



CIRCLE SQUARE 3, – UXO SAFETY AWARENESS **BRANCASTER ROAD**

Mike Sainsbury, Managing Director

INTRODUCTION

Who are Zetica

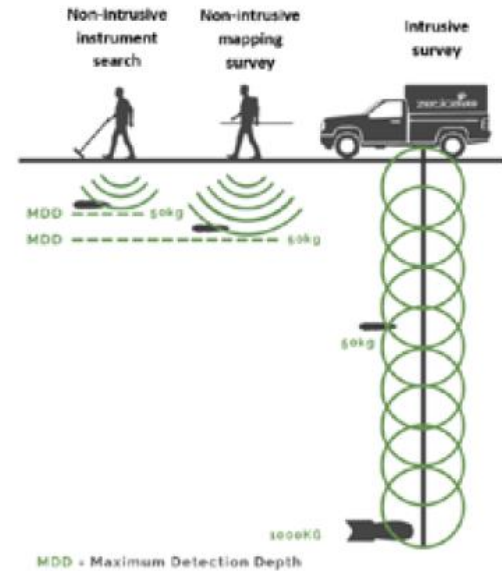
- Where we started and what we did
- Where we are now
 - Mapping hazards, infrastructure – feeding into asset management
- UXO



INTRODUCTION

Zetica UXO

- **Guidance & Consultation**
- **UXO Assessments**
 - Preliminary Assessments
 - Detailed UXO Desk Study & Risk Assessments
 - UXO Hazard Constraints Assessments
- **UXO Site Services**
 - UXO Awareness Briefings
 - Watching Briefs
 - UXO Detection
 - UXO Clearance
 - Explosive Ordnance Disposal



INTRODUCTION

Aim of today?

To provide you with:

- An awareness of the UXO hazards.
- Some awareness of the most likely types of ordnance that could be encountered.
- The principle safety procedures that should be adopted to manage the risk during site works.
- For you to cascade out into the work teams.

What do UXO look like?

- Not always like the day they were made!
- Rusty lumps of metal
- Distinguishing features (rifling/fuze pockets)



SOME TERMS

Glossary

Below is a list of descriptions and definitions for terms commonly used in the UXO industry:-

Abandoned Bomb

A UXB that was abandoned during WWII rather than being dealt with at the time by bomb disposal teams due to benign position, difficulty of access, or a lack of resources.

Abandoned Explosive Ordnance (AXO)

AXO is explosive ordnance that has not been left behind or disposed of by a party under control of that party. AXO may or may not be otherwise prepared for use.

Ammunition

A complete device charged with explosives of chemical composition, or nuclear, biological or chemical, including demolitions.

Battle Area Clearance (BAC)

BAC is the systematic and controlled clearance of an area known not to include mines. BAC operations include UXO and AXO, over specific areas, positions and sites where air delivered or air

Caesium Vapour Magnetometer

Instrument that measures the Earth's total magnetic field in ferrous material will cause a measurable

Construction Design and Management (CDM)

A person appointed to advise a developer on the design of their project, including the potential for the project to seek specialist advice and must be satisfied that the developer can advise the developer on the competent contractor and other contractors.

If the CDM coordinator does not have the required to identify the need for a UXO specialist from UXO and advise the developer on the

Clearance Certificate

Issued by the MoD and other official bodies, a clearance certificate does not provide a 100 per cent guarantee on a site, but rather that trained staff using the best available technology have been applied to reducing the potential risk.

Clearance Report

A report issued by a UXO specialist following a site survey, detailing the works undertaken to

mounted on a distinct

- Inert
- Live
- Blind

Non-Ferrous

A metal that is not detected by a metal detector sensor.

Ordnance

Military supplies, particularly pertaining to weapons and ammunition.

Pyrotechnic

A pyrotechnic is an explosive article or substance designed to produce an effect by

chemical reaction due to heat and pressure resulting in an explosion.

it within the explosives train that, when initiated, detonates a less sensitive but explosive charge, or when containing its own primer initiates the detonation.

Pyrotechnic Survey

- 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.
- An explosive article is an article containing one or more explosive substances.

Ferrous Target

Material containing ferrous metals which may be detectable using a magnetometer or

Some abbreviations and definitions!

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.

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.

risk mitigation measures recommended are in the best interests of the developer and not the UXO specialist.

