

Technical Note 09.30 / 01

Version 1.0



EOD Clearance of Armoured Fighting Vehicles (AFV)



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Foreword

Management practices and operational procedures for humanitarian mine action are constantly evolving. Improvements are made, and changes are required, to enhance safety and productivity. Changes may come from the introduction of new technology, in response to a new mine or UXO threat, and from field experience and lessons learned in other mine action projects and programmes. This experience and lessons learned should be shared in a timely manner.

Technical Notes provide a forum to share experience and lessons learned by collecting, collating and publishing technical information on important, topical themes, particularly those relating to safety and productivity. Technical Notes complement the broader issues and principles addressed in International Mine Action Standards (IMAS).

Technical Notes are not formally staffed prior to publication. They draw on practical experience and publicly-available information. Over time, some Technical Notes may be 'promoted' to become full IMAS standards, while others may be withdrawn if no longer relevant or if superseded by more up-to-date information.

Technical Notes are neither legal documents nor IMAS. There is no legal requirement to accept the advice provided in a Technical Note. They are purely advisory and are designed solely to supplement technical knowledge or to provide further guidance on the application of IMAS.

Technical Notes are compiled by the Geneva International Centre for Humanitarian Demining (GICHD) at the request of the United Nations Mine Action Service (UNMAS) in support of the international mine action community. They are published on the James Madison University (JMU) website (<http://www.hdic.jmu.edu>) and the GICHD website (<http://www.gichd.ch/>).

Introduction

The explosive ordnance disposal (EOD) clearance of armoured fighting vehicles (AFV) can be one of the most technically complex and demanding operations conducted by an EOD technician. It requires the development of render safe procedures (RSP) from first principles combined with a detailed understanding of the design and make-up of ammunition systems.

In post-conflict environments there could be a requirement to ensure that AFVs are safe as part of the humanitarian demining process. This Technical Note has been written, as an advisory document, to ensure that managers, field staff and EOD technicians are aware of all the potential hazards and provides guidance to the development of a safe RSP.

The EOD clearance of AFVs should only be undertaken by appropriately qualified EOD personnel; it is not a task for basic deminers or other field staff.

EOD clearance of armoured fighting vehicles (AFV)

1. Scope

This Technical Note establishes principles and provides guidance on the EOD clearance of armoured fighting vehicles (AFV) encountered during demining operations in a permissive post-conflict environment.

2. References

A list of normative references is given in Annex A. Normative references are important documents to which reference is made in this Technical Note and which form part of the provisions of this Technical Note.

3. Terms and definitions

A list of terms and definitions used in this document is given in Annex B. In the Technical Notes series, the words 'should' and 'may' are used to indicate the intended degree of compliance. This use is consistent with the language used in International Mine Action Standards (IMAS), and guides.

- a) 'should' is used to indicate the preferred requirements, methods or specifications; and
- b) 'may' is used to indicate a possible method or course of action.

4. Background

The clearance of AFVs, whether damaged or not, can be a functional task for demining organisations. Experience has been gained by a limited number of personnel in various demining programmes, but the passage of time inevitably means that the corporate knowledge of this methodology is fading.

The clearance of AFVs is based on the first principles taught to EOD technicians during their formal training. The methodology suggested in this Technical Note has been proven operationally, but may not necessarily be the most efficient clearance methodology to suit all circumstances. As in all EOD operations, the RSP must be modified to address the particular threat.

5. Reasons for AFV clearance

There are numerous reasons why the clearance of AFVs may be desirable in a post-conflict situation. These include:

- a) to reduce risk to human life;
- b) to permit the destruction of unserviceable or unstable ammunition;
- c) to safeguard the environment;
- d) exploitation to gain information on ammunition systems and other UXO faced by demining organisations;
- e) to permit environmental clearance of the area, and the removal of AFVs;
- f) to enable the recovery of corpses for war graves registration processes; and/or
- g) to prevent the recovery of ammunition by others for improper purposes.

