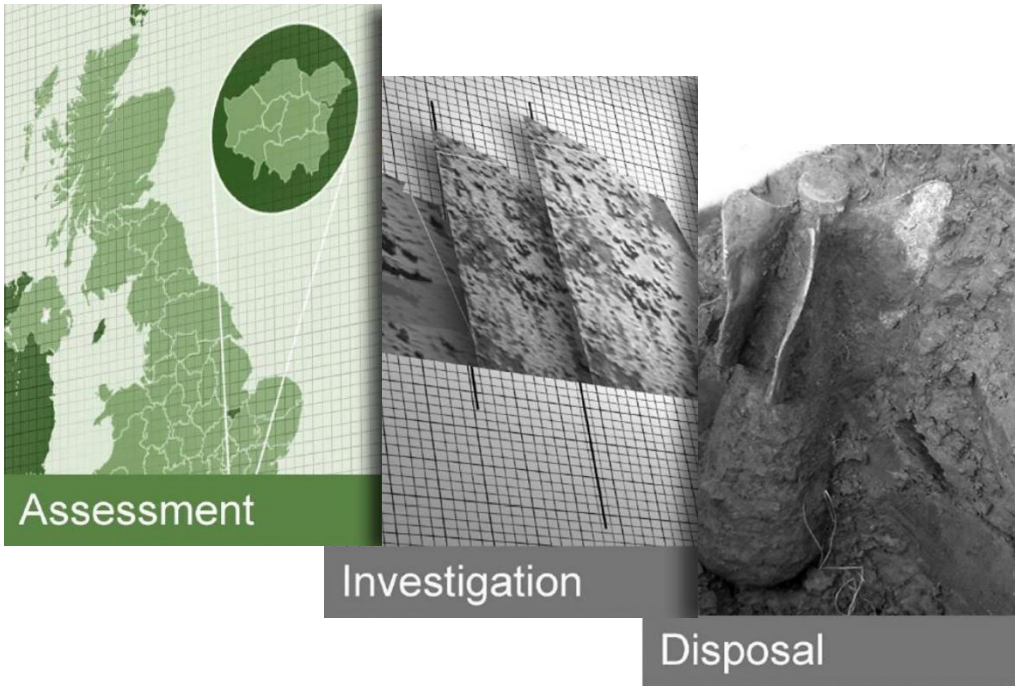
zeticaUXO



Almondbury - UXO Desk Study & Risk Assessment

Drafted by James Major
Checked by Kim Pelling
Authorised by Stefan Lang

Document Title	**UXO Desk Study & Risk Assessment**
Document Ref.	**P12610-23-R1**
Revision	**A**
Project Location	**Almondbury**
Client	**The LK Group**
Date	**20th February 2023**

UXO DESK STUDY & RISK ASSESSMENT

EXECUTIVE SUMMARY

Key findings: No significant sources of Unexploded Ordnance (UXO) hazard have been identified.

Key actions: A UXO awareness briefing is recommended for staff involved in excavations.

UXO Hazard Assessment

In June 1940, Leeds S Heavy Anti-Aircraft (HAA) battery was established on the Site. It was armed with 4No. 4.7-inch (") guns. Leeds S HAA battery and associated activities are not considered to provide a significant source of UXO hazard to the Site.

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the Site.

Given this, it is considered that the Site has a low UXO hazard level, as shown in the following Figure, reproduced as Figure 2 in the main report.

The UXO hazard zone plan of the Site is also given in the accompanying P12610-23-R1-MAP01-A.

UXO hazard zone plan of the Site

Source: OpenStreetMap *Not to Scale*

Legend	Very Low	Low	Moderate
	High	Very High	Site boundary

The main findings of the report are summarised below.

- No records of bombing or military activity on the Site during World War One (WWI) have been found.
- During World War Two (WWII) the main strategic targets in the vicinity of the Site included engineering works, major transport infrastructure, and public utilities.
- During WWII, 1No. HAA battery was located on the Site. It was armed with 4No. 4.7" guns and manned by the 96th Royal Artillery (RA) Regiment.

- No records have been found indicating that the Site was bombed during WWII. Records indicate that the nearest High Explosive (HE) bomb fell on open ground near Lump Lane, approximately 1.5km west-northwest of the Site, on the 11th June 1941.
- No records of military activity on the Site post-WWII have been found.

Data Confidence Level

The findings of this report were based on good corroborative evidence of the military activity and bombing on the Site.

Proposed Works

It is understood that the proposed works on the Site are associated with the removal of the existing high school.

Initial works will comprise a ground investigation, including 3No. hand dug, 2No. soakaway, and 2No. mechanical excavated trial pits, and 24No. window sample boreholes to approximately 3-4 meters (m) below ground level (bgl).

For the purpose of this risk assessment, it is assumed that future works on the Site may include piling.

Risk Assessment

The Table below, reproduced as Table 3 in the main report, provides a UXO risk assessment for the proposed works on the Site.

Further details on the methodology for the risk assessment are provided in Section 7.2 of the main report.

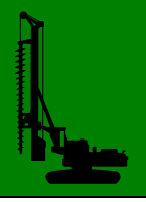
UXO risk assessment for the Site

Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
UXB	Shallow Excavations	1	1	1	1	5	5	**Low**
	Deep Excavations	1	1	1	1	5	5	**Low**
	Boreholes/Piling	1	1	1	1	4	4	**Low**
Other UXO	Shallow Excavations	1	1	1	1	4	4	**Low**
	Deep Excavations	1	1	1	1	4	4	**Low**
	Boreholes/Piling	1	1	1	1	3	3	**Low**
PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)								
Shallow Excavations defined as <1.0m bgl.								

Risk Mitigation Plan

The Table below, reproduced as Table 4 in the main report, summarises the UXO risk for proposed works on the Site and recommended actions.

Summary of UXO risk and mitigation recommendations

Proposed Works	UXO Risk	Recommended Mitigation
Excavations		**UXO awareness briefing** – Given the history of military activity on the Site, it is recommended that a formal UXO awareness briefing is provided to staff involved in excavations.
Boreholes/Piling		**Proceed with works**

In summary, it is recommended that staff involved in excavations are provided with a formal UXO awareness briefing so that they take appropriate action in the event of a suspect find.

What Do I Do Next?

If you require a quote for an awareness briefing or have any comments, contact us via phone (01993 886682) or email (uxo@zetica.com) and we can help.

If you have requirements to identify other buried hazards (such as mapping utilities or obstructions) we can provide these surveys.

If proposed works on the Site change, or additional works are planned, contact Zetica for a re-assessment of the UXO risk and the risk mitigation requirements.

CONTENTS

Figures, Plates & Tables

Accompanying GIS Data

P12610-23-MAP01-A (UXO Desk Study)

ABBREVIATIONS

AA	Anti-Aircraft
ALARP	As Low As Reasonably Practicable
ARP	Air Raid Precaution
AXO	Abandoned Explosive Ordnance
BGS	British Geological Survey
CIRIA	Construction Industry Research and Information Association
DCLG	Department of Communities and Local Government
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance
EOR	Explosive Ordnance Reconnaissance
ERW	Explosive Remnants of War
ESA	Explosive Substances and Articles
HAA	Heavy Anti-Aircraft
HE	High Explosive
HER	Historic Environment Record
IB	Incendiary Bomb
IED	Improvised Explosive Device
IWM	Imperial War Museum
LAA	Light Anti-Aircraft
MoD	Ministry of Defence
NARA	National Archives & Records Administration
NCAP	National Collection of Aerial Photography
OB	Oil Bomb
OSNGR	Ordnance Survey National Grid Reference
PM	Parachute Mine
RA	Royal Artillery
RAF	Royal Air Force
RFC	Royal Flying Corps
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
WWI	World War One
WWII	World War Two

UXO DESK STUDY & RISK ASSESSMENT

Please read: Zetica has colour coded each paragraph. Paragraphs with black text on a white background are paragraphs that provide site-specific information or information specifically researched as part of this project.

Boxed paragraphs in a dark green text with a green background are paragraphs providing general information and, where appropriate, links to online resources giving further detail. These are all available at www.zeticauxo.com. If you cannot gain access to these resources, Zetica can forward them on request.

1 INTRODUCTION

1.1 Project Outline

Zetica Ltd was commissioned by The LK Group to carry out a detailed Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an area of approximately 8.8 hectares (ha) off Fernside Avenue in Huddersfield, West Yorkshire (the 'Site').

The aim of this report is to gain a fair and representative view of the UXO hazard for the Site and its immediate surrounding area in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

Where appropriate, this hazard assessment includes:

- Likelihood of ordnance being present.
- Type of ordnance (size, filling, fuze mechanisms).
- Quantity of ordnance.
- Potential for live ordnance.
- Probable location.
- Ordnance condition.

It should be noted that some military activity providing a source of UXO hazard may not be recorded and therefore there cannot be any guarantee that all UXO hazards affecting the Site have been identified in this report.

1.2 Sources of Information

Zetica Ltd researched the military history of the Site and its surrounding area using a range of information sources. The main sources of information are detailed in the following sections and referenced at the end of this report.

1.2.1 Zetica Ltd Defence Related Site Records

Zetica Ltd's in-house records were consulted, including reference books and archived materials from past work in the region. Relevant documents have been cited within the bibliography of this report.

1.2.2 Zetica Ltd Bombing Density Records and Maps

Reference has been made to the Zetica Ltd bomb risk maps located on Zetica's website (http://zeticauxo.com/downloads-and-resources/risk-maps/)

1.2.3 Ministry of Defence and Government Records

Government departments and units within the Ministry of Defence (MoD) were approached for information of past and present military activity in the area. These included the Department of Communities and Local Government (DCLG) records of abandoned bombs.