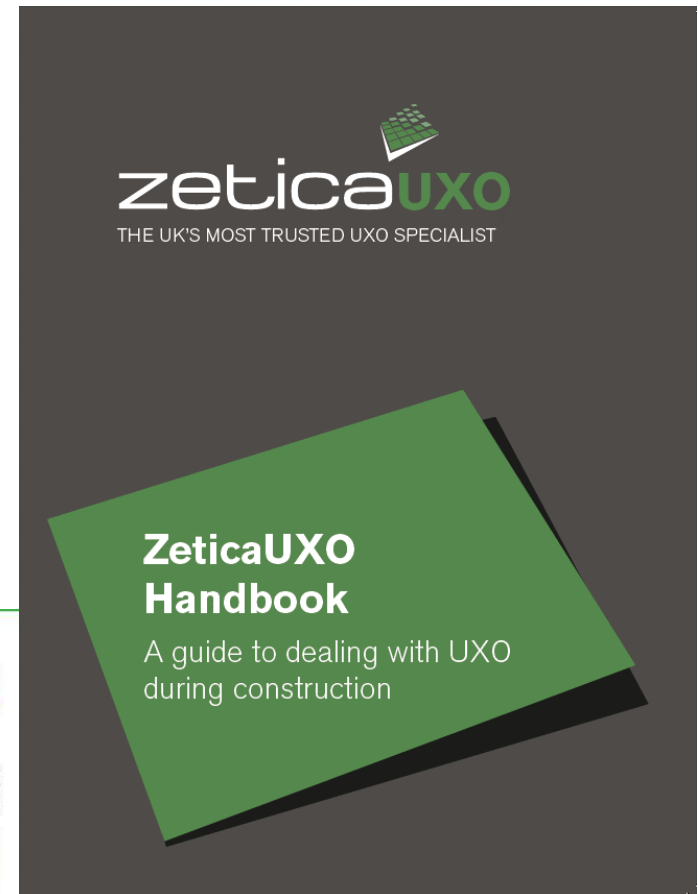
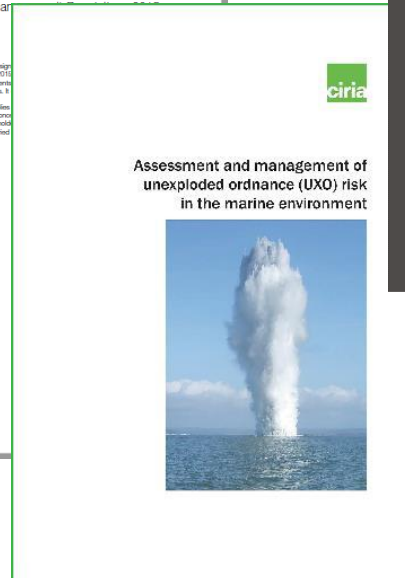
Verification Report

Report issued after the completion of a UXO detection survey/target investigation, detailing detection levels achieved, the works undertaken and any residual UXO risk.

GUIDANCE AND REGULATION

- UK situation
 - Regulation (poor)
 - Guidance (limited)

Our new Handbook helps ensure compliance with industry good practice.... Making it easier to follow the process.



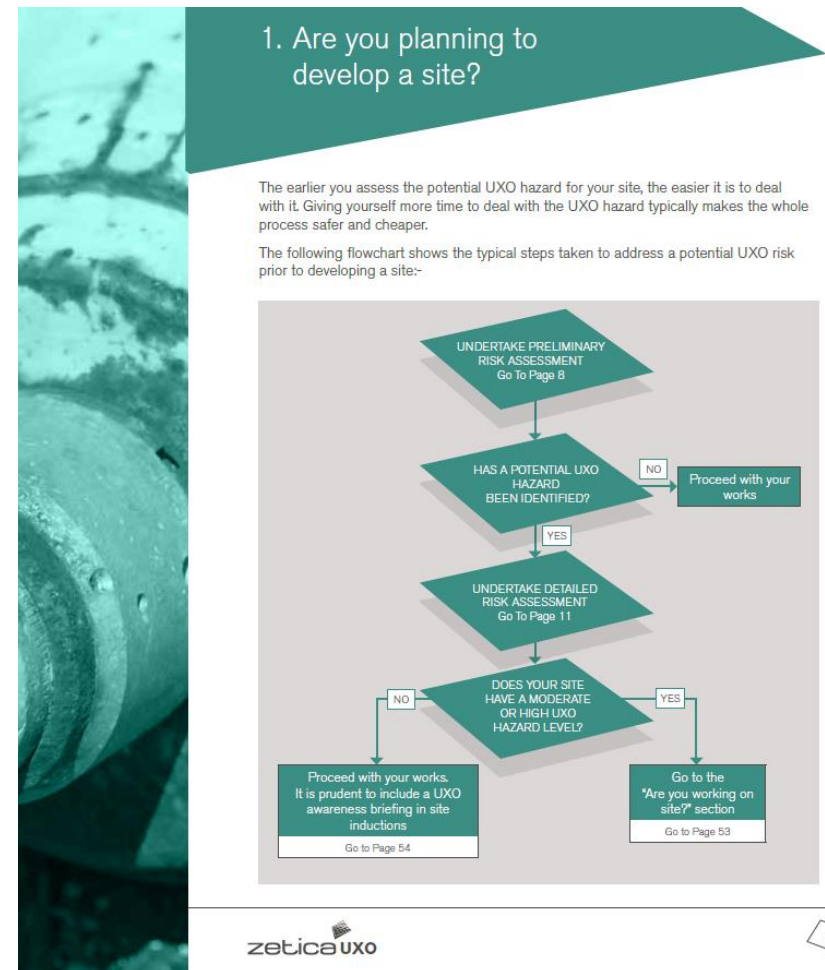
APPROACH – GOOD PRACTICE

Key is good detailed Desk Study & risk assessment in order to understand the hazard properly at this stage, avoiding:-

- Undertaking unnecessary work (err on side of caution).
- Missing the real hazard (making things more unsafe!)

