA1 Waterfront Campus	Vulnerable Building	500 m

24	Multistorey Accommodation (SA1 8AJ)	Inhabited Building	600 m
25	Commercial Business (SA1 8PP)	Inhabited Building	800 m
26	Fabian Way	High-Density PTR	300 m
27	Langdon Road	Medium-Density PTR	220 m
28	Roberts Road	Low-Density PTR	400 m

The proposed storage buildings are ESH (without traverse) to store ammunition and explosives in accordance with the guidance set out in IATG 05.20 [23]. The proposal states that each ESH will be earth covered with directional effects for blast as the side of the magazine perpendicular to the identified ES. This orientation implies the back wall will be perpendicular to the ES, which is important as the side and rear walls are thicker and earth-covered, providing greater resistance to blast and fragmentation effects. In contrast, the front will incorporate an access point and a lighter construction. Figure 3 illustrates a standard ESH configuration without traverse.



Figure 3 – Example of an Earth-Covered Storehouse (without traverse) [24].

In addition to site-specific design considerations, the Council is entitled to consider broader local risk factors, including:

- The presence of nearby bulk storage of flammable/hazardous substances.
- Adjacent hazardous activities or operations that may contribute to cumulative risk.
- Proximity of critical infrastructure, such as gas pipelines or high-voltage electrical lines.

3.2 Safety Distance Assessment

The QDs proposed by the Applicant were reviewed against the IATG, with reference to the stated NEQ, ESH configuration and the absence of traverses stated in section 2.1. Based on this information, a conservative worst-case scenario was assessed of 3,000 kg of HD-1.1. This generated the map shown in Figure 4 and the comparative analysis presented in Table 8.



Figure 4 - Quantity distance map for 3,000 kg of hazard division 1.1.

Table 8 - Comparison of Proposed and IATG-Derived Quantity Distances [25].

Quantity Distance Type	Applicant Proposed Distance (m)	IATG Quantity Distance for NEQ of 3,000 kg 1.1	IATG Quantity Distance for NEQ of 1350 kg 1.1
Vulnerable Building Distance (VBD)	300	640	490
Inhabited Building Distance (IBD)	125	400	400
Public Traffic Route Distance (PTRD)	270	270	270

For the QDs based on 3000 kg of HD-1.1, the values for VBD and IBD significantly exceed those proposed by the Applicant, confirming non-compliance with the IATG under a standard Explosive Limit License (ELL).

Where standard QDs cannot be achieved, a potential option is the application of a non-standard ELL. A proportionate approach would be to limit the NEQ of HD-1.1 to 250 kg per ESH, which reduces the NEQ of each ESH to a tolerable level of risk. This strikes a balance between safety, operational usefulness and proportionality. When aggregation is considered, the worst-case NEQ is 1,350 kg HD-1.1 per ESH. The revised QD map (Figure 5), demonstrates that vulnerable buildings lie at the outer extent of the VBD, while IBD and PTRD remain the same, supported by Table 8. This represents a clear improvement over the previous NEQ allocation and, when combined with proposed engineering and organisational measures, it supports the conclusion that the residual risk can be reduced to a tolerable level consistent with ALARP principles.



Figure 5 - Quantity distance map for 1,350 kg of hazard division 1.1.

Local environmental factors may further influence consequence severity. Adjacent bodies of water may amplify ground shock and surface wave effects, as observed in historical incidents [5], [6]. Vessels carrying explosives should be treated as separate PES, as they provide limited protection compared with ESHs. Traverses may further reduce QDs if correctly implemented (Figure 6), although the proportionality of land acquisition and construction must be considered [26].