1.2.4 Other Historical Records, Maps and Drawings

Numerous reference documents including historical maps, aerial photographs and drawings have been consulted from sources such as the National Archives, the US National Archives & Records Administration (NARA), the Imperial War Museum (IWM), Historic England, National Collection of Aerial Photography (NCAP), and the Defence of Britain Project.

The British Geological Survey (BGS) was consulted for borehole information.

1.2.5 Local Authority Records

Information was obtained from Kirklees Council.

1.2.6 Local Record Offices and Libraries

West Yorkshire Archive Service Kirklees was consulted for records.

1.2.7 Local Historical and Other Groups

Local history groups and archaeological bodies were consulted, including the West Yorkshire Historic Environment Record (HER).

1.3 Data Confidence Level

In general, there is a high level of confidence in the researched information sources used for this report.

Due to the current closure of the West Yorkshire Archive Service Kirklees, Zetica has relied on detailed archive records gathered for previous projects in the area, as well as aerial photography, to provide a good corroborative assessment of the UXO hazard level on the Site.

It is possible that additional relevant records are potentially available at archives, although it is considered unlikely that this would change the UXO hazard assessment for the Site.

2 THE SITE

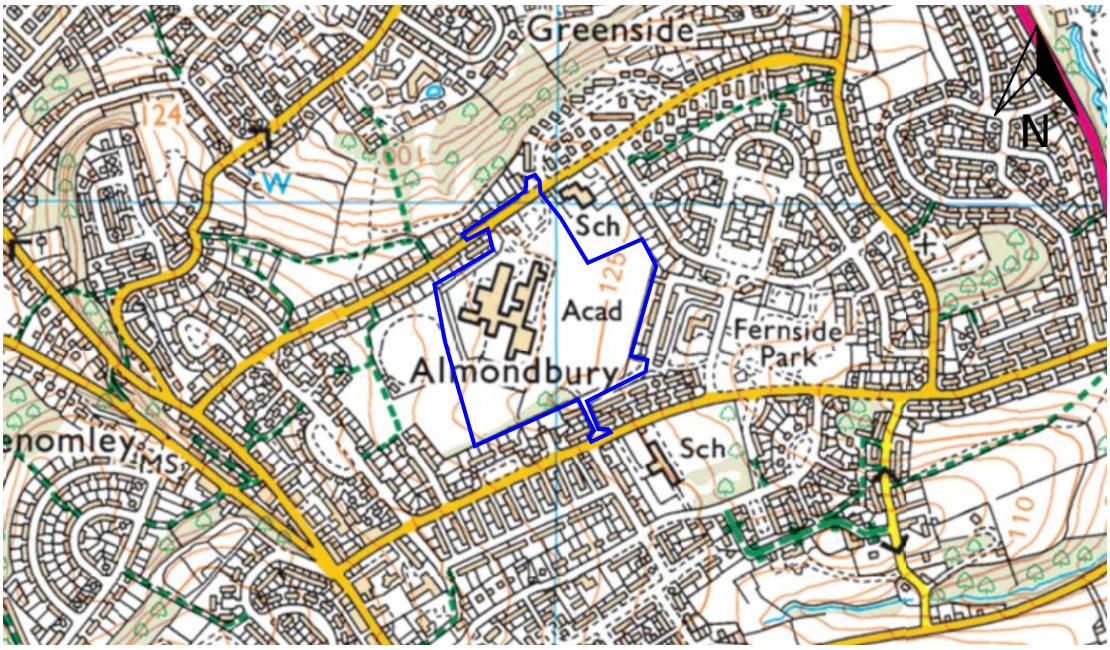
2.1 Site Location

The Site is centred on Ordnance Survey National Grid Reference (OSNGR) SE 168158. It is located approximately 2.5km east-southeast of central Huddersfield.

The Site comprises open ground, hardstanding, Hill View Academy, Fernside Avenue, and Eastlands. It is bounded to the north by Fernside Avenue, Fernside Crescent and residential buildings, to the east by residential buildings, to the south by residential buildings and Almondbury Junior School, and to the west by open ground and residential buildings.

Figure 1 is a Site location map and Plate 1 is a recent aerial photograph of the Site.

Figure 1 Site location map



Source: © Crown Copyright 2023. Reproduced by permission of Ordnance Survey *Not to Scale*

Legend	Site boundary

Plate 1 Recent aerial photograph of the Site

Source: Google Earth *Not to Scale*

Legend	Site boundary

3 MILITARY ACTIVITY

The following sections outline the recorded military activity in the vicinity of the Site. The potential UXO hazard from World War One (WWI) and World War Two (WWII) bombing is detailed in Section 4.

Each sub-section provides hyperlinks to further information on potential sources of UXO hazard. These are also available at www.zeticauxo.com. If you cannot gain access to these resources, Zetica can forward them on request.

3.1 Defences

For further information on military defences, and the potential UXO hazards associated with them, follow the links below:

- Anti-Aircraft Guns
- Anti-Invasion Defences
- Barrage Balloons
- Bombing Decoys
- Home Guard
- Mined Locations
- Mortar & Gun Emplacements
- Pillboxes

Records have been found to indicate that 1No. Heavy Anti-Aircraft (HAA) battery was established on the northern part of the Site during WWII. This is described below, along with other defences recorded in the vicinity of the Site.

3.1.1 Anti-Aircraft Guns

During WWI there were 5No. Anti-Aircraft (AA) batteries within 10km of the Site. The nearest was located at Moldgreen (SE 155168), approximately 1.4km northwest of the Site. It was armed with 1No. 3-inch (") gun.

During WWII there were 12No. HAA batteries within 10km of the Site. The nearest was located at Almondbury (SE 172160), on the northern part of the Site. It was established in June 1940 and designated Leeds S HAA battery.

Records indicate the battery was armed with 4No. 4.7" guns. It was initially manned by the 287 Battery, 96th Royal Artillery (RA) Regiment. Other units which manned the battery included the 294 and 295 Battery, 96th RA Regiment.

It is likely that troops manning the HAA guns were equipped with small arms and close combat munitions (including grenades and mortars) for defence. These would have been kept in nearby munitions stores to allow them to be quickly accessed.

Plate 2 is an aerial photograph dated the 11th September 1940. The Leeds S HAA battery, including the 4No. gun emplacements and munitions stores, and the associated accommodation area have been identified on the Site.

Plate 2 Aerial photograph, 11th September 1940

Source: Historic England *Not to Scale*

Legend			
	Site boundary	HAA battery	Munitions stores
	Gun emplacements	Accomodation area	

After WWII, Leeds S HAA battery and associated facilities were removed.

Potential UXO Hazard

During WWII the HAA guns at Leeds S battery would have fired away from the battery, leaving little possibility that AA shells from the battery fell in the immediate vicinity of the Site (see Appendix 2.3).

Shells would only have been stored at the battery for a very short period of time to serve operational purposes.

Whilst munition stores were typically removed once the threat of invasion had passed, the possibility of localised disposal in the immediate vicinity of a HAA battery cannot be totally discounted.

Given the number of HAA gun batteries in the surrounding area during WWII, the potential for an Unexploded AA (UXAA) shell from a HAA battery other than the Leeds S HAA battery to have fallen on the Site unnoticed, whilst unlikely, cannot be totally discounted.

3.1.2 Bombing Decoys

The nearest recorded bombing decoy was located at Emley (SE 259138), approximately 9km east-southeast of the Site.

Bombing decoys are not considered to provide a source of UXO hazard to the Site.

3.2 Military Airfields

For further information on military airfields, and the potential UXO hazards associated with them, follow the link below:

- Military Airfields

No records of any military airfields on or in close proximity to the Site have been found.

The nearest operational airfield during WWI was Royal Flying Corps (RFC) Middleton approximately 18.4km northeast of the Site. It opened in 1916 as a Home Defence Landing Ground for No. 33 Squadron and No. 76 Squadron RFC. It was abandoned at the end of WWI.

The nearest operational airfield during WWII was Royal Air Force (RAF) Yeadon, approximately 26km north-northeast of the Site. The airfield was established in 1931 by the Yorkshire Light Aeroplane Club before being requestioned in 1939.

During WWII, RAF Yeadon was used by RAF training units, and to transport aircraft produced by the nearby Avro aircraft works.

In 1953, the airfield was taken over by the Yeadon Aviation Ltd and it reverted to a civilian airport.

Military airfields are not considered to provide a source of UXO hazard to the Site.

3.3 Aircraft Crashes

For further information on military aircraft crashes, and the potential UXO hazards associated with them, follow the link below:

- Aircraft Crashes

No records of any aircraft crashes on or in close proximity to the Site have been found.

3.4 Explosives Factories, Munitions Depots and Disposal Areas

For further information on explosives factories, munitions depots and disposal areas, and the potential UXO hazards associated with them, follow the links below:

- Explosives Factories
- Munitions Depots
- Munitions Disposal Areas

No records of any explosives factories, munitions depots or munitions disposal areas on or in close proximity to the Site have been found.

3.5 Firing Ranges and Military Training Areas

For further information on firing ranges and military training areas, and the potential UXO hazards associated with them, follow the links below:

- Artillery Ranges
- Bombing Ranges
- Military Training Areas
- Small Arms Ranges

No records of any firing ranges or military training areas on or in close proximity to the Site have been found.

3.6 Other Military Establishments

No other military establishments have been identified on or in close proximity to the Site.

4 BOMBING

4.1 WWI Bombing

For further information on WWI bombing in the UK, and the potential UXO hazard associated with it, see Appendix 2.1. Alternatively, use the following link.

- WWI Bombing

No records have been found indicating that the Site was bombed during WWI.