6. The Threat

6.1. Explosive

There are a number of explosive -related threats that require elimination during the AFV clearance operation:

6.1.1. Explosive Reactive Armour (ERA)

Any remaining ERA may well be in an unstable condition after being subjected to the effects of anti-tank weapons, submunitions or mines.

6.1.2. Depleted Uranium (DU)

The use of DU munitions could have produced a radio-active or toxic hazard (Refer to Technical Note 02/2001 for the threat posed by DU and the principles for the clearance of DU ammunition or contaminated areas).

6.1.3. Access denial devices

The threat of access denial devices laid by the warring factions prior to abandonment of the AFV should be considered.

6.1.4. Surrounding UXO

The threat posed by UXO in the surrounding area of the AFV should always be considered. In particular be aware of the dangers posed by ammunition “kicked out” of the AFV during its destruction. This may well look “unfired” or safe, but the fuze system may have been subjected to the centrifugal, set back and set forward forces required to arm many fuze types.

The ammunition will also have been subjected to diurnal cycling, which may have a negative effect on the stability and consistency of the explosive fill. Degradation of the explosive will affect the sensitivity of the explosive, whilst heat can change the explosive consistency allowing explosive migration into the fuze cavity and threads.

6.1.5. Submunitions

Artillery or air delivered submunitions could well have been used to destroy the AFV. Failure rates of such munitions can be as high as 30%; there could be failed sub-munitions on the surface of, and around, the AFV.

6.2. Health hazards

In addition to the hazards posed by the possible presence of DU contamination, additional health hazards could be present because of human remains still in the vehicle; the remains are classified as UN Class 6.2 dangerous goods. Due to the contagious nature of naturally occurring bodily fluids and diseases in human remains, and the need to maintain the appropriate respect for the dead, the handling of human remains during clearance operations must be carried out with great care. The detailed hazard will be dependant on factors such as time of death, cause of death, any diurnal cycling the remains have been subjected to etc. The EOD technician should, wherever possible, obtain medical advice prior to AFV entry and disturbance of the remains. (Further information is given Clause 08.10).

AFV will also present other industrial health hazards. These will include:

- a) leakage of battery acids;
- b) leakage of hydraulic fluids;

- c) fuel; and
- d) radiac sources, such as tritium, for weapons systems and optical systems.

7. Equipment

7.1. Personal Protective Equipment (PPE)¹

The following PPE shall be used by the EOD technician until the presence of DU can be positively discounted:

- a) inner cotton gloves;
- b) outer heavy PVC gloves;
- c) respirator²; and
- d) protective trousers and overboots. (Optional to protect clothing).

7.2. Thermoluminescent Dosimeter (TLD)

The EOD technician should wear a TLD during AFV clearance operations. Personal dosimetry and health checks should be co-ordinated with a local appropriately qualified medical facility.

8. AFV clearance methodology

8.1. Visual search

Visually search the surrounding area for UXO. Disposal of any UXO found is a matter of judgement for the EOD technician. If there is any risk of mines, then demining assets should be deployed to clear a safe working area.

8.2. External search of AFV

Conduct an external search of the AFV to identify any UXO (submunitions) present on the external surface of the AFV. Mark any found.

8.3. Assess condition of ERA

Some nation's ERA has been subjected to trials to ensure that hot-cutting techniques, if used with care, can be used to remove damaged plates. This is not necessarily the case for all ERA, therefore hot cutting techniques should not be used.

8.4. Identify how the AFV was damaged or destroyed

During the external search of the AFV the EOD technician should assess the likely munition that has caused the damage or destruction. The threat from DU can then be ascertained. Remember that DU munitions may well be part of the turret stocks of the AFV, and therefore a DU threat can not be discounted at this stage.

A Portable Contamination Meter (PCM) - Type Mini-Monitor fitted with a B-6-H GM Tube can be used to identify DU contaminated areas.

¹ This PPE is in addition to the blast and fragmentation PPE requirements discussed in IMAS 10.30.

² Industrial Filtering Face Mask, Type 3M 8825 or 4255 may be used if it is positively confirmed that DU not present but human remains are still in the AFV.