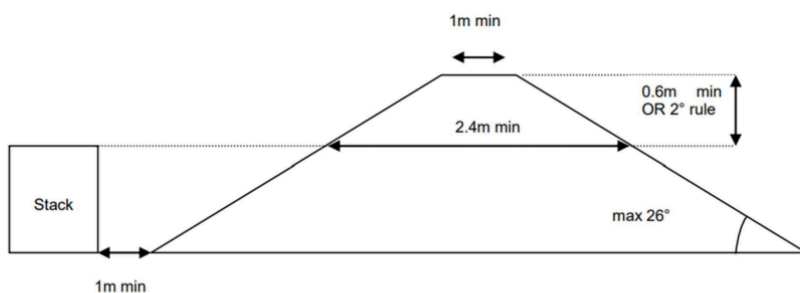


Figure 6 - Example of a standard double slope traverse [27].

3.3 Explosive Storehouse Allocation

The allocation of ammunition across the five ESHs was assessed using IATG 01.50 [12]. Given a per HD limit of 1,000 kg NEQ per ESH, the proposed allocation is shown in Table 10.

Under this configuration, the 5,000 kg of HD-1.1 ammunition is distributed evenly across all five ESHs. The 500 kg of HD-1.2 ammunition is fractioned to reduce aggregation risk, while HD-1.3 and HD-1.4 stocks are collocated in ESH 5.

Table 9 - Compatibility group mixing rules Matrix [12].

Compatibility Group	A	B	C	D	E	F	G	H	J	K	L	N	S
A	X												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 ₍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 10 - BigBang Storage Solutions ESH allocation.

ESH N°	HD 1.1	HD 1.2	HD 1.3	HD 1.4	Notes
1	1,000 kg 1.1D	100 kg 1.2C	0	0	1.1D Fractioned, 1.2 Fractioned

2	1,000 kg 1.1D	100 kg 1.2 C	0	0	1.1D Fractioned
3	1,000 kg 1.1D	100 kg 1.2C	0	0	1.1D Fractioned
4	200 kg 1.1D + 800 kg 1.1E	50 kg 1.2C + 50 kg 1.2D	0	0	Remaining 1.1D + 1.1E Fractioned + Remaining 1.2C + 1.2D Fractioned
5	450 kg 1.E +500 kg 1.1F + 50 kg 1.1B	50 kg 1.2D + 50 kg 1.2F	1,000 kg 1.3C	1,000 kg 1.4s	All remaining 1.1E + 1.1F + 1.1B +1.2D +1.2F + 1.3 + 1.4

This allocation is based on assumptions regarding the ammunition configuration and segregation. 1.1B is assumed to consist of fuzes associated with the parent article 1.1E, which is aggregated as 1.1F. Additionally, 1.2D and 1.3C may only be stored with 1.1F and 1.2F, where effective segregation prevents propagation. If the stated assumptions cannot be met, additional ESHs would be required.

Authorisation of an ELL would permit the storage and handling within defined NEQ limits. However, due to the assessment in section 3.2, the QD cannot fully be achieved for the proposed ESHs. Consequently, a non-standard ELL example of what the NA would produce is presented in Appendix 2 [28].

Where non-standard ELLs are proposed, full compliance with standard licensing assumptions is not achievable. However, acceptability may be demonstrated by showing risks are at a tolerable level. The residual risk can be underwritten by the Ministry of Defence and supported through Explosion Consequence Analysis (ECA) and Cost-Benefit Analysis (CBA), provided in Appendices 3 and 4 [29].

3.4 Security Assessment

Security is a fundamental component of ammunition stockpile management and reduces the risk of theft, loss or deliberate interference. The IATG guidance promotes a proactive, rather than a reactive, approach to ensure security to the highest standards [30]. The proposal provides no details of any security measures or

provisions. Consequently, the proposal does not meet the minimum expectations for RRPL 1 compliance.

3.5 Public Safety and Emergency Response

Public safety considerations include both immediate and long-term risks associated with ammunition storage. An effective emergency response capability within Swansea would be critical in mitigating the consequences of an incident. The proposal does not address emergency planning, responder liaison or hazard-awareness training, creating uncertainty regarding the readiness and limiting situational awareness. Approaches should integrate external responders into risk-reduction planning, and the absence of such foresight limits the feasibility.