So what are the hazards associated with the work area?

The following slide summarises this.



Page 7 in the Zetica UXO Handbook

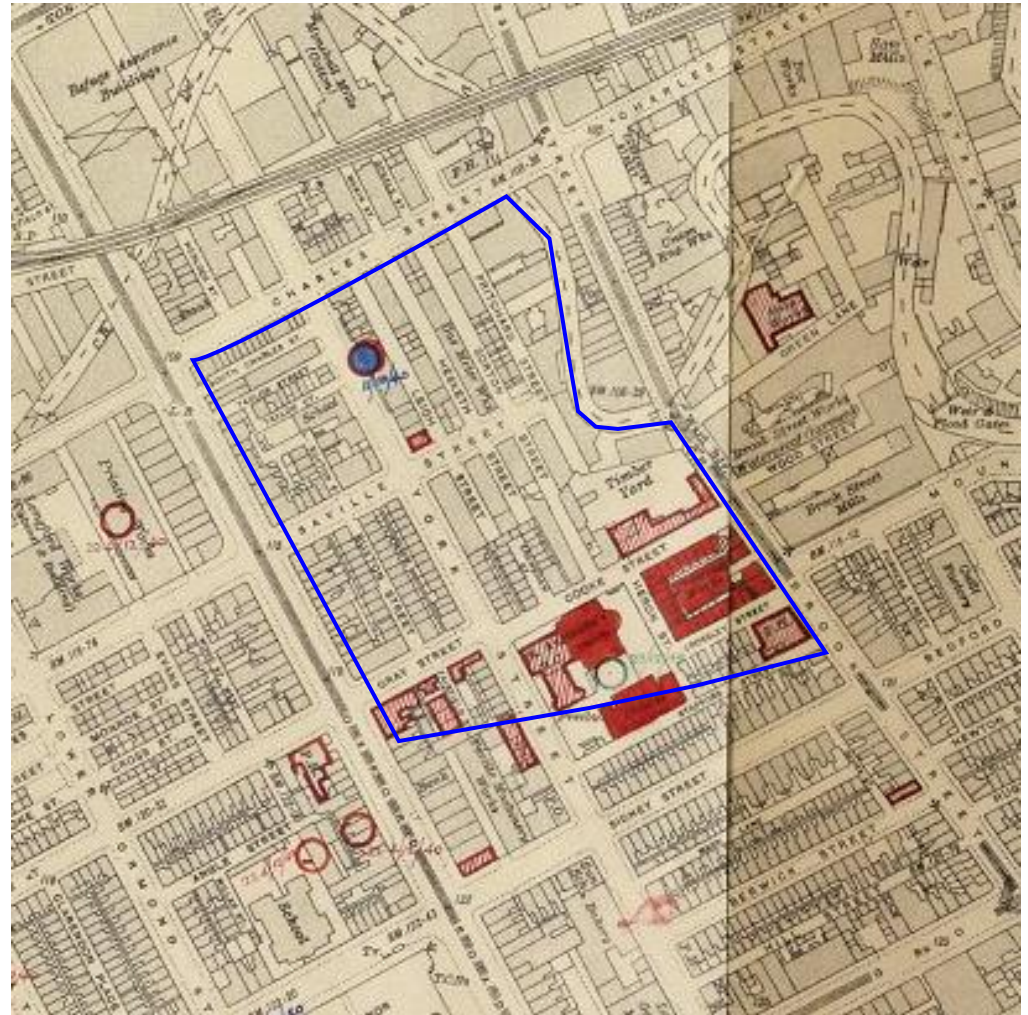
SITE BACKGROUND – SITE HISTORY

- Site is in Central Manchester.
- Formerly comprised mixture of residential and commercial properties and church.
- Area extensively redeveloped post-WWII.
- Used as BBC broadcasting house until recently.



SITE BACKGROUND – WWII BOMBING

- 1,710 No. HE bombs on Manchester during WWII.
- Thousands more IBs during 1940 Blitz destroyed much of city centre.
- 1 No. HE bomb recorded on northern part of Site.
- 1 No. Parachute Mine on southern part of Site caused major damage.
- AA defences surrounded docks and many UX shells recorded.



SUMMARY OF UXO HAZARD

- Main potential hazard is from German UXB
- Unexploded AA shells from surrounding WWII gun batteries also cannot be totally discounted.
- Close combat munitions/SAA very unlikely to be encountered



UXO AWARENESS – IDENTIFICATION

What do they look like ?

- Not much like the day they were made!
- Rusty lumps of metal.



