Technical notes for mine action

TNMA

Technical Note 09.30 /02

Version 2.0

Clearance of Depleted Uranium (DU) hazards

Warning

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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 Over time, some Technical Notes may be 'promoted' to become full IMAS standards, while others may be withdrawn if no longer relevant or if superseded by more up-to-date information.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

There has been recent major media speculation and interest in the potential hazards presented by DU contamination in post-conflict environments. This has resulted in the publication of speculative material about the possible risks to health from DU. Much of this recently published material is not supported by the existing scientific knowledge of the real health hazards posed by DU.

This Technical Note has been written, as an advisory document, to remind mine action managers and field staff of all the potential hazards of DU and to provide guidance on the establishment of a safe operating environments and procedures.

The DU clearance tasks should only be undertaken by appropriately qualified EOD personnel or other qualified staff; they are not a task for basic deminers or other field staff.

Clearance of depleted uranium (DU) hazards

1. Scope

This Technical Note establishes principles and provides guidance on the clearance of depleted uranium (DU) hazards 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 Technical Note 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 (INMAS) and guides.

a) 'should' is used to indicate the preferred requirements, methods or specifications.

b) 'may' is used to indicate a possible method or course of action.

4. Background

Recent conflict has seen the limited use of DU munitions by both air and ground forces to destroy ground targets, mainly AFVs. The legacy of the use of these munitions remains and could be a clearance task for demining organisations in, currently, Bosnia and Herzegovina, Kuwait and Kosovo and following other future conflicts.

DU ammunition is known to be currently in service with the armed forces of Israel, Russia, UK and USA, and is reportedly under development by India. It is thought that DU ammunition is restricted to the following generic types of ammunition;

a) Armour Piercing Fin Stabilised Discarding Sabot (APFSDS) tank and AFV ammunition in calibres including 25mm, 105mm and 120mm;

b) 20mm cannon rounds for the U.S. Navy's Close-In Weapons System (CIWS), commonly referred to as "Phalanx"; and

c) Cannon rounds, both 25mm and 30mm, for U.S. ground attack aircraft, including the A-10 "Warthog," and the AV-8B "Harrier."

5. Reasons for DU hazard clearance

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

a) to reduce risk to human health;

b) to allow destruction of unserviceable or unstable ammunition;

c) to safeguard the environment;

d) to permit environmental clearance of the area;

e) to allow the EOD clearance of armoured fighting vehicles (AFV).

6. The DU threat

6.1. Uranium

Natural uranium is a material of low radioactivity, which can be handled, worked and stored with simple safety precautions. When enriched uranium is manufactured from natural uranium, a residue of depleted uranium is left, which is markedly less radioactive than the initial uranium; it is no more chemically toxic than lead.[1]

Natural uranium exists as three isotopes of different half-life and different radioactivity in the following proportions:

ISOTOPE	ABUNDANCE (ATOM %)	DISCHARGES / MINUTE	HALF-LIFE (YEARS)	REMARKS
^{238}U	99.200%	10^5	10^9	The parent of the natural uranium series.
^{235}U	0.720%	10^6	10^8	the parent of the natural actinium series.
^{234}U	0.006%	10^{10}	10^5	A daughter product of ^{238}U decay.

The ^{235}U and ^{234}U are more active and are therefore more commercially useful isotopes. In order to provide the commercial uranium industry with a standard for the activity of uranium, a level of 0.711 weight% (wt%) of ^{235}U is considered to be natural uranium. ^{235}U was chosen for this standard because it is the most relevant isotope for use as fuel in nuclear reactors. To exceed this 0.711wt% requires processing, to produce what is known as “enriched uranium”. The remaining uranium substrate from which the ^{235}U has been removed to enrich other uranium is known as “depleted uranium” (DU). This DU usually has less than 0.2wt% ^{235}U content.

To display sufficient radioactivity to be commercially useful, uranium requires enrichment to more than 8.0wt%. At this level, the radiation hazard exceeds the metal’s toxicity. DU, with a ^{235}U component of less than 0.2wt% emits too little radiation to cause serious harm, and therefore the hazard is metal toxicity.

DU is a by-product of the uranium enrichment process and is also widely used as ballast or counterbalances in ships and aircraft. It is also used as radiation shielding and in non-nuclear civil applications requiring high-density material.