3.6 Transport and Maritime-User Considerations

The movement of OME introduces additional transient risks that must be assessed alongside storage. The proposal does not provide information on routing, timing, frequency or traffic management, which prevents a meaningful assessment of risk along PTRs. Given the proximity of the PES to the adjacent marina, maritime-user safety also requires consideration. Temporary exclusion zones may be required during OME movements, supported by advanced notification through the harbour master and scheduling during periods of minimal road and harbour activity. Without this information, transport-related risks remain unknown.

4.0 Recommendations to the City and County of Swansea Council

4.1 Proposal Review

Based on the technical assessment presented in section 3.0, the proposed application is not suitable for approval by the City and County of Swansea Council. The QDs associated with the proposed NEQ do not meet the minimum IATG separation requirements for the identified ES.

4.2 Recommended Adjustments

To support informed and defensible decision-making, it is recommended that the Applicant complete the questions provided in Appendices 5 and 6. This would enable the Council to determine the RRPL using the IATG framework and aid further assessments.

Based on the findings of section 3.0, several adjustments are required to improve compliance and reduce risk to a tolerable level. The most immediate measure would be a reduction in the NEQ per ESH for HD-1.1. Limiting HD-1.1 to a proportional NEQ, supported by a non-standard ELL, would reduce QDs and associated risks to identified ES.

Alternative design and layout choices should be considered, including ESH designs that provide enhanced directional blast protection and staggered ESH entrances to reduce the likelihood of propagation between ESHs. Engineering controls, such as traverses, may further reduce low-angle fragmentation and climatic controls. However, their implementation must be proportionate to the land availability, construction cost and the value of the stored OME.

Facility relocation, including the removal of the warehouse to the south of the PES, so the facility can be repositioned further south, increasing key separation distances to ES. Where relocation of the site locally is not an option, alternative sites with a greater inherent separation distance should be considered.

Any application for a non-standard ELL must be supported by a formal CBA and ECA, demonstrating that risks are tolerable and consistent with ALARP principles.

Organisational and security controls should also be strengthened through enhanced emergency planning, responder liaison, hazard-awareness training and community notification arrangements, alongside defined transport and maritime movement controls.

5.0 Conclusion

This report has provided an independent technical assessment of the proposed explosive storage facility against the IATG, in support of the Council's safeguarding responsibilities. The assessment focused on the facility design, QDs, environmental conditions, security, emergency preparedness and impacts on the public.

The findings demonstrate that from a credible worst-case scenario, the Applicant's proposed QDs do not meet the minimum requirements for a standard ELL. Therefore, the proposal does not demonstrate compliance with the IATG or provide adequate assurance that public safety risks have been reduced to a tolerable level.

The maritime location introduces additional factors, including elevated corrosion rates, potential for long-term OME degradation and environmental factors that may amplify explosive effects, such as increased ground shock from adjacent bodies of water. These conditions necessitate robust environmental controls and conservative safety assumptions. These factors highlight the need for conservative safety approaches, robust environmental controls and risk mitigation measures.

Although the proposal is not suitable in its current form for approval, this assessment has identified a pathway to improve the approval likelihood. A reduced NEQ, supported by a non-standard ELL in conjunction with formal ECA and CBA, could reduce risks to a tolerable level in-alignment with ALARP principles. However, this would require proportionate engineering, organisational, security, emergency planning and transport controls to be implemented.

Consistent with the Council's role as the safeguarding authority, approval should be withheld until the Applicant has addressed the identified issues and demonstrated, through formal evidence-based assessments, that the risk to the public and environment has been reduced to a tolerable level.

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7.0 Appendix

Appendix 1 – Assignment Task Description

The Council has received an application for planning permission for an explosive facility to be erected at the following GPS location shown on the map below.

The proposal is to build 5 x ESH (without traverse) to store the ammunition. We have been told the ESH would be earth covered with directional effects for blast described as *Side of magazine perpendicular to the direction of the ES*. What does that mean?