4.2 WWII Bombing

For further information on WWII bombing in the UK, and the potential UXO hazard associated with it, see Appendix 2.2. Alternatively, use the following link.

- WWII Bombing

No records have been found indicating that the Site was bombed during WWII. Details of WWII bombing in the vicinity of the Site are provided in the following sections.

4.2.1 Bombing in Huddersfield and West Yorkshire

From prior to the declaration of war in 1939, Britain was subjected to reconnaissance flights by the Luftwaffe which was building up a photographic record of potential targets.

Some areas of West Yorkshire were bombed, including the industrial cities of Bradford, approximately 17km north of the Site, and Leeds, approximately 20.7km northeast of the Site.

West Yorkshire was on the flightpath for aircraft attacking the significantly more heavily raided cities of Manchester and Liverpool. This meant it was vulnerable to 'tip and run' raids, where bomber crews would drop their bombs to avoid AA fire or allied fighter aircraft, on route to and from other strategic targets.

Between August 1940 and December 1944, Huddersfield was subjected to sporadic raids, with 7No. air raids recorded on the town.

4.2.2 Strategic Targets

The Site was located in an area which contained numerous potential strategic targets, including engineering works, major transport infrastructure, and public utilities.

The nearest identified Luftwaffe target was Dewsbury Power Station, approximately 7.2km northeast of the Site.

4.2.3 Bombing Densities and Incidents

Table 1 gives details of the overall bombing statistics recorded for the Local Authority Districts of the Site (highlighted by bold text) and surrounding districts. These were categorised as Rural Districts (RD), Urban Districts (UD), Municipal or Metropolitan Boroughs (MB) and County Boroughs (CB). WWII bomb density levels are defined below:

<5 bombs per 405ha is a Very Low regional bombing density.

5-15 bombs per 405ha is Low.

15-50 bombs per 405ha is Moderate.

50-250 bombs per 405ha is High.

>250 bombs per 405ha is Very High.

Table 1 Bombing statistics

Area	Bombs Recorded				
	High Explosive	Parachute Mines	Other	Total	Bombs per 405ha (1000 acres)
Huddersfield CB	**29**	**1**	**1**	**31**	**2.2**
Colne Valley UD	21	0	0	21	1.3
Holmfirth UD	21	0	1	22	1.2
Brighthouse MB	7	0	0	7	0.9
Meltham UD	1	0	0	1	0.2
Kirkburton UD	0	0	0	0	0

Note that Table 1 excludes the figures for Incendiary Bomb (IBs). Discrepancies between this list and other records, such as bomb clearance records, demonstrate that this data is likely to under-represent actual bombing.

Details of the nearest recorded bombing incidents to the Site are given in the following section.

29th August 1940

2No. High Explosive (HE) bombs fell on open ground at Hall Bower, approximately 2.1km west-southwest of the Site.

14th March 1941

11No. HE bombs fell on fields near Bradley Mills, approximately 2.0km northwest of the Site.

11th June 1941

2No. HE bombs and 1No. Oil Bomb (OB) fell on open ground near Lumb Lane, within approximately 1.5km south-southwest of the Site.

Several IBs fell in the River Colne, approximately 2.0km west of the Site.

Several IBs fell on Firth Street, approximately 2.1km west of the Site.

Several IBs fell on Kuvo Vat Works, Kings Bridge Road, approximately 2.1km west of the Site.

Several IBs fell on Castle Iron Works, Queen Street South, approximately 2.3km west of the Site.

12th June 1941

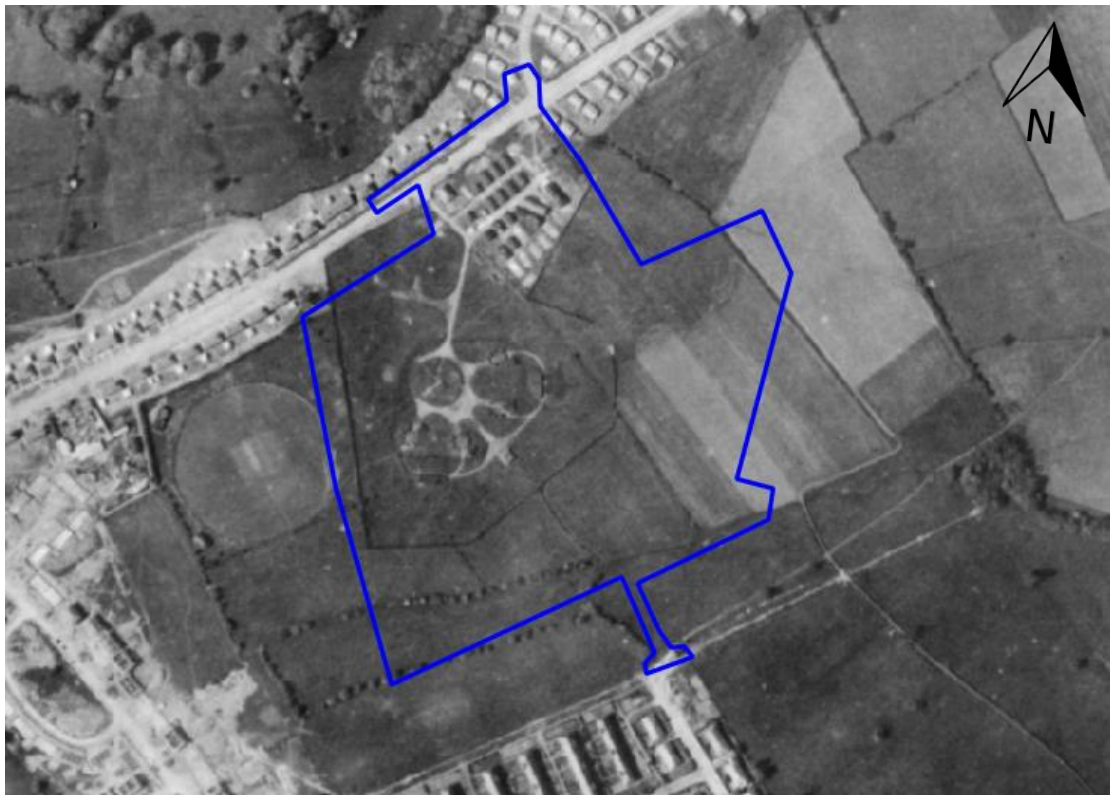
1No. 1000kg HE bomb fell on the riverbank near King's Mill Lane, approximately 1.8km west-northwest of the Site. This was recorded as an Unexploded Bomb (UXB).

It should be noted that during WWII, many UXBs were mapped and subsequently removed as and when conditions and demands on Bomb Disposal teams allowed. Their removal was not always accurately recorded and sometimes records were later destroyed. In practice, most UXBs were probably removed and only a much smaller number were actually registered as officially abandoned bombs.

Plate 3 is an aerial photograph dated the 15th May 1948. No bomb damage or cratering has been identified on the Site.

The remains of Leeds S HAA battery can be seen on the Site (see Section 3.1.1).

Plate 3 Aerial photograph, 15th May 1948



Source: Historic England *Not to Scale*

Legend	Site boundary

Potential UXO Hazard

No records have been found indicating that the Site was bombed and no bomb damage has been identified on the Site on historical aerial photography.

WWII bombing is not considered to provide a source of UXO hazard to the Site.

4.2.4 Geology and Bomb Penetration Depths

It is important to consider the geological materials present at the time that a bomb was dropped in order to establish its maximum penetration depth.

At the time of writing, no Site-specific ground investigation data was available.

BGS 1:50,000 Sheet 77 Huddersfield (Solid & Drift) and BGS borehole records from nearby investigations have been consulted to get an indicative overview of the Site geology.

The WWII geology of the majority of the Site is understood to consist of clay, overlying the mudstone of the Greenmoor Rock.

Table 2 provides an estimate of average maximum bomb penetration depths for the Site assuming WWII ground conditions of 2.5m of soft clay, overlying more than 20m of mudstone (modelled as weak rock).

Table 2 Estimated average maximum bomb penetration depths

Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	4.0m
	250kg	5.0m
	500kg	7.5m

These calculations can be refined on receipt of Site-specific information.

The estimated bomb penetration depths given in Table 2 are from the WWII ground level and are based on the following assumptions:

a) High level release of the bomb resulting in an impact velocity of 260m/s (>5,000m altitude).

b) A strike angle of 10 to 15 degrees to the vertical.

c) That the bomb is stable, both in flight and on penetration.

d) That no retarding units are fitted to the bomb.

e) That the soil type is homogenous.

A high altitude release of a bomb will result in ground entry at between 10° and 15° to the vertical with the bomb travelling on this trajectory until momentum is nearly lost. The bomb will then turn abruptly to the horizontal before coming to rest. The distance between the centre of the entry hole and the centre of the bomb at rest is known as the 'offset'. A marked lateral movement from the original line of entry is common.

Low-level attacks may have an impact angle of 45° or more, which will frequently lead to a much greater amount of offset movement during soil penetration.

The average offset is one third of the penetration depth, i.e. an offset of 2m may be expected for a 50kg bomb in dry silts and clays. If hard standings or Made Ground were present during WWII, bomb penetration depths would have been significantly reduced but offset distances may have been up to four times greater.

5 EXPLOSIVE ORDNANCE CLEARANCE ACTIVITIES

Official UK bombing statistics have been compiled from both British and German sources. There were differences in the way the figures were originally reported and collated which has led to discrepancies in the summary data.

Based on data from 1939 to 1945, War Office statistics indicate that 200,195No. HE bombs exploded within Great Britain. Additionally, 25,195No. HE bombs (representing 11%) were recorded as UXBs. However, records from the Royal Engineers who were responsible for bomb disposal at the time indicate that as of 27th February 1946 upwards of 45,000No. UXBs were disposed of.