SUMMARY OF UXO HAZARD SOURCE – UXB

Potential UXO hazards – WWII Bombing

- Air-dropped German bombs, 50kg - maybe 250kg and 500kg.
- Unlikely but cannot be totally discounted.



UXO INFORMATION AND IDENTIFICATION – 50KG UXB

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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)

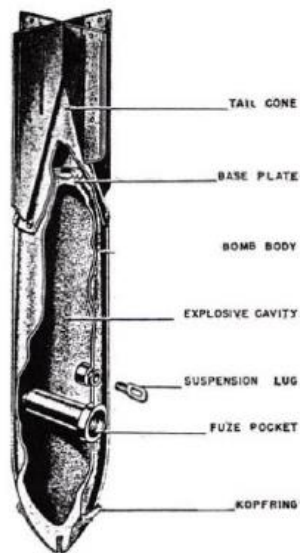
Charge Weight 25kg (54lbs)

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 Trilolite 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.



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UXO INFORMATION AND IDENTIFICATION – 250KG UXB

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Information Data Sheet

Category Bomb (Luftwaffe)

Type Sprengbombe-Cylindrisch (SC) 250kg

Variants 8

Body Dimensions 1194mm x 368mm (47' x 14.5")

Weight 249-264 kg (548-582lbs)

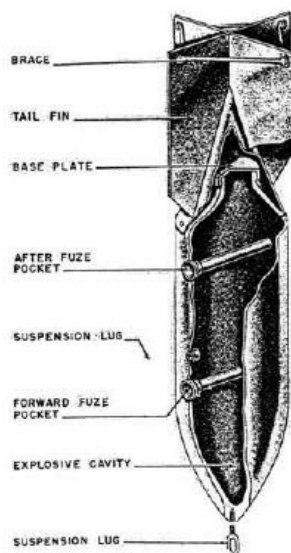
Charge Weight 130-145 kg (287-320lbs)

Fuze Electric impact fuze/electric clockwork time fuze & 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.



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UXO INFORMATION AND IDENTIFICATION – 500KG UXB

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Information Data Sheet

Category Bomb (Luftwaffe)

Type Sprengbombe-Cylindrisch (SC) 500kg

Variants -

Body Dimensions 1414–1486mm x 470mm (55.7–58.5" x 18.5")

Weight 500kg (1,100lbs)

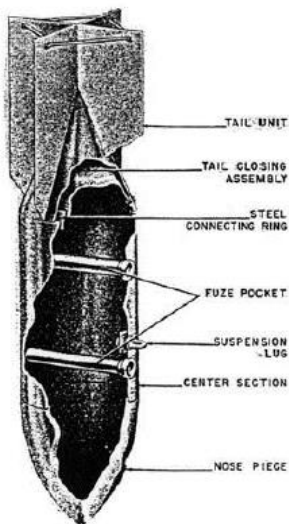
Charge Weight 220kg (484lbs)

Fuze Electric impact fuze/electric clockwork time fuze & 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.



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UXO INFORMATION AND IDENTIFICATION – 1,000KG UXB

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Information Data Sheet

Category Bomb (Luftwaffe)

Type Sprengbombe-Cylindrisch (SC) 1,000kg (HERMANN)

Variants 3

Body Dimensions 1742-1905mm x 648-660mm (68.6-75" x 25.5-26")

Weight 1,000-1,088kg (2,204-2,398lbs)

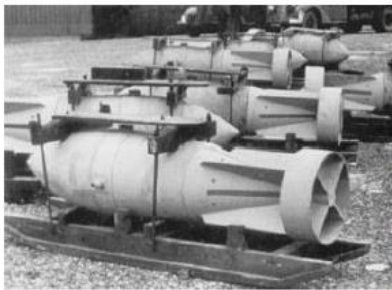
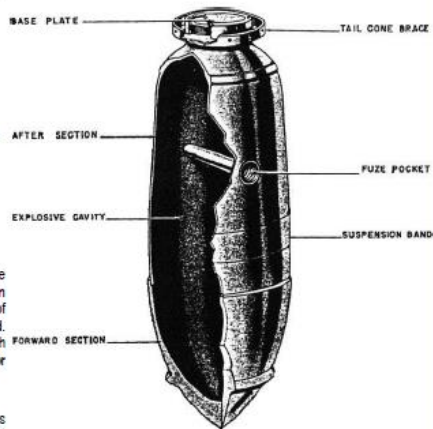
Charge Weight 529-619kg (1,166-1,364lbs)

Fuze Electric impact fuze/ electric clockwork time fuze & electric anti-disturbance fuze

Composition Magnesium alloy with drum

Description Thick nose welded to steel body. Nose attached to Kopfring (triangular section steel ring). Drum-shaped tail made of magnesium alloy. Suspension band. Originally painted sky-blue. Filled with amatol, TNT/aluminium/wood meal or trialen.

Function Designed to maximise shock waves through air, water and earth and for general demolition.