The storage facility, as a whole, is required to hold the following quantities of ammunition by NEQ:

HD 1.1 – 5000 kg

HD 1.2 – 500 kg

HD 1.3 – 1000 kg

HD 1.4 – 1000 kg

Sadly, we have no OME experts on the Council staff and believe this to be a significant hazard to the public. As such, we would wish to commission your services to determine that the following information is correct. Please also advise us if the distances that are being stated are correct and what additional public safety, storage or transportation issues we should be concerned with.

The following information has been provided by 'BigBang' Storage Solutions which has recently won the UK MOD tender:

- Each ESH will be able to hold up 1000 kg of each type of hazard division (pallets stacked 3 high), thereby requiring no more than 5 x ESH built east to west along the waste land.
- The Vulnerable building distance is no more than 300 m for each ESH;
- The Inhabited building distance is no more than 125 m for each ESH
- The Public traffic route distance is 270 m for each ESH
- HD 1.1 is divided as follows:
 - HD 1.1B – 50 kg

- HD 1.1D – 3200 kg
 - HD 1.1E – 1250 kg
 - HD 1.1F – 500 kg
- HD 1.2 is divided as:
 - HD 1.2C – 350 kg
 - HD 1.2D – 100 kg
 - HD 1.2F – 50 kg
- HD 1.3C – 1000 kg
- HD 1.4S – 1000 kg

If this plan is to be approved, what advice would you provide for maritime users of the area – they use the marina regularly.

Finally, can you provide us with a list of safety questions for risk reduction that we should go back the BigBang with? If this can be a stand-alone Appendix then that would be outstanding.

Latitude:	51.61818	51° 37' 5.45"	☐
Longitude:	-3.91886	-3° 55' 7.90"	Go



Appendix 2 – Explosive Limit License (ESH)

Non-Standard Explosives Limit Licence (ELL)									
IATG Form 02.30C									
PES Number / Designation:			ESH 1						
Unit			Location			Authorised as			
BigBang Storage Solutions			Port Tennant, Swansea			Explosive Storehouse			
Maximum Authorised NEQ									
HD 1.1		HD 1.2.1		HD 1.2.2		HD 1.3.1		HD 1.3.2	
kg	and kg	for No Limit	and kg	for No Limit	and kg	for 102990kg	and kg	for 102990kg	kg
									To physical capacity, or _____ kg
Aggregation Rules Apply									
Safeguarded Outside Quantity Distance Authorised:					Units of Space:			Meters (m)	
Licensed in Accordance With:					IATG 02.20 Quantity Distances as recommended in IATG matrices and QD tables.				
Special Conditions and Notes									
Nil									
Acceptance of Risk:					Yes, as ALARP principle applied.				
Endorsements:					Nil				
Explosives Limit Licence Authorisation									
Signature:	AD Smith			Name:	AD Smith			Rank:	Major
Appointment:	Technical Officer			Unit:	Ammunition Inspectorate (South)				
Date ELL Issued:	05 December 2025								
Date ELL Expires:	05 December 2030								
Attached Documentation:	IATG 02.30F ELL Supplementary Matrix								
Licence Serial Number:									

Appendix 3 – Explosion Consequence Analysis

Risk Assessment Process Component	Ser	ECA Activity	Data Source
Risk Analysis (Hazard)	1	Determine UN Hazard Division of Ammunition.	IATG 01.50 (UN Classifications)

Identification and Analysis)	2	Determine sympathetic detonation risk. Check separation distances between ESHs (IMD)	IATG 02.20 (Quantity Distances)
	3	Establish Maximum Credible Event (MCE). Determine the NEQ to be used for the blast calculations.	Scenario A: 3,000 kg Scenario B: 1,350 kg
	4	Determine the protection level of the ESHs.	Facility Site Plans / IATG 04.20
	5	Determine the distance to the nearest Public Traffic Route.	Laser Range Finder / GIS / Google Earth
	6	Determine the distance to the nearest Inhabited Building.	Laser Range Finder / GIS / Google Earth
	7	Determine the distance to the nearest Vulnerable Building.	Laser Range Finder / GIS / Google Earth
	8	Identify secondary hazards	Site Survey
	9	Determine the condition of Ammunition and the likelihood of spontaneous ignition of Propellant.	Historical / Surveillance Results
	10	Determine physical effects reflected overpressure and reflected impulse at each range to Serials 5-8.	IATG 01.80, Clause 6.2. (using IATG Software).
Risk Analysis (Risk Estimation)	11	Estimate ranges for thresholds of impact on humans (Bowen)	IATG 01.80, Clause 11.2