On average 8.5% of UXBs later self-exploded. In some cases the bombs had delayed action fuzes or were never intended to explode, their purpose being to cause inconvenience and fear. Given the discrepancy in records and the fact that UXBs are still being found unexpectedly, it is clear that the original figures are understated and provide only an approximation of the number of potential UXBs in the UK.

War Office statistics also show that between October 1940 and May 1941 most of the UXBs (93%) were either 50kg or 250kg. It should be noted that details of the recovery and the size of the UXB were not always accurately reported.

The larger WWII UXBs are often difficult to recover due to both penetration depths and the presence of two or more fuzes, combined with more sensitive fillings of explosive mixtures including Amatol and Trialen.

5.1 Abandoned Bombs

For further information on abandoned bombs, and the potential UXO hazard associated with them, follow the link below:

- Abandoned Bombs

No records have been found indicating that any officially abandoned bombs are located on the Site.

5.2 EOC Tasks

Zetica holds no records of post-WWII EOC tasks having taken place in the vicinity of the Site.

6 UXO HAZARD ASSESSMENT

6.1 UXO Hazard Level

The definitions for the levels of UXO hazard are provided below.

Definitions of UXO Hazard Level for a Site	
Hazard Level	**Definition**
Very Low	There is positive evidence that UXO is not present, e.g. through physical constraints or removal.
Low	There is no positive evidence that UXO is present, but its occurrence cannot be totally discounted.
Moderate	There is positive evidence that ordnance was present or that other uncharted ordnance may be present as UXO.
High	There is positive evidence that UXO is present.
Very High	As high, but requires immediate or special attention due to the potential hazard.

In June 1940, Leeds S HAA battery was established on the Site. It was armed with 4No. 4.7-inch" guns. Leeds S HAA battery and associated activities are not considered to provide a significant source of UXO hazard to the Site.

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the Site.

Given this, it is considered that the Site has a low UXO hazard level, as shown in Figure 2.

The UXO hazard zone plan of the Site is also given in the accompanying P12610-23-R1-MAP01-A.

Figure 2 UXO hazard zone plan of the Site

Source: OpenStreetMap *Not to Scale*

Legend					
	Very Low		Low		Moderate	
	High		Very High		Site boundary	

7 UXO RISK ASSESSMENT

7.1 Proposed Works

It is understood that the proposed works on the Site are associated with the removal of the existing high school.

Initial works will comprise a ground investigation, including 3No. hand dug, 2No. soakaway, and 2No. mechanical excavated trial pits, and 24No. window sample boreholes to approximately 3-4 meters (m) below ground level (bgl).

For the purpose of this risk assessment, it is assumed that future works on the Site may include piling.

7.2 Risk Assessment Methodology

A UXO risk assessment has been undertaken for the proposed works, taking into consideration the identified UXO hazard.

Firstly, the probability of encountering UXO (PE) has been considered and rated for the different construction techniques, as detailed below.

Probability of Encounter (PE)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Secondly, the probability of detonating a UXO (PD) has been considered and rated for the different construction techniques, as detailed below.

Probability of Detonation (PD)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Next, the probability of encountering and detonating the UXO (PE x PD) have been used to generate an overall likelihood rating (P).

P = PE x PD	LIKELIHOOD of Encounter and Detonation	Rating
21 to 25	Frequent, highly likely, almost certain.	5
16 to 20	Probable, more likely to happen than not.	4
6 to 15	Occasional, increased chance or probability.	3
2 to 5	Remote, unlikely to happen but could.	2
1	Improbable, highly unlikely.	1
0	Impossible	0
P ranges from 25, a certainty of UXO being encountered and detonated on the Site by engineering activity, to 0, a certainty that UXO does not occur on the Site and will not be detonated by engineering activity.		

The likelihood of encountering and detonating UXO during site works is multiplied by the severity of such an event occurring (P x S), in order to provide a risk level using the following matrix.

Severity (S)	Rating
Multiple fatalities	5
Major injury, long term health issues, single fatality.	4
Minor injury, short term health issues, no fatalities.	3
First aid case but no lost time or ill health.	2
Minor injuries, no first aid.	1
No injuries.	0

UXO Risk Matrix							
	SEVERITY (S)						
LIKELIHOOD (P)		5	4	3	2	1	0
	5	25	20	15	10	5	0
	4	20	16	12	8	4	0
	3	15	12	9	6	3	0
	2	10	8	6	4	2	0
	1	5	4	3	2	1	0
	0	0	0	0	0	0	0

7.3 UXO Risk Level

The UXO risk assessment for proposed works on the Site is given in Table 3.

Table 3 UXO risk assessment for the Site

Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
UXB	Shallow Excavations	1	1	1	1	5	5	Low
	Deep Excavations	1	1	1	1	5	5	Low
	Boreholes/Piling	1	1	1	1	4	4	Low
Other UXO	Shallow Excavations	1	1	1	1	4	4	Low
	Deep Excavations	1	1	1	1	4	4	Low
	Boreholes/Piling	1	1	1	1	3	3	Low
PE (Probability of Encounter), PD (Probability of Detonation), P (Overall Probability)								
Shallow Excavations defined as <1.0m bgl.								

8 RISK MITIGATION PLAN

Key findings: No significant sources of UXO hazard have been identified.

Key actions: A UXO awareness briefing is recommended for staff involved in excavations.

8.1 UXO Risk Summary

Table 4 summarises the UXO risk for proposed works on the Site and recommended actions.

Table 4 Summary of UXO risk and mitigation recommendations

Proposed Works	UXO Risk	Recommended Mitigation
Excavations		**UXO awareness briefing** – Given the history of military activity on the Site, it is recommended that a formal UXO awareness briefing is provided to staff involved in excavations.
Boreholes/Piling		**Proceed with works**

In summary, it is recommended that staff involved in excavations are provided with a formal UXO awareness briefing so that they take appropriate action in the event of a suspect find.

8.2 Risk Mitigation Techniques

The section below provides further details of the recommended techniques for mitigating the UXO risk on the Site.

8.2.1 UXO Awareness Briefing

Typically ~1hour in duration, these briefings will be expected to provide site workers with:-

- Background to the potential UXO hazards that could be encountered.
- Awareness of how the UXO hazard could present a risk.
- Knowledge of what to do in the event that a suspect item is encountered.

The briefing is to be provided along with back-up materials such as UXO awareness posters, emergency contact numbers and other background information to assist site workers in becoming familiar with what potential UXO can look like.

The materials can also be used by key staff to pass on the relevant points of the induction to others who visit or work on the Site.

By providing the UXO awareness briefing, it ensures that in the unlikely event that UXO is encountered:-

- All site staff take appropriate action.
- A support mechanism and points of contact are established.
- The likelihood of harm to people or property is reduced.
- Significant delays to site work are prevented.

8.3 What Do I Do Next?

If you require a quote for an awareness briefing or have any comments, contact us via phone (01993 886682) or email (uxo@zetica.com) and we can help.

If you have requirements to identify other buried hazards (such as mapping utilities or obstructions) we can provide these surveys.

If proposed works on the Site change, or additional works are planned, contact Zetica for a re-assessment of the UXO risk and the risk mitigation requirements.

APPENDICES

Appendix 1 Anticipated Ordnance Types

The probability of encountering UXO on the Site is considered to be low. As with any similar site in the UK, there is always a background risk of finding ordnance and potential types to be encountered are detailed below. For a more comprehensive set of ordnance data sheets, see http://zeticauxo.com/downloads-and-resources/ordnance-data-sheets/.

Information Data Sheet

Category Small Arms Ammunition
Type Various

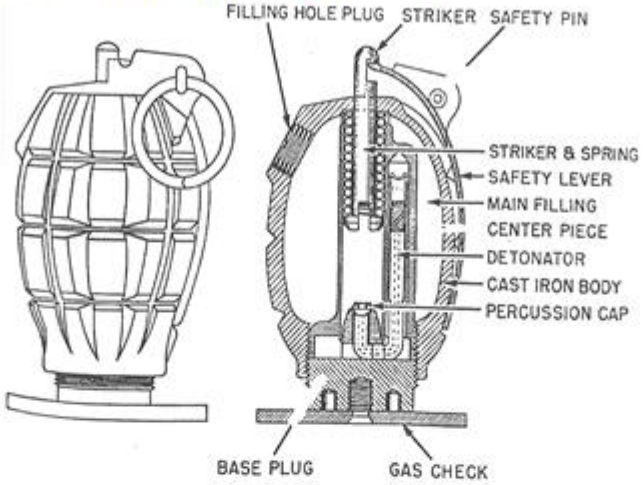
Description: Small Arms Ammunition (SAA) is one of the more recognisable categories of ordnance which is primarily designed for anti-personnel use. SAA include items such as bullets, generally up to a calibre (diameter) of 20mm.

Generally small arms ordnance has a relatively low risk as UXO, although the larger calibre categories may have the same detonation risk as larger high explosive ordnance.

SAA is often associated with discarded ammunition boxes around firing practice ranges and training areas and is often found scattered across former military airfields as a result of aircraft crashes and localised disposal.