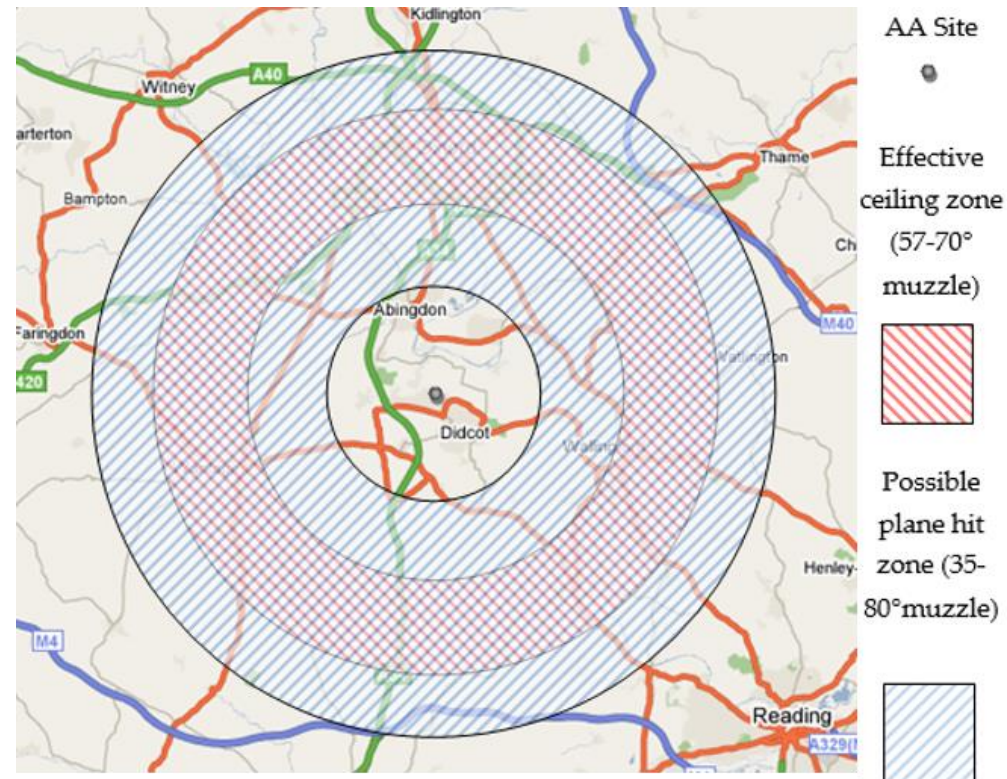
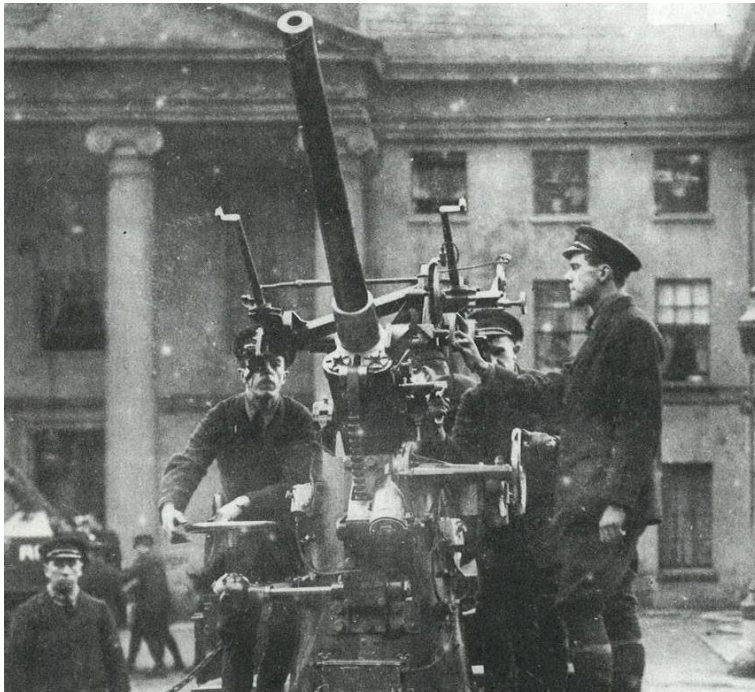


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SUMMARY OF UXO HAZARD SOURCE – ANTI AIRCRAFT SHELLS

Potential UXO hazards – Defensive

- Anti-Aircraft shells 3.7/4.5" (13mls range).
- Where found?



UXO INFORMATION AND IDENTIFICATION– ANTI AIRCRAFT SHELLS

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Information Data Sheet

Category Projectiles (British)
Type 3.7" Anti-Aircraft Shell

Variants 6

Body Dimensions 94mm x 360mm (3.7 x 14.7")

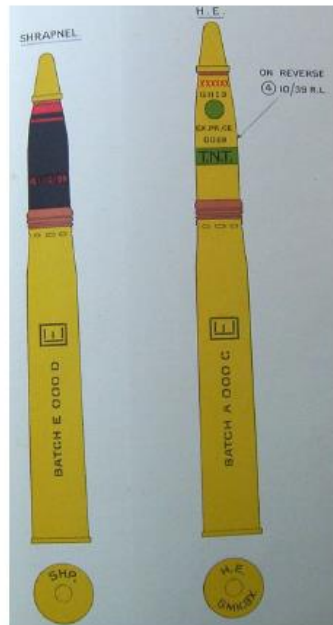
Weight 12.7kg (28lb)

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.