	12	Determine the Number of Humans likely to be in the open within ranges of Serial 11.	
	13	For the NEQ at Serial 2, determine the ranges at which various levels of damage to the buildings are expected.	IATG 01.80, Clause 10.1
	14	Determine the number of buildings within each damage criteria range estimated at Serial 13	
	15	Calculate ground shock damage	IATG 01.80 Clause 10.3
	16	Determine the number of buildings within ground shock range. Check they are not also damaged by blast to avoid double-counting.	
	17	Apply the probability values for secondary blast injury to the Serial 14 results.	IATG 01.80, Clause 11.3, Table 36
	18	Estimate occupancy levels and exposure probabilities for the house at Serial 16. Then estimate the casualty numbers.	
	19	Estimate financial values of stocks, costs to repair/rebuild storage infrastructure and civilian damaged buildings.	
	20	Use the Serial 19 data in the EMV model to estimate the likely financial consequences of an explosive event.	

Risk and ALARP Evaluation	21	Compare estimated predicted casualties at Serials 12 and 18 to other industrial accident levels. Are the predicted casualties tolerable?	
	22	Are the financial consequences at Serial 20 acceptable to the government? If no, then is the MOD prepared to accept lower stock levels. If yes to both, then risk tolerable. If no to both or one, then risk not tolerable.	

Appendix 4 – Cost-Benefit Analysis

This CBA assesses whether additional risk reduction measures proposed for the explosive storage facility are reasonably practicable in accordance with ALARP methodologies. The analysis is informed by the ECA and compares credible storage scenarios to evaluate the proportionality of further controls.

Two credible scenarios are assessed: Scenario A, storage up to 3,000 kg of HD-1.1 per ESH under a standard ELL and Scenario B, up to 1,350 kg of HD-1.1 per ESH, supported by a non-standard ELL.

Scenario B will cause operational and administrative costs, including a reduced storage capacity, non-standard ELL compliance, and engineering controls such as environmental controls and site relocation.

The ECA shows that Scenario B reduces QDs and the number of inhabited and vulnerable buildings within the distance thresholds. This lowers the likelihood of mass casualties and building damage.

Under Scenario A, expected consequences were significantly above tolerable thresholds and cannot be considered tolerable. The safety benefits of reducing the NEQ in Scenario B are high compared to the costs incurred. Further measures, like

land purchasing or ESH re-designs, are unlikely to provide large safety gains and the costs are disproportionate.

Based on the ECA and comparison of costs and benefits, Scenario B is a proportionate and reasonably practicable risk reduction method, which brings the facility in alignment with ALARPS principles. Scenario A does not meet the same level of tolerable risks.

[Appendix 5 – IATG Risk Reduction Questions for BigBang Storage Solutions](#)

Ammunition Management Policy

1. Will ammunition facilities be independently and formally inspected?
2. Will a formal system be in place to routinely determine surplus stocks of ammunition and explosives?

Health and Safety at Work

3. How often will risk assessments be completed and recorded?
4. What has the risk assessment been based on? Probability, explosion consequence analysis or individual risk?
5. How will the risk be formally communicated to the local civilian communities?
6. Is there a formal system in place within the government system for the identification and authorisation of new land for explosive facilities?

Explosive Limit Licensing

7. Have explosive limit licences been prepared for all permanent storage locations?
8. Have appropriate internal and external safety distances been identified based on a quantity distance system for permanent storage locations?
9. Will logbooks or record cards be formally kept for each explosive storehouse?
10. Will the copies of all relevant documentation be kept at each exploitive storehouse?