WARNING 1: DU fragments. Do not let DU residue or fragments come into contact with exposed unprotected skin. DU fragments are not to be picked up by hand. A scoop or other such tool is to be used.

If DU is suspected, then the area of penetration can be decontaminated by vigorously throwing shovelfuls of sand or earth in the area of penetration. This removes traces of DU oxide on the surface. Residual DU fragments and contaminated sand or earth should be disposed of in accordance with Technical Note 02/2001 - Depleted Uranium.

Jammed penetrators should be decontaminated as above. They may be removed with a sharp knock. Should they fail to move then they should be marked, and removal attempted between 7 to 14 days later, by which time they should have contracted.

WARNING 2: Do not attempt to remove jammed penetrators explosively as re-contamination will result.

8.5. Dispose of UXO on external surface of AFV

If any are found then a suitable disposal technique should be used. The EOD technician should be aware that this may result in damage to optics and external equipment. If exploitation is the reason for AFV clearance, then these should be protected before initiation of the charge. The EOD technician should consider the effect that his/her actions may have on any ERA present. Multi initiation should be considered.

WARNING 3: Should the vehicle catch fire as a result of EOD action, then any DU alloy used in shot may ignite. (An ignition temperature of 600-1000^oc is required). Dispersion of DU aerosol oxide may result. A downwind area within 22.5^o sectors at a radius of 60m should be cleared.

8.6. Remove ERA

Undamaged ERA can be removed using a bolt croppers, spanner or wrench. Should the ERA be damaged, then an assessment of the ERA design and damage to the ERA is necessary.

WARNING 4: If explosive has been forced into the screw threads by the force of explosions then it may be initiated by frictional forces when unscrewed. If the ERA is bolted direct onto the AFV then this risk will not be extant.

If in doubt, damaged ERA should be removed explosively (or, if available, by EOD Hydro Abrasive Cutting (HAC) systems). The explosive should be placed directly onto the ERA to ensure that initiation of the ERA charge does not result in the plate "flying off". Sufficient explosive should be used to ensure initiation of all of the ERA explosive; otherwise loose explosive will be spread over the surrounding area.

WARNING 5: The EOD technician should be aware that the resultant blast caused may disturb other UXO on the surface of the AFV.

The use of a shaped charge will inevitably result in initiation of the ERA as intended, with a consequentially large danger area.

If EOD Hydro Abrasive Cutting systems are deployed then these are an alternative to explosive removal.

8.7. Gain access to AFV

The EOD technician should then gain access to the AFV to assess the condition of turret stocks.

WARNING 6: There is a possibility that the access hatches to the AFV may have access denial devices deployed. Hook and line should be used to open all access hatches from the exterior.

8.8. Visual search

The EOD technician should conduct a detailed search in order to identify any access denial devices deployed within the crew compartment of the vehicle.

8.9. AFV entry

The EOD technician may now enter the vehicle.

8.10. Removal of human remains

It may be necessary to remove human remains in order to gain access to assess the condition of turret stocks³. International advice from an appropriate international organisation, such as the International Committee of the Red Cross (ICRC), should be obtained to ensure that all necessary war graves registration processes are carried out.

8.11. Clear turret stocks

The EOD technician should now proceed to clear turret stocks of ammunition in accordance with the principles of ammunition design, inspection and surveillance. Further RSPs may be necessary for ammunition that is considered too dangerous to be removed for bulk destruction.

9. Responsibilities

9.1. National mine action authorities

It is the responsibility of the National Mine Action Authority to ensure that the managers of all local demining teams, NGOs or commercial companies are aware of the existence of this Technical Note, especially if AFVs may have been used during international or internal conflicts in the nation concerned.

9.2. Demining organisations

It is the responsibility of the management of local demining teams, NGOs or commercial companies to pay attention to this Technical Note, and incorporate the recommendations into SOPs where appropriate. Where no National Mine Action Authority exists, it is the their responsibility to ensure that all demining teams are aware of the recommendations in this Technical Note.