Information Data Sheet

Category Grenades (British)
Type No. 36 Hand Grenade ('Mills Bomb')



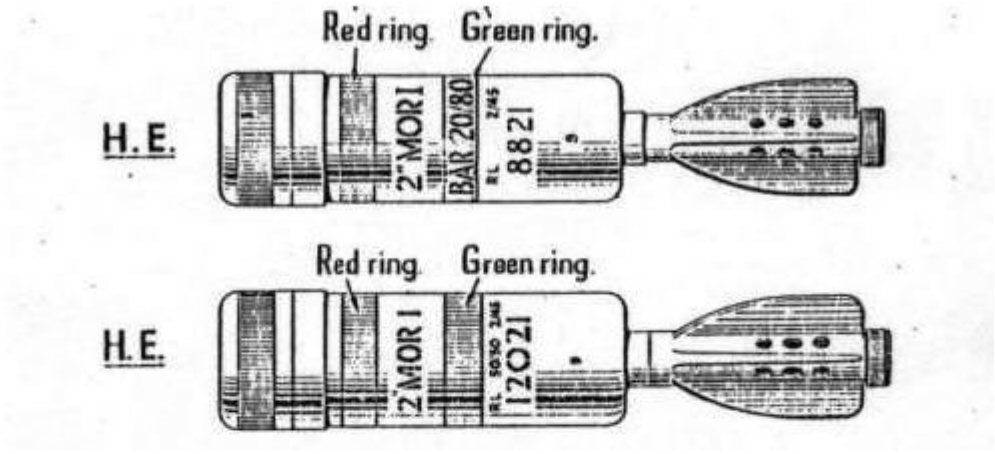
Variants	-	**Dimensions**	101.6mm x 61mm (4" x 2.4")
Weight	2 lbs	**Delay**	4 seconds
Filling	Baratol	**Material**	Cast Iron

Description Lemon-shaped, cast-iron body filled with high explosive. Three holes in the body; one in the base for priming, one near the top for filling; one on the top holding striker.

Function Used as a defence against enemy personnel.

Information Data Sheet

Category Mortar (British)
Type 2-Inch Mortar Bomb



Variants	14	**Length**	11.4" x 2"
Weight	2.5lbs	**Firing Mechanism**	Trip (small trigger)
Calibre	50.8mm (2.0 inches)	**Rate of Fire**	8 rounds per minute

Description Pear-shaped steel body with 6 or 8 vanes. Originally painted buff yellow or dark grey. Filled with c TNT, granular TNT or powdered Amatol. Also smoke, illumination and practice versions.

Function Small enough to be carried by one man, with a range limited to 500 yards, the 2" mortar was used an anti-personnel role.

Information Data Sheet

Category Bomb (Luftwaffe)
Type Sprengbombe-Cylindrisch (SC) 50kg

Variants 8

Body Dimensions 762 x 200mm (30" x 7.9")

Weight 55kg (122lbs)

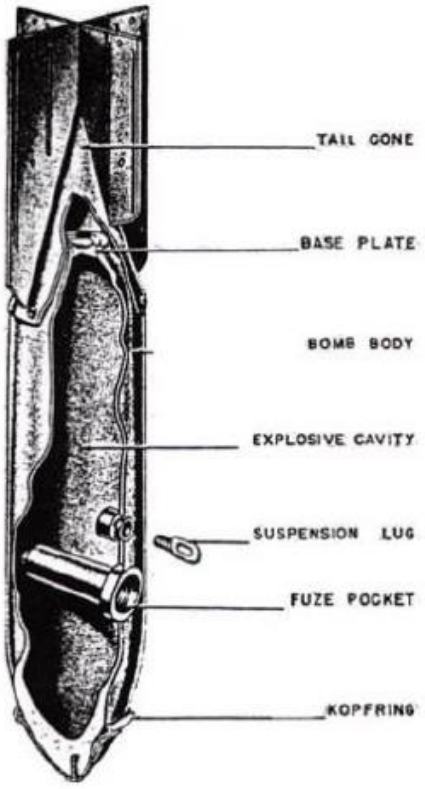
Charge Weight 25kg (54lbs)

Fuze Single electric impact fuze. Some have short time delay

Composition Sheet steel

Description Thick nose welded to a steel body. Nose may be attached to Kopfring (a triangular section steel ring) or spike. Suspension bolt in eye/body and sheet metal tail attached to body with rivets/screws. Originally painted green-grey with a yellow stripe on the tail. Cast TNT, Amatol or Trialen filling.

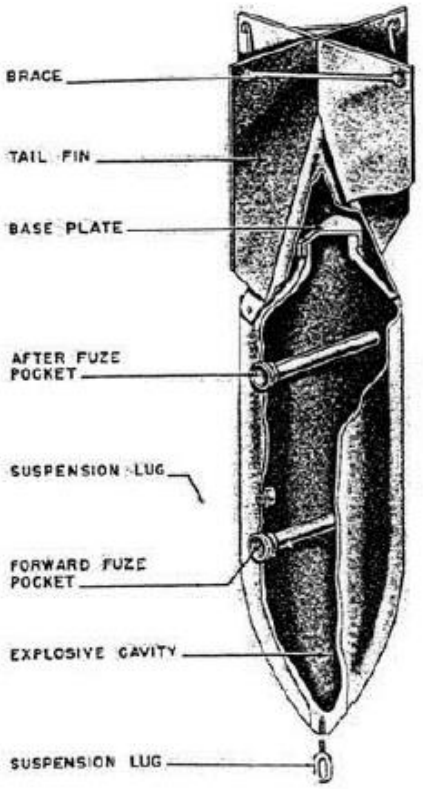
Function Designed to maximise shock waves through air, water and earth and for general demolition. Used against easily damageable targets, including roads, aircraft hangars, rolling stock and small buildings. Spike bombs/ 'Stabo' (SC 50 with spikes attached to nose) were used against rail lines and country roads, with Kopfring used against naval targets.



Information Data Sheet

Category Bomb
Type Sprengbombe-Cylindrisch (SC) 250kg

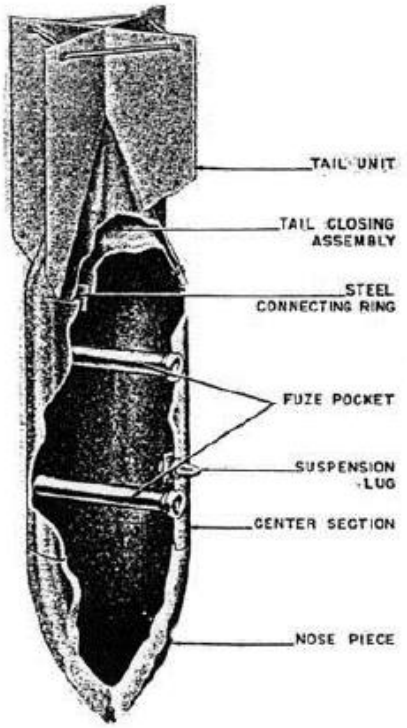
Variants	8
Body Dimensions	1194mm x 368mm (47" x 14.5")
Weight	249-264 kg (548-582lbs)
Charge Weight	130-145 kg (287-320lbs)
Fuze	Electric impact fuze/electric clockwork time fuse & electric anti-disturbance fuze
Composition	Sheet steel with stays
Description	Thick nose welded to steel body. Nose may be attached to Kopfring (triangular section steel ring) or spike. Sheet metal tail attached to body with rivets/ screws. Suspension eye bolt in the nose/body. Originally painted green-grey with a yellow stripe on the tail. TNT; amatol; TNT and aluminium powder, naphthalene, ammonium nitrate and wax/ wood meal filling.
Function	Designed to maximise shock waves through air, water and earth and general demolition. Used against railway installations, large buildings, ammunition depots and below-ground installations (to 8m). Spike bombs/ 'Stabo' (SC 50 with spikes attached to nose) used against rail lines and country roads.



Information Data Sheet

Category Bomb
Type Sprengbombe-Cylindrisch (SC) 500kg

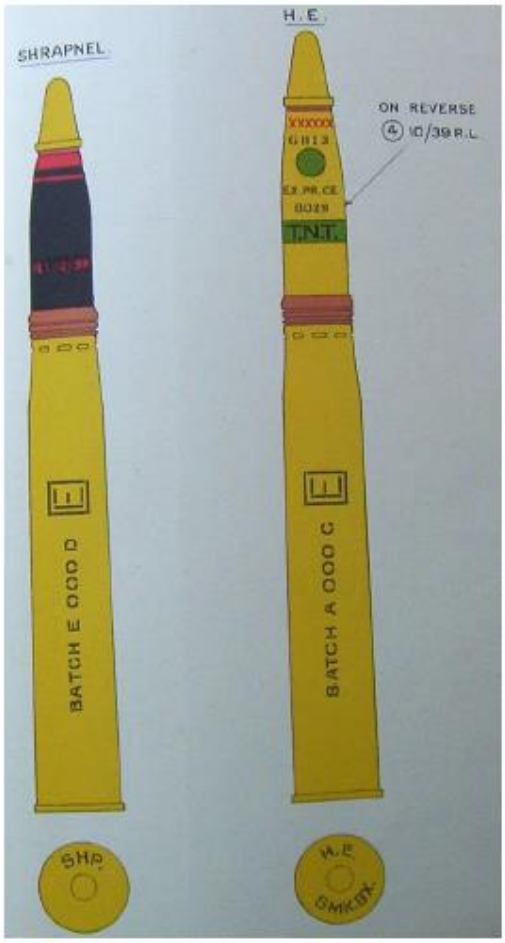
Variants	-
Body Dimensions	1414–1486mm x 470mm (55.7-58.5" x 18.5")
Weight	500kg (1,100lbs)
Charge Weight	220kg (484lbs)
Fuze	Electric impact fuze/electric clockwork time fuse & electric anti-disturbance fuze.
Composition	Sheet steel with stays or drum
Description	Thick nose welded to steel body. Nose may be attached to Kopfring (triangular section steel ring). Tail either steel sheet or drum-shaped. Suspension band. Originally painted green-grey/ buff (some later versions sky blue) with yellow stripe on tail. Filled with amatol, TNT or trialen.
Function	Designed to maximise shock waves through air, water and earth and for general demolition. Used against railway property, large buildings, shipping and below-ground installations.