Inventory Management

11. Will the ammunition stockpile be formally divided between operational, training, surplus and unserviceable categories/
12. Will ammunition management policy statements be used to assist the through-life management of each ammunition type?
13. Will there be an independent organisation responsible for the technical inspection of ammunition stock holding units?

14. Will the ammunition accounting system account for type, quantity, batch number, technical condition and location of ammunition?

15. How regularly will independent stocktakes and audits be carried out?

16. Will ammunition be marked in accordance with the national system of marking?
And if so, does this comply with the UN marking system?

Lotting and Batching

17. What is the formal system for the effective logistic lotting and batching of ammunition?

Infrastructure – Design

18. Are permanent explosive storehouses in compliance with the design principles set out in IATG 05.20 or NATO standards?

19. Is there a formal system to ensure that all lightning protection systems are constructed in compliance with IATG 05.40?

Infrastructure – Cleanliness

20. Will the packaging or rubbish be kept inside the explosive storehouses?

21. Will empty boxes, pallets and waste material be removed by the end of a day's work?

22. How will the accumulation of explosive or propellant dust in explosive storehouses be kept to a minimum?

Infrastructure – Drains and Gutters

23. How will all drains and gutters be kept free of grass cuttings, leaves, wind-blown foliage, rubbish, etc?

Infrastructure – Heating

24. Will ventilators be kept open?

25. Will the facilities require any heating/air conditioning/

26. Will radiators have sloped guards?

Security

27. How often will security keys be rotated?

28. How will the entry and access of explosive areas be controlled?

29. Will staff be subjected to routine security vetting?

30. How will doors and gates be secured?

31. Will the perimeter be fitted with an intrusion detection system?

32. What class of security fencing will the facility have?

33. Will the perimeter have lighting to allow the detection of intruders?

34. Who will the guard force to check the integrity of ammunition storage areas during non-working hours?

Safety – Explosive Contents

35. Will the UN hazard division marking system and relevant compatibility groups for the safe mixing of ammunition during storage?

36. Will explosive storehouse stacking systems be in place that contain the hazard division, batch, lot number and quantity?

37. Will unserviceable stock be clearly marked and segregated?

38. Will unsealed boxes be clearly marked with the remaining quantity?

39. What will be the formal process for ensuring ammunition packaging is certified as free from explosives by qualified personnel?

40. What will be the formal process for ammunition that is qualified as safe to move by qualified personnel?

41. Will sufficient gangways between stacks be in place?

Safety – Fire Fighting

42. Will an emergency water supply be present and kept free from debris?

43. Will firefighting equipment like extinguishers, fire beaters and sand be present within explosive storehouses and regularly checked?

44. Will there be a formal and written fire plan and fire orders?

45. Will fire alarms be maintained, tested and recorded?

46. Will vegetation around the explosive storehouses be regularly cut?

47. How often will fire drills be held and recorded?

48. Will fire division signs that reflect the correct stocks be displayed and legible?

49. Will a formal liaison and meetings with the local authority fire service be set up?

50. Will the local fire service know what is stored in the facility and be aware of the inherent risks?

60. Will a 1m sterile area around each explosive storehouse be maintained?

Safety – Operations

61. Where will explosive limit licences be displayed?

62. What system will be in place to restrict prohibited items from the explosives area?

63. Will smoking be allowed on site, and if so, are smoking areas designated with clear signage?

64. What will the reporting process be for accidents and incidents?

65. Will accident procedures be clearly established, documented and displayed in all ammunition storage buildings?

66. What PPE will be available to staff working in explosive areas?

Safety – Equipment

67. What category of electrical safety will explosive storehouses be rated to?

68. Will a master switch be available for each building?

69. How often will electrical tests be carried out, and will they be formally recorded?

70. Will explosive storehouses have lightning conductors present in compliance with the design principles in IATG 05.40?

71. Will the anti-static flooring within explosive storehouses be compliant with the requirements of IATG 05.40?

Ammunition Faults

72. What formal system will be in place for the reporting of ammunition faults and performance failures?

73. Is there written guidance available for users to follow in the event of an ammunition or performance failure?

74. Will formal cause and closure codes be allocated to ammunition faults and performance failures?

Bans and Constraints

75. What formal system will be in place for imposing bans and constraints at the national level as a routine task?

76. What system will be used to immediately inform user units of all bans and constraints?

Surveillance and Proof

77. What formal system will be implemented for the physical inspection of all ammunition in storage on a routine basis?

[Appendix 6 – Site Specific Questions for BigBang Storage Solutions](#)