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UXO INFORMATION AND IDENTIFICATION– ANTI AIRCRAFT SHELLS

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Information Data Sheet

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

Variants -

Body Dimensions 114mm x 566mm (4.5" x 21.9")

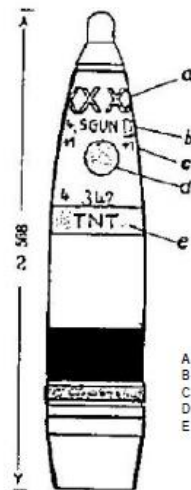
Weight 24.9kg (55lb)

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



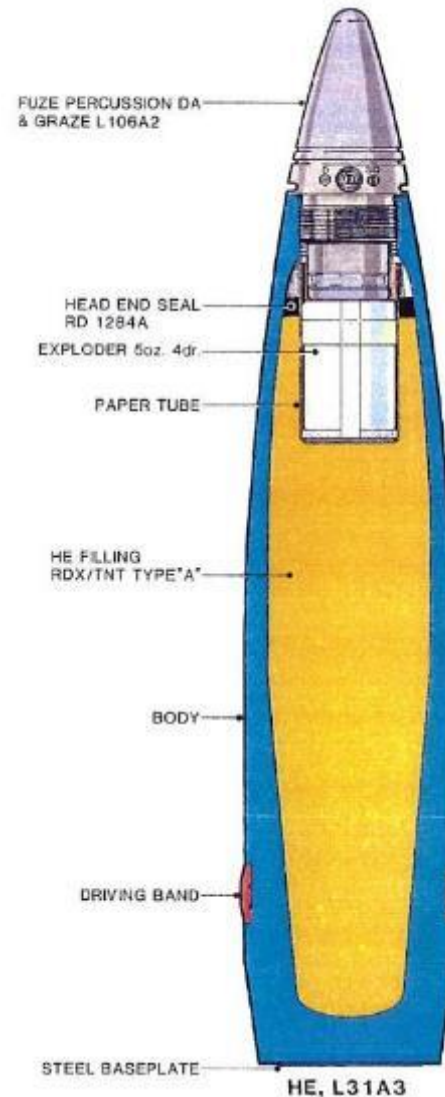
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DETONATION/DEFLAGRATION - BACKGROUND

The explosive train

- Typically the explosive element of ordnance comprises three main components:-

- the fuze
- the booster or exploder pellet
- the main HE charge



DETONATION/DEFLAGRATION

- How to initiate UXO

Many ways! Most relevant to your works:-

- Blows, shock
- Sparks/naked flame
- Change of conditions



Health and Safety
Executive

Explosives Regulations 2014: Safety provisions

might initially be expected. The behaviour of an explosive or substance in bulk storage, or in production conditions, might also differ from the intended effect or the behaviour 'in use' or in laboratory conditions. For example, explosives which might normally simply deflagrate could, under confinement, produce a mass explosion.

5 In certain circumstances there will also be secondary hazards such as the release of toxic or flammable substances.

How can a fire or explosion start?

Properties of explosives and sources of ignition

6 Determining how a fire and explosion can start will involve considering:

- the properties of the explosive, its sensitiveness to different sources of energy;
- the properties of any other flammable materials, their sensitiveness to different sources of energy and the nature of any tasks involving them;
- sources of ignition and how they could start a fire or initiate an explosion.

7 These steps may need to be reconsidered along with the initially identified controls to decide whether the likelihood of a fire and explosion has been reduced sufficiently to appropriately manage the explosives risks or whether any additional controls are required.

8 Depending on the type of explosive, potentially any application of energy might initiate an explosion. Sources of initiation to consider include:

- naked lights and flames;
- heat and temperature;
- electricity (including static electricity and electromagnetic energy);
- sparks from mechanical or frictional contact between metal surfaces;
- impact and friction;
- pressure; and
- chemical incompatibility between certain substances.

9 Consider how sources of energy can combine to increase the likelihood of an initiation, for example friction and impact combining when an explosive is dropped onto an edge, spike or spigot.

10 Other issues that can, depending on the explosive, affect sensitiveness to initiation and the likelihood of an event include:

- contamination of the explosive with grit etc either as a part of an on-site activity or as a consequence of the contamination of raw materials;
- contact with water;
- reduction of chemical and thermal stability over the life of the explosive;
- loss of a desensitising agent.

UXO HAZARD – RISK

Risk is detonation (or deflagration).

- Destruction of property
- Harm to you and others (fatality?)