Information Data Sheet

Category Projectile
Type 3.7" Anti-Aircraft Shell

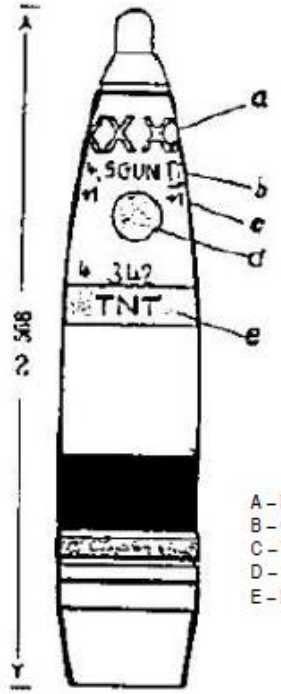
Variants	6
Body Dimensions	94mm x 360mm (3.7 x 14.7")
Weight	12.7kg (28lb)
Fuze	Mechanical time fuze
Composition	Cast steel
Description	Brass cartridge case. Square-based shell with tapered nose, filled with Amatol, TNT or RDX/TNT. MK6 had forward centring bands and a wider driving band.
Function	Used as a defence against enemy aircraft, fired from fixed batteries and mobile mountings. Could fire approximately 20 rounds per minute with a maximum ceiling of 41,000ft and horizontal range of 20,600 yards.



Information Data Sheet

Category Projectile
Type 4.5" Shell (Mark II – Anti-Aircraft)

Variants	-
Body Dimensions	114mm x 566mm (4.5" x 21.9")
Weight	24.9kg (55lb)
Fuze	Mechanical time fuze
Composition	Cast steel
Description	Square-based, tapered-nosed shell filled with TNT or Amatol. Steel casing, rotating band of either copper or gilding metal located 3.5" in front of the base end with single groove.
Function	Used as field artillery and adapted for use in anti-aircraft defence from fixed batteries. Rate of fire of 8 rounds per minute, maximum ceiling of 44,000ft and horizontal range of 22,800 yards.



A – Missile Identification
B – Gun and Bullet Type
C – Weight
D – Smoke pot
E – Explosives Ring

Appendix 2 Sources of UXO Hazard

The sections below provide background information on the potential sources of UXO hazard (albeit low) affecting the Site. For a more comprehensive set of UXO information sheets, see http://zeticauxo.com/downloads-and-resources/uxo-information-sheets/.

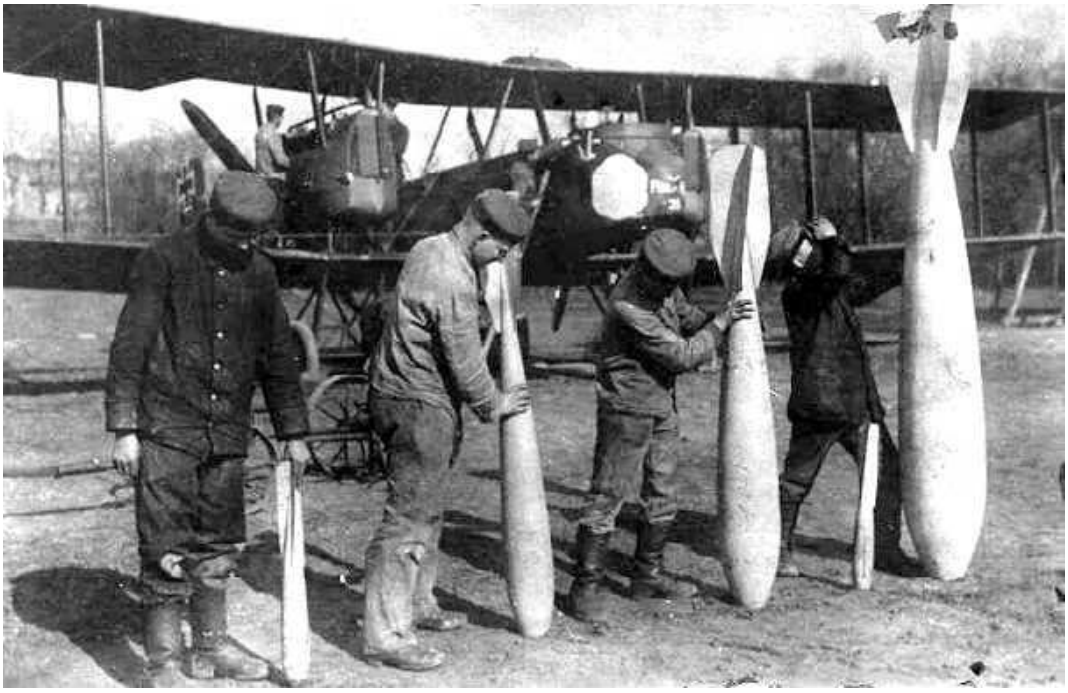
Appendix 2.1 WWI Bombing

It is not generally realised that during World War One (WWI) significant bombing took place across some areas of the UK. An estimated 9,000No. German bombs were dropped on Britain during the course of 51No. airship and 52No. aircraft raids. It was the first time that strategic aerial bombardment had been used. More than 1,400No. people were killed during these raids.

Most air raids were carried out on London and Southeast England. Areas along the East Coast were also targeted regularly due to their proximity to the European continent. Bombing raids further inland were rare and West England and Wales were out of reach for German aircraft of the time.

Aerial bombing during WWI initially relied on visual aiming, with bombsights not developed until later in the war. The inaccuracy inherent in this method meant that bombs often fell some way from their intended targets.

The first recorded raid against England occurred on the 21st December 1914 when 2No. high explosive bombs fell near the Admiralty Pier at Dover. Zeppelin raids intensified during 1915 and 1916, with aircraft raids becoming more frequent after 1917. The last raid of WWI took place on the 19th May 1918, when 38No. Gotha and 3No. Giant aircraft bombed London and surrounding districts, dropping a total of more than 2,500lbs of bombs.



The potential of coming across an Unexploded Bomb (UXB) from WWI is far less likely than a WWII UXB given the lower bombing densities during raids in the Great War.

Some areas which were subjected to sustained bombing raids, such as parts of London and coastal towns, recorded a higher number of UXBs. In these areas, where there has been no significant development for the last century, the potential of a UXB remaining from WWI cannot be totally discounted.

Appendix 2.2 WWII Bombing

Bombing raids began in the summer of 1940 and continued until the end of WWII. Bombing densities generally increased towards major cities or strategic targets such as docks, harbours, industrial premises, power stations and airfields. In addition to London, industrial cities and ports, including Birmingham, Coventry, Southampton, Liverpool, Hull and Glasgow, were heavily targeted, as well as seaside towns such as Eastbourne and cathedral cities such as Canterbury.

The German bombing campaign saw the extensive use of both High Explosive (HE) bombs and Incendiary Bombs (IBs). The most common HE bombs were the 50kg and 250kg bombs, although 500kg were also used to a lesser extent. More rarely 1,000kg, 1,400kg and 1,800kg bombs were dropped.

The HE bombs tended to contain about half of their weight in explosives and were fitted with one or sometimes two fuzes. Not all HE bombs were intended to explode on impact. Some contained timing mechanisms where detonation could occur more than 70 hours after impact.

Incendiary devices ranged from small 1kg thermite filled, magnesium bodied Incendiary Bombs (IBs) to a 250kg 'Oil Bomb' (OB) and a 500kg 'C300' IB. In some cases the IBs were fitted with a bursting charge. This exploded after the bomb had been alight for a few minutes causing burning debris to be scattered over a greater area. The C300 bombs were similar in appearance to 500kg HE bombs, although their design was sufficiently different to warrant a specially trained unit of the Royal Engineers to deal with their disposal.

Anti-Personnel (AP) bombs and Parachute Mines (PMs) were also deployed. 2No. types of anti-personnel bombs were in common use, the 2kg and the 12kg bomb. The 2kg bomb could inflict injury across an area up to 150m away from the impact. PMs (which were up to 4m in length) could be detonated either magnetically or by noise/vibration.

Anti-shipping parachute mines were commonly dropped over navigable rivers, dockland areas and coastlines. The Royal Navy was responsible for ensuring that the bombs were made safe. Removal and disposal was still the responsibility of the Bomb Disposal Unit of the Royal Engineers.

In 1944, the Germans introduced new weapons; the V1, a 'flying bomb' and guided missile, and the V2, a ballistic missile rocket that travelled at such speed that no one could see or hear its approach. London was the main target for these attacks.

WWII bomb targeting was inaccurate, especially in the first year of the war. A typical bomb load of 50kg HE bombs mixed with IBs which was aimed at a specific location might not just miss the intended target but fall some considerable distance away.

It is understood that the local Civil Defence authorities in urban areas had a comprehensive system for reporting bomb incidents and dealing with any Unexploded Bombs (UXB) or other UXO. In more rural areas, fewer bombing raids occurred. It is known that Air Raid Precaution (ARP) records under-represent the number and frequency of bombs falling in rural and coastal areas. Bombs were either released over targets or as part of 'tip and run' raids where bomber crews would drop their bombs to avoid anti-aircraft fire or Allied fighter aircraft on the route to and from other strategic targets. Bombs dropped as a result of poor targeting or 'tip and run' raids on rural and coastal areas often went unrecorded or entered as 'fell in open country' or 'fell in the sea'. The Luftwaffe are thought to have dropped approximately 75,000 tons of bombs on Britain throughout the Second World War and an estimated 11% of all bombs dropped during the war failed to detonate.