DU is comprised almost entirely of ^{238}U isotopes; it is approximately 60% as radioactive as natural uranium and behaves, chemically and physically in the same way as natural uranium.

The uranium industry has been operating for over 50 years and the experience gained from handling uranium in its raw, enriched and depleted state over this period has provided the basis for the handling and use of DU. As a result of this experience, care and safety standards have been developed to reduce the potential hazards of handling and using DU to a minimum.

[1] UK Ministry of Defence website, (http://www.mod.uk/index.php3?page=2442).

6.2. Advice and International Responsibilities

Advice on radiation safety and on the disposal of radioactive waste can be obtained from either:

International Atomic Energy Authority (IAEA)
P.O. Box 100
Wagramer Strasse 5
A-1400 Vienna, Austria

Tel: (+43) (1) 2600-0
Fax: (+43) (1) 2600-7
E-Mail: Official.Mail@iaea.org

http://www.iaea.org/worldatom/Press/P_release/2001/du_background.shtml

World Health Organisation (WHO)
Avenue Appia 20
1211 Geneva 27
Switzerland

Tel: (+41) (22) 791 2599
Fax: (+41) (22) 791 3111

E-Mail: inf@who.int
http://www.who.int/inf-fs/en/fact257.html

The IAEA has statutory responsibilities for establishing standards for the protection of health against exposure to ionising radiation and for providing for the application of these standards at the request of any State. In fulfilment of these functions, the IAEA has established a comprehensive corpus of radiation safety standards in close collaboration and consultation with other relevant organisations in the United Nations system.

The International Basic Safety Standards for Protection against Ionising Radiation and for the Safety of Radiation Sources (Basic Safety Standards), which were established jointly with the International Labour Organisation (ILO) and other international organisations including the WHO, are the authoritative radiation protection standards for assessing the potential radiological impact of the uses of DU.

The exposures to which the requirements of the Basic Safety Standards apply are any occupational exposure, medical exposure or public exposure. However, they only cover risks of radiation and do not cover the toxic risks that may be associated with uranium intake. In the past, the IAEA, based on its statutory mandate and competence has prepared comprehensive scientific radiological impact assessments.

6.3. DU ammunition

DU is used in kinetic energy attack munitions because of its metallurgical properties; it is metallurgically similar to steel, thereby allowing similar production and processing techniques to be used. The very high density[2] allows for much higher kinetic energy[3] levels to be delivered to the target than an equivalent round made of, for example, steel. A secondary effect is that the DU oxidises readily, thereby proving a pyrophoric effect within the target.

The combination of design, high mass and high velocity allows the DU round to penetrate the target using the principle of hydrodynamic penetration. The pressures involved are so high that the armour of the target flows away from the DU penetrator

6.4. Identification of DU fragments

DU fragments have the following physical characteristics:

a) non-magnetic;

b) extremely heavy. In relation to size DU is 60% more dense than lead;

c) jet-black lumps or dust, possibly with a greenish tinge. After three to four weeks they will turn green;

d) honeycombed. The fragment will have an aerated texture;

e) they retain heat. DU fragments will retain heat to the point where they will cause serious burns for three to four hours after firing. A red hot core may be coated with black dust and therefore appear cool; and

f) sparking. When cold, if struck with a metallic object such as a pick or shovel, they will spark in a similar fashion to a lighter.

6.5. Depleted Uranium (DU)

6.5.1. Health hazards

The health hazards depend on:

a) the route of exposure, (inhalation, ingestion or contact in wounds);

b) the magnitude of exposure; and

c) the particle size and solubility of DU.

Effects due to external exposure would be limited to radiological effects, whilst the effects due to internal exposure include both radiological and chemical toxicity effects.

Information on the health and environmental effects of DU is limited. However, since uranium and DU are essentially the same, except for the composition of their radioactive components, scientific studies on natural uranium are applicable to DU.

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[2] Density (D) = Mass (M) / Volume (V).

[3] Kinetic Energy (KE) = ½ Mass (M) x Velocity $(v)^2$.

Notwithstanding these hazards, the real risks have been assessed as minimal, provided appropriate safety precautions are taken and followed.