Context

- UXO buried for decades.
- Likelihood of detonation?
- Accidents/Harm caused in UK?



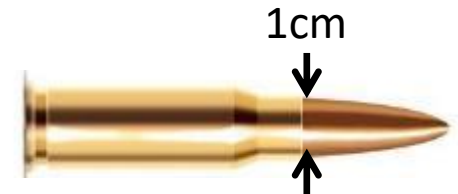
Construction worker dies as World War II bomb explodes in Germany

Bulldozer driver fatally injured after his vehicle hit World War II bomb on construction site in German town of Euskirchen, with 13 others hurt



The following guidance is provided in relation to Small Arms Ammunition (e.g. bullets/rounds) which may be found during excavation at the site. This guidance is provided on the basis that those working on the site have already undergone a UXO awareness induction.

- Treat SAA with respect. SAA may not have a high explosive content, but if mishandled they can still be lethal!
- **Do not pick up** any round with a diameter of **greater than ~1cm** (of the bullet)
- Any SAA found should be stored in a metal box and kept in a secure location.
- Once a number (approximately **12**) have accumulated, drop them off at a local Police station (explaining how you came across them. Be careful not to raise undue alarm).



RISK MITIGATION – REACTING TO A SUSPECT FIND



Page 89 in handbook

Don't panic!

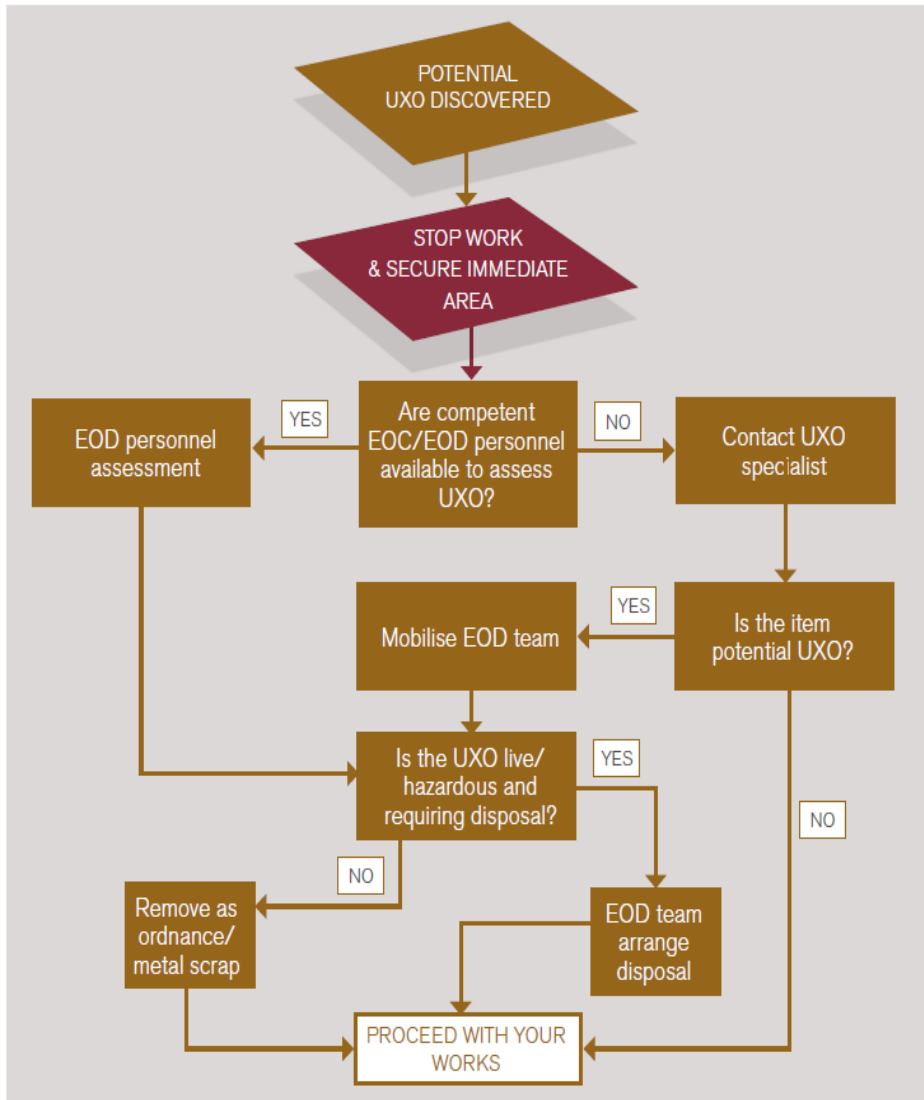
Most UXO in the UK are unlikely to detonate on first encounter. It is essential that you now take appropriate action and there are three key rules to heed:-

Rule 1: Do not move, cover or do anything else that will disturb the item further.

Rule 2: Ensure that others do not breach rule 1.

Ideally you will evacuate the site (like a fire drill).

Rule 3: Get advice from a UXO specialist!