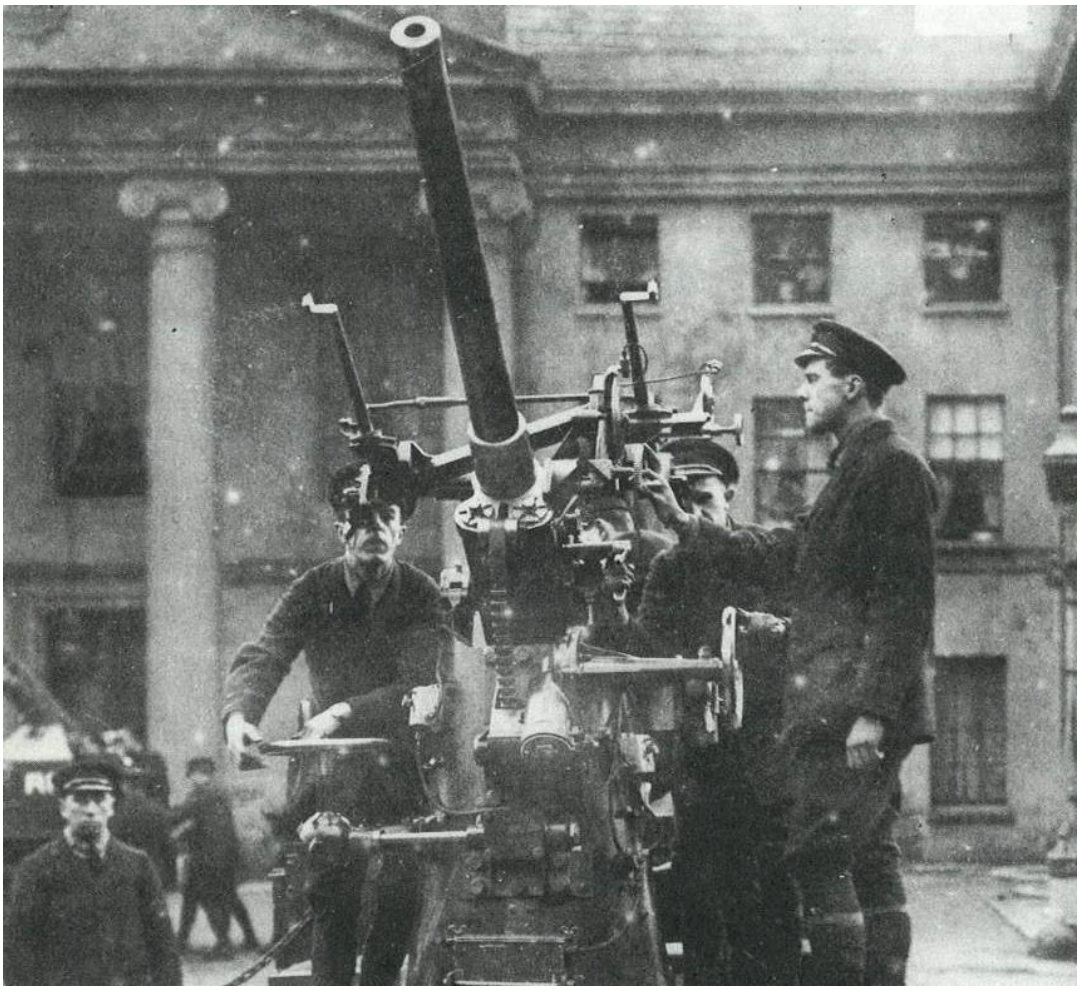
The potential for a UXB hazard to exist on a site depends on a variety of factors. Were there strategic targets in the surrounding area? Was the site bombed? Could a UXB impact have been missed? Even in rural areas, the potential for UXB cannot be totally discounted and therefore it is essential that detailed local bombing records are obtained when assessing the UXB hazard on any site.

Appendix 2.3 Anti-Aircraft Guns

As aerial bombardment first began during WWI, Anti-Aircraft (AA) gun batteries were established were gradually established throughout much of England to counter German bombing raids. By June 1916, there were approximately 271No. AA guns and 258No. searchlight installations defending London alone.

Common AA defences during WWI included 3-inch, 75 millimetre, 6-pounder and 1-pounder guns. Many of these guns were mobile, being mounted on lorry chassis. They were driven about following the course of an airship and fired from any area of open land.

During WWI, Unexploded AA (UXAA) shells, could land up to 13km from the firing point, although more typically fell within 10km.



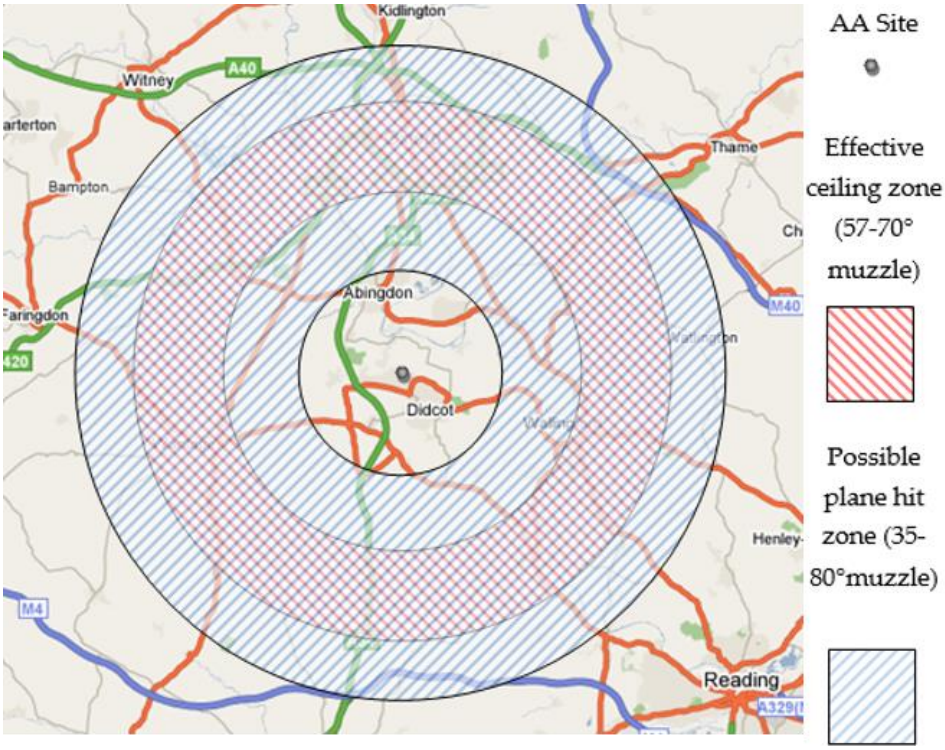
AA gun batteries were used extensively during WWII to counter the threat posed by enemy aircraft. In many instances, AA shells caused damage to Allied territory and in some areas caused significant numbers of civilian fatalities.

During WWII, AA shells could land up to 27km from the firing point, although more typically fell within 15km. These could be distributed over a wide area.

3No. types of AA batteries existed:

- **Heavy Anti-Aircraft (HAA)** batteries of large guns (typically 3.7", 4.5" and 5.25" calibre) designed to engage high flying bomber aircraft. These tended to be relatively permanent gun emplacements.
- **Light Anti-Aircraft (LAA)** weaponry, designed to counter low flying aircraft. These were often mobile and were moved periodically to new locations around strategic targets such as airfields. They typically fired 40mm shells and machine gun ammunition.
- **Rocket batteries (ZAA)** firing 3" or 3.7" AA rockets with a maximum altitude of 5,800m and a ground range of 9km were typically permanent emplacements.

Unexploded AA (UXAA) shells were a common occurrence during WWII. As the figure below demonstrates, shells were unlikely to fall in the immediate vicinity of a gun battery but in the surrounding area. This would be dependent upon the angle of fire and the flight height of the attacking aircraft.



AA batteries were deliberately targeted by the Luftwaffe and therefore areas surrounding a gun battery may have a greater risk of UXB being present.

Munitions stores were also established around AA batteries. These stored the shells for the batteries and small arms ammunition for troops manning the position. Such stores were typically removed at the end of WWII, although some disposal may have occurred in the immediate vicinity of the gun battery.

Appendix 3 Recent UXO Finds

UXO finds in the UK are a regular occurrence, although they almost never result in an accidental detonation.

It is still important to note that explosives rarely lose effectiveness with age. In some instances, mechanisms such as fuzes and gaines can become more sensitive and more prone to detonation, regardless of whether the device has been submersed in water or embedded in silt, clay or similar materials.

The effects of an accidental UXO detonation are usually extremely fast, often catastrophic and invariably traumatic to any personnel involved. Such occurrences are largely restricted to current theatres of war and overseas minefields, with occasional events in mainland Europe.

Zetica, and other commercial EOD companies, uncover and make safe thousands of items of UXO each year, though details are rarely made public knowledge.

Publicly-recorded discoveries do also occur regularly, as demonstrated by the list of recent significant UXO finds in the UK below. To keep up to date with the latest UXO finds, visit http://zeticauxo.com/news/.

On the 26th February 2021, a 1,000kg German "Hermann" UXB was discovered by builders at Exeter University campus (see plate below). It was investigated and detonated in-situ following the evacuation of nearby properties and University halls of residence.

On the 29th March 2021, 1No. 250lb UXB was discovered on the seabed near Hinkley Point C harbour, Bristol. A maritime exclusion was imposed while the item was investigated and then destroyed in a controlled explosion.

On the 10th May 2021, 1No. Anti-Aircraft shell dating from WWII was found by a member of the public in Horsham, Surrey. It was destroyed in-situ by a bomb disposal unit.