Facility, Infrastructure, and Environment

1. What public consultation has been conducted?

2. What is the justification/purpose of having the facility in this location?

3. Does the site require a NOTAM?

4. What are the proposed dimensions, construction standards, and earth-cover specifications of each Explosive Storehouse (ESH)?
5. How will site drainage, stormwater management, and erosion be controlled around the ESHs?
6. Have traverses been considered, and if so, what design options and assessments have been completed?
7. Will a process building be required or in future operations?
8. Where will administration and inert stores be located on site?
9. What backup power supply arrangements are in place?

Quantity distances, licensing and risk justification

10. How have the stated quantity distances in the proposal been calculated?
11. Has an ALARP justification been completed for the site?
12. Can the NEQ of HD-1.1, be reduced to improve separation distances?
13. Have previous ECA and CBA been conducted for this site?
14. Has BigBang Storage Solutions been in contact with the national authority?
15. Has an independent OME expert been consulted to justify NEQ limits, safety distances and storage considerations?

Ammunition and storage

16. How long will this site store OME?
17. What condition will the OME being delivered be in?
18. What considerations have been made to the management and disposal of unserviceable ammunition?
19. Will OME be offloaded from vessels in the harbour in the future?

Operations

20. What vehicles and Mechanical handling equipment will be used within explosive facilities, and are they in compliance with IATG 05.50?
21. How frequently will OME movements take place?
22. What transport routes will be used for the movement of OME to and from the site?
23. What emergency access and evacuation routes have been identified?

Security and emergency response

24. What security measures will be implemented to meet minimum IATG and RRPL expectations?
25. What measures are in place to prevent unauthorised waterborne access by vessels (kayaks, small boats) to the site's perimeter fence?

- 26. What emergency response and firefighting arrangements are proposed?
- 27. How frequently will emergency procedures be conducted, and will external responders be involved?
- 28. What management structure, inspection regime, and internal audit process will the facility have?
- 29. How will explosives accountability, record keeping and surveillance be managed?
- 30. What spill procedures are in place for explosives-related or hazardous material incidents?
- 31. Have RADHAZ and HERO assessments been conducted for the local area?

Environmental

- 32. Has the site had any previous chemical contamination, and what environmental site assessments have been done?

Personnel

- 33. How many staff are regularly on site?
- 34. What competencies, qualifications, training and experience will staff have?

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

GRADEMARK REPORT

FINAL GRADE

78/100

GENERAL COMMENTS

Engagement with Literature Skills 7/10

The student has demonstrated excellent engagement with relevant literature. A wide range of sources have been used including legislation, UNSaferGuard and wider academic literature. References are consistently formatted and used throughout the document. The formatting of the references could be improved as they are difficult to interrogate due to the placement of the numbers and brackets. The references could be improved by further expanding the list of references used as a large proportion are from UNSaferGuard and by using references to support arguments rather than solely to reference facts. Furthermore, the statement that "adjacent bodies of water may amplify ground shock & surface wave effects" in section 3.2 is not directly discussed in either of the references stated.

Finally, in the guidance for this assignment, students were told "You will have to use the tools taught during to complete this assignment." and that "IATG are specific to this assignment". ER2014 was not taught, yet the student quotes from it in Section 1.1. However, the points made were valid.