9.3. Demining personnel

It is the responsibility of all field staff, whether deminers or EOD, to carry out the recommendations in this Technical Note to the best of their ability, and to inform their management if compliance with the recommendations cannot be achieved.

³ Industrial Filtering Face Mask, Type 3M 8825 or 4255 may be used if it is positively confirmed that DU not present but human remains are still in the AFV. The EOD technician should also wear protective overalls and gloves to prevent contamination of normal clothing. These should be burnt on completion of the task.

Annex A (Normative) References

The following documents, when referred to in the text of this Technical Guide, form part of the provisions of this guide.

- a) IMAS 04.10. Glossary of demining terms; and
- b) Technical Note 02/2001. Clearance of Depleted Uranium (DU) hazards.

The latest version/edition of these references should be used. UNMAS hold copies of all references used in this Technical Note. A register of the latest version/edition of the IMAS standards and references is maintained by UNMAS, and can be read on the UNMAS web site: (See www.un.org/depts/dpko/mine/). National mine action authorities, employers and other interested bodies and organisations should obtain copies before commencing mine action programmes.

The latest version/edition of the Technical Notes can be read on the GICHD web site: (See <http://www.gichd.ch/>).

Annex B (Informative) Terms and definitions

1.1. demining

the survey and subsequent **clearance** of contaminated land by the **detection**, removal or **destruction** of all **mine** and **UXO hazards**. Demining may be carried out by different types of organisations, such as NGOs, commercial companies, national mine action teams or military units. Demining may be emergency-based or developmental.

1.2. demining organisation

refers to any organisation (government, NGO, military or commercial entity) responsible for implementing **demining** projects or tasks. The **demining organisation** may be a prime contractor, subcontractor, consultant or agent.

1.3. explosive ordnance

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 and small arms **ammunition**; all **mines**, torpedoes and depth charges; pyrotechnics; clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature. [AAP-6]

1.4. explosive ordnance disposal (EOD)

the **detection**, identification, evaluation, **render safe**, recovery and **disposal** of **UXO**. EOD may be undertaken:

- a) as a routine part of mine **clearance** operations, upon discovery of the UXO.
- b) to dispose of UXO discovered outside **mined areas**, (this may be a single UXO, or a larger number inside a specific area).
- c) to dispose of **explosive ordnance** which has become **hazardous** by damage or attempted destruction.

1.5. munition

a complete device charged with **explosives**, propellants, pyrotechnics, initiating composition, or nuclear, biological or chemical material for use in military operations, including **demolitions**. [AAP-6].

Note: In common usage, "munitions" (plural) can be military weapons, ammunition and equipment

1.6. personal protective equipment (PPE)

all equipment and clothing designed to provide protection, which is intended to be worn or held by a employee at work and which protects him/her against one or more **risks** to his/her safety or health.

1.7. render safe procedure (RSP)

the application of special **EOD** methods and tools to provide for the interruption of functions or separation of essential components to prevent an unacceptable **detonation**.

1.8. standing operating procedures (SOPs)

standard operating procedures

instructions which define the preferred or currently established method of conducting an operational task or activity. Their purpose is to promote recognisable and measurable degrees of discipline, uniformity, consistency and commonality within an organisation, with the aim of improving operational effectiveness and safety. SOPs should reflect local requirements and circumstances.

1.9. submunition

any **munition** that, to perform its task, separates from a parent **munition**. [AAP-6]

mines or **munitions** that form part of a **cluster bomb**, artillery shell or missile payload.

1.10. unexploded ordnance (UXO)

explosive ordnance that has been primed, fuzed, armed or otherwise prepared for use or used. It may have been fired, dropped, launched or projected yet remains unexploded either through malfunction or design or for any other reason.

1.11. United Nations Mine Action Service (UNMAS)

the focal point within the UN system for all mine-related activities. UNMAS is the office within the UN Secretariat responsible to the international community for the development and maintenance of International Mine Action Standards (IMAS)