REPORTING SUSPECT FIND

What we need to know

- If safe to do so try and record:-
 - Shape
 - Size (diameter very important)
 - Colour
 - Any lettering.
 - Fuzed?
- The site situation (where on it)?
- Golden Rule?



Calm, co-ordinated communication by 1 nominated individual.

RETREAT - SAFE DISTANCES

Golden Rule – Do not disturb further (do not touch).

- If possible, safe distance is **greater than 100m** for items with a diameter of **10cm or less**.
- For items with a greater diameter, move as far away and reasonably practicable, **ideally over 500m away**.

It is imperative that advice is sought from Zetica as soon as possible.

The above is provided as **guidance only**. The determination of a safe distance can only be accurately determined after an assessment of the hazard and site conditions.



999? - EXPLOSIVE ORDNANCE DISPOSAL (EOD)

- Do you need to call the Police for EOD
 - UK situation – Commercial solution
 - Reasonably foresee a hazard.
 - Advantages
 - Commercial awareness
 - Enhanced safety
 - Less disruption
 - Quicker/better timing
 - Smaller exclusion zones



CFOA
Chief Fire Officers
Association



**Ministry
of Defence**

ADVANTAGES OF COMMERCIAL EOD

Unexploded bomb shuts Aston Expressway

15 May 2017

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BBC NEWS

LIVE BBC NEWS CHANNEL

Last Updated: Thursday, 6 October 2005, 10:58 GMT 11:58 UK

E-mail this to a friend

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Evacuation as fourth bomb found

About 500 homes, a primary school and an asylum seekers' centre are to be evacuated after a fourth World War II bomb was discovered near a gas line.



Diversion have remained in place

Detonation of two remaining bombs is planned for Friday but will depend on cloud cover at the former RAF Oakington airfield north of Cambridge.

Experts say low cloud could cause a dangerous shockwave.

Bomb disposal experts will talk to the Met Office about the conditions before exploding the bombs, said police.

The Cambridgeshire force could not say how many people were going to be affected by Friday's evacuation plans but they would be "significant".

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SUMMARY - UXO SAFETY MANAGEMENT

Potential UXO risk

- Potential detonation risk.
- Risk will be managed / minimised by adopting safe working procedures.

UXO safety management

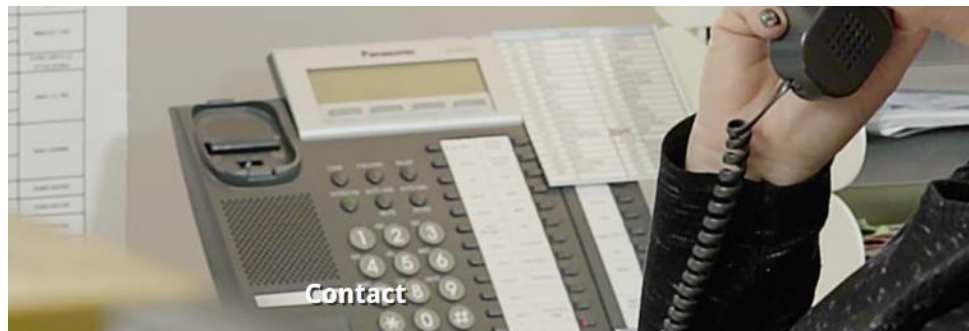
- What is it
 - Control measures
 - Prevent detonation
- What it isn't
 - Foolproof
 - Self-disciplined



SUMMARY – CASCADING OUT

Incorporate selected slides/info into standard inductions

- Highlight the potential hazard.
- What the hazards look like (posters, data sheets).
- What to do on discovery (3 RS.....next slide!)
- Communication/Support routes.



SUMMARY

1. Do not touch/disturb (Recognise a hazard)
2. **Stop access/working.** (Retreat)
3. **Record details/Get advice.** (Report)

3Rs

1. **Recognise.**
2. **Retreat.**
3. **Report.**

Include the number of a UXO specialist in your RA/Ms



IS THAT A BOMB?

CALL ZETICA ON
01993 886682

STOP. DON'T TOUCH!

If you discover an object that has a similar size and shape to a WWII bomb or other ordnance item stop what you are doing – and try to avoid disturbing the item further.

WHAT NEXT?

If you find a suspicious item that you are not sure about, contact a senior member of the staff. Do not touch it. There is a potential risk to your safety and the safety of others. Contact Zetica. For a full and complete understanding of the risks, contact a senior member of the staff and call the police.

WHAT TO LOOK FOR

After 65 or more years in the ground, bombs and other ordnance have generally retained their shape, but will become very rusty and damaged.

Commonly found unexploded bombs range in the main from 1kg to 15kg (often the other way round and unexploded bombs can be found from 100g up to a tonne, and with a diameter of over 100mm (4in)).

Out-of-hours contact numbers: 07958 931581 and 07801 457449

zeticauxo For more details on this and related services, telephone +44 (0)1993 886682 or visit our website www.zetica.co.uk

Questions?

www.zeticauxo.com