Knowledge and Understanding Skills 25/30

The student has demonstrated excellent knowledge and understanding of explosives licencing and OME safety management through the detailed content discussed in the document. The

student has provided detailed information informed by several sources. The student has discussed several safety considerations of storing OME, site management, security and emergency arrangements. Further marks could be obtained by expanding upon the background OME principles such as stating what the IATG define as rules for aggregating explosives of different hazard divisions. Additionally, the body of the report could be improved by discussing in more detail the security considerations necessary, logistics, ammunition accounting and identifying more clearly the limitations of the information provided in the proposal.

Attention to detail: Figure 3 is captioned "Example of an Earth-Covered Storehouse (without traverse)", but the supporting text states "...a standard ESH configuration without traverse." The student should use the technical terminology with appropriate abbreviations, e.g. Earth Covered Magazine (ECM) as given in IATG.

Section 4.2 advocates the use of the IATG RRPL tool, which shows an excellent understanding of the risk reduction methodology.

Cognitive and Intellectual Skills 17/20

The student has demonstrated exceptional cognitive skills through the discussions of feasibility of the proposal. The student has shown critical analysis of the proposal and its limitations in the provided context in how it is not feasible with a standard explosive limit licence due to its violation of inhabited building distance. The student has provided a detailed discussion of potential solutions to resolve the flaws in the proposal using a non-standard licence. Furthermore, the student has provided examples of how to reach the solution by providing examples of cost

benefit analysis and explosion consequence analysis. The student also provides a good discussion of how compatibility groups of explosives could be stored in the proposed number of explosive store houses. This could have been improved by providing examples of specific solutions such as how effective segregation can be achieved within an ESH. Additionally, this could have been improved by ensuring assumptions are highlighted and explained more clearly. For example, in Section 3.2, an assumption of worst-case scenario is made that the maximum quantity of HD1.1 would be 3000kg, however, it is not described where the 3000kg has been derived. Regardless of whether this is a sensible figure or not, the justification behind it should have been explained to the reader to demonstrate the student's understanding.

The assumption on page 14 that "...the facility will be licensed for HD 1.1 as this provides the most conservative planning approach." is somewhat naïve in that while the statement is correct, it does not consider the flexibility that might be required by the applicant on behalf of their client.

They make a good case for taking the maritime climate into consideration.

The counterproposal they offer, i.e. the use of a Non-Standard ELL is valid despite their own calculations leaving vulnerable buildings within their revised QD circles in Figure 5. They could consider it as either the backbone of an argument for disallowing the development as proposed or a solution that BBSS could consider with their client.

The student has demonstrated excellent practical application skills by applying the principles of OME safety management to the proposal. The student has demonstrated detailed application of the IATG tools and guidance throughout and applied knowledge to evidence arguments. Additionally, the student has applied their knowledge in distributing the explosives among the ESH using the compatibility mixing rules. This could have been improved by providing examples of how the ESHs can be laid out on the site and a discussion of what inter-magazine distance would be needed including associated calculations.

Further marks could be gained by using a wider range of more sophisticated tools such as blast and fragmentation (Primary, secondary and tertiary effects) estimation tools and information.

In Table 2, albeit a summary, the definition of HD 1.2 is incorrect: "serious projectile" should read "severe projection". Accuracy in definitions is vital in technical reports for paying clients.

The Legend in Figure 4 would be more accurate if the QD circles were depicted as lines and the Exposed Sites as coloured blocks.

Proper use of IATG ELL tools to support a Non-Standard Licence.

Transferable Skills for Life and Professional Practice

7/10

The student has demonstrated they can communicate professionally confidently and consistently in a suitable format in the presentation of the report. The report was well-

structured and coherent;
however, it could be improved by ensuring
references are formatted clearly,
presenting information and arguments succinctly
where possible and ensure
arguments flow coherently from previously stated
information and link to that
information clearly.

Attention to detail and correct spelling e.g. licence (a
noun) and license (a verb).

The Abstract is fine for an academic paper, but
this assignment would be better served if it were
presented as an Executive
Summary, which would also include the responses
to the Council's big questions.
Currently it does not address the provision of advice
to maritime users

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