On the 17th May 2021, 1No. Sea Wolf missile was brought onboard a fishing vessel near Brixham in Devon. A Royal Navy EOC team destroyed the missile in a controlled explosion.

On the 1st June 2021, a cache of approximately 100No. hand grenades dating from WWII were found in a Nottinghamshire forest, a possible relic from nearby wartime camps. They were destroyed.

On the 24th July 2021, 1No. 500lb British UXB was uncovered during construction works in Goole, East Yorkshire. Reports indicated that the UXB had been jettisoned by a Lancaster bomber aircraft prior to crashing nearby in WWII. The item was investigated and destroyed.

On the 18th August 2021, 1No. UXB was found by construction workers on a Site in Earl Sterndale, Derbyshire. Upon inspection the UXB was deemed to be dangerous and a controlled detonation was undertaken.

On the 10th September 2021, EOD teams destroyed 25No. mortar bombs which had been washed up onto beaches around Nairn and Ardersier in Morayshire. These beaches had been used during WWII for training prior to the D-Day landings in Normandy.

On the 18th October 2021, 1No. 18.5lb artillery shell was discovered during the clearing-out of a barn near Aberfeldy in Perthshire. The shell dated from WWI and was removed.

On the 15th December 2021, approximately 200No. artillery shells were discovered at a construction site located within the former Royal Ordnance Factory at Swynnerton in Staffordshire. The shells were removed and destroyed.

On the 15th December 2021, 1No. apparent UXB was snagged by a fishing trawler off the Norfolk Coast and then detonated, causing significant damage to the vessel. Upon further investigation, it was concluded that the UXB had been dropped in the water during WWII.

On the 2nd January 2022, 1No. heavily deteriorated 105mm artillery shell was discovered by dogwalkers on a beach in Cumbria. This may have originated on one of the several offshore ranges which have been operational along the nearby coastline since WWII.

Between the 24th and 27th January 2022, 5No. empty artillery shells were uncovered at a construction site in Manchester. These were likely linked to a shell-production factory which had been active on the site during WWII.

On the 17th February 2022, 1No. WWI-era Mk1 Mills hand grenade was found in the River Frome in Dorset by magnet fishermen. This was the third grenade to be pulled from the same stretch of the river over the past year. It was inspected by local police and destroyed.

On the 7th April 2022, 1No. mortar bomb was discovered on a beach in northern Norfolk. An EOD team arrived and carried out a controlled explosion.

On the 30th May 2022, 1No. WWI-era Mills hand grenade was discovered on a beach in County Down. An EOD team carried out a controlled explosion.

On the 13th June 2022, 1No. 2" mortar bomb was discovered at a garden centre in Argyll & Bute. An EOD team was mobilised and made the device safe.

On the 14th July 2022, 1No. 2" mortar bomb and several Small Arms Ammunition roundsa were discovered on a beach near Ardnamurchan. An EOD team disposed of the items.

On the 13th September 2022, 1No. unexploded shell was discovered on a construction site in Rugby. A 400m security cordon was established and a controlled explosion carried out.

On the 3rd October 2022, 1No. unexploded shell was discovered in wetlands near Wakefield by magnet fisherman. It was removed by an EOD team.

On the 11th November 2022, 3No. suspected mortar bombs were discovered near Sudbury. An EOD team assessed the mortar bombs and removed them for safe disposal.

On the 28th November 2022, 45No. Self Igniting Phosphorus grenades were discovered during construction works at a school in Swindon. They were disposed of by an EOD team.

On the 5th December 2022, 1No. UXB was discovered during construction at Biggin Hill Airport. An EOD team removed the UXB for safe disposal.

On the 3rd January 2023, 1No. WWII-era shell was discovered on Brighton Beach by members of the public. An EOD team was called and the shell was made safe.

Appendix 4 Glossary and Definitions

Abandoned Explosive Ordnance (AXO)	Abandoned Explosive Ordnance is explosive ordnance that has not been used during an armed conflict, that has been left behind or disposed of by a party to an armed conflict, and which is no longer under control of that party. Abandoned explosive ordnance may or may not have been primed, fuzed, armed or otherwise prepared for use.
Close Combat Munitions	Items of ordnance thrown, propelled or placed during land warfare, to include grenades, mortars, projectiles, rockets and land mines.
Demil	Derived from the term 'Demilitarisation', it refers to the break down and the recycling or disposal of ordnance components.
Detonation	The high-speed chemical breakdown of an energetic material producing heat, pressure, flame and a shock wave.
Device	This term is used for any component, sub-assembly or completed ordnance, which may or may not have an explosive risk. It can apply to detonators, primers, gaines, fuzes, shells or bombs.
Explosive	The term explosive refers to compounds forming energetic materials that under certain conditions chemically react, rapidly producing gas, heat and pressure. Obviously, these are extremely dangerous and should only be handled by qualified professionals.
Explosive Ordnance (EO)	Explosive Ordnance is all munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads, guided and ballistic missiles, artillery, mortar, rocket, small arms ammunition, mines, torpedoes, depth charges, pyrotechnics, cluster bombs & dispensers, cartridge & propellant actuated devices, electro-explosive devices, clandestine & improvised explosive devices, and all similar or related items or components explosive in nature.
Explosive Ordnance Clearance (EOC)	Explosive Ordnance Clearance is a term used to describe the operation of ordnance detection, investigation, identification and removal, with EOD being a separate operation.
Explosive Ordnance Disposal (EOD)	Explosive Ordnance Disposal is the detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance.
Explosive Ordnance Reconnaissance (EOR)	Explosive Ordnance Reconnaissance is the detection, identification and on-site evaluation of unexploded explosive ordnance before Explosive Ordnance Disposal.
Explosive Remnants of War (ERW)	Explosive Remnants of War are Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO), excluding landmines.

Explosive Substances and Articles (ESA)	Explosive substances are solid or liquid substances (or a mixture of substances), which are either: • capable by chemical reaction in itself of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings. • designed to produce an effect by heat, light, sound, gas or smoke, or a combination of these as a result of a non-detonative, self-sustaining, exothermic reaction. Explosive article is an article containing one or more explosive substances.
Fuze	A fuze is the part of an explosive device that initiates the main explosive charge to function. In common usage, the word fuze is used indiscriminately, but when being specific (and in particular in a military context), fuze is used to mean a more complicated device, such as a device within military ordnance.
Gaine	Small explosive charge that is sometimes placed between the detonator and the main charge to ensure ignition.
Geophysical survey	A geophysical survey is essentially a range of methods that can be used to detect objects or identify ground conditions without the need for intrusive methods (such as excavation or drilling). This is particularly suited to ordnance as disturbance of ordnance items is to be avoided where ever possible.
Gold line	This is the estimated limit of blast damage from an explosive storage magazine. It usually means that development within this zone is restricted.
High Explosive	Secondary explosives (commonly known as High Explosives (HE)) make up the main charge or filling of an ordnance device. They are usually less sensitive than primary explosives. Examples of secondary explosives are: Nitro glycerine (NG), Trinitrotoluene (TNT), AMATOL (Ammonia nitrate + TNT), Gunpowder (GP), and Cyclotrimethylenetrinitramine (RDX).
Munition	Munition is the complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including demolitions. This includes those munitions that have been suitably modified for use in training, ceremonial or non-operational purposes. These fall into three distinct categories:- • inert - contain no explosives whatsoever. • live - contain explosives and have not been fired. • blind - have fired but failed to function as intended.

Primary Explosive	Primary explosives are usually extremely sensitive to friction, heat, and pressure. These are used to initiate less sensitive explosives. Examples of primary explosives are: Lead Azide, Lead Styphnate, and Mercury Fulminate. Primary explosive are commonly found in detonators.
Propellants	Propellants provide ordnance with the ability to travel in a controlled manner and deliver the ordnance to a predetermined target. Propellants burn rapidly producing gas, pressure and flame. Although usually in solid form they can be produced in liquid form. Examples of propellants are: Ballistite often found in a flake form and Cordite used in small arms ammunition.
Pyrotechnic	A pyrotechnic is an explosive article or substance designed to produce an effect by heat, light, sound, gas or smoke, or a combination of any of these, as a result of non-detonative, self-sustaining, exothermic chemical reactions.
Small Arms Ammunition (SAA)	SAA includes projectiles around 12mm or less in calibre and no longer than approximately 100mm. They are fired from a variety of weapons, including rifles, pistols, shotguns and machine guns.
Unexploded Anti-Aircraft (UXAA) Shell	UXAA shells are army ordnance commonly containing HE, though they can also contain pyrotechnic compounds that produce smoke. Most commonly, these were 3.7” and 4.5” HE shells, although they ranged from 2” to 5.25” calibre.
Unexploded Bomb (UXB)	UXB is a common term for unexploded air-dropped munitions.
Unexploded Ordnance (UXO)	UXO is explosive ordnance that has been either primed, fuzed, armed or prepared for use and has been subsequently fired, dropped, launched, projected or placed in such a manner as to present a hazard to operations, persons or objects and remains unexploded either by malfunction or design.
V1	The Vergeltungswaffe-1, V-1, also designated Fieseler Fi 103/FZG-76, known colloquially in English as the Flying Bomb, Buzz Bomb or Doodlebug, was the first guided missile used in WWII and the forerunner of today's cruise missile.
V2	The Vergeltungswaffe 2 (V-2) (‘Reprisal Weapon 2’) was the first ballistic missile. It was used by the German Army primarily against Belgian and British targets during the later stages of WWII. The V-2 was the first man-made object launched into space, during test flights that reached an altitude of 189km (117 miles) in 1944.

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