6.5.2. Radiation dose rate

DU emits alpha, beta and gamma radiation. Alpha radiation will not penetrate clothing or even skin. The radiation dose rate at the surface of unshielded DU is approximately 2.3 milli sieverts per hour (mSv/hr). A large proportion (98%) of this dose rate is attributable to beta radiation.

The density of DU means that only radiation emitting from the surface is a factor, as the DU itself shields the internal emissions.

Despite this decay rate, it is emphasized that DU is not a nuclear, radiological or chemical weapon; the DU is used because of its high atomic mass/density and metallurgical properties.

6.5.3. Hazard reduction

The bare DU material (either as a complete round or as pieces of a fired penetrator) would have to be handled in excess of 200 hours before the UK Safe Exposure Limit (SEL) of 500mSv (for the hands) is exceeded. This SEL is extremely conservative. The external radiation hazard to the hands can be significantly reduced by the wearing of gloves that attenuate the beta dose further, giving safe times of up to 5000 hours per year.

The risk can therefore be considered to be low and it becomes negligible once gloves are worn.

6.5.4. DU dust

A slightly increased hazard to those undertaking EOD clearance arises from the presence of DU dust produced as a result of fire or explosion. Ingestion, inhalation or the passage through an open wound or abrasion of DU particles could, but is very unlikely to, affect the kidneys and lungs.

Insoluble DU particles could accumulate in the lung parenchyma; this presents a low toxic risk because of the insolubility, but could lead to localised low-level radiation damage.

Soluble DU particles at a low concentration level can be rapidly excreted by the kidneys without damage. At very high concentrations, there is a possibility of renal necrosis followed by regeneration. However, to reach these high levels, an individual would have to be exposed to DU dust particles, without any form of personal protection, for a very long time. Normal EOD operations require the use of PPE, and are completed long before there is any real risk of surpassing even the low concentration levels.

The UK Defence Radiological Protection Service (DRPS) consider the precautions recommended in this Technical Note are more than adequate to provide protection. Good personal hygiene, such as the covering of cuts and grazes before work commences and the washing of hands after work will further reduce the already small hazard.

The respiratory protection requirement is related more to the chemical toxicity of DU than to its radioactivity. The danger from heavy metal poisoning may exceed the radiation hazard.

6.5.5. DU contamination from stored or unbroken fired rounds

In all DU ammunition, the DU component of the projectile or round is contained within a steel or aluminium jacket. Should it be obvious that the projectile or round is intact, being either unfired or having impacted on a soft surface, and the jacket appears to be unbroken, the rounds have almost nil hazard.

6.5.6. DU fragments and contamination from fired rounds

As the sub-projectile, (penetrator), of DU ammunition hydro-dynamically penetrates through a target it breaks up into fragments, some of which can be quite large. At the same time, very high temperatures are generated within the DU and DU oxide is dispersed into the atmosphere, albeit in very small quantities.

DU fragments will be in all shapes and sizes. Some may still be oxidizing and, as such, their cores will remain red hot up to some hours after firing.

7. Equipment

7.1. Personal Protective Equipment (PPE)[4]

The following PPE should ideally be used by the EOD technician or qualified staff member until the presence of DU can be positively discounted:

a) inner cotton gloves;

b) outer heavy PVC gloves of industrial quality;

c) respirator[5] or face mask; and

d) protective trousers and overboots. (Optional to protect clothing).

The aim of the PPE should be to provide complete overall protection from inhaled or skin-contact dust, and cuts from sharp fragments. Managers unable to obtain military equipment should use the best materials, and ingenuity, to achieve this requirement.

7.2. Thermoluminescent Dosimeter (TLD)

The EOD technician should wear a TLD during DU clearance operations. Personal dosimetry and health checks should be co-ordinated with a local appropriately qualified medical facility. TLDs can be obtained from a variety of sources. The following have been identified from an Internet search; there will be many others:

a) Landeur. (http://www.landaueriii.com/);

b) Proxtronics Incorporated. (http://www.radiationmanagement.net/); or

c) Rados Technology. (http://www.rados.fi/).

Information on how thermoluminescent dosimetry works can be found at http://www.ab.ust.hk/sepo/tips/rp/rp002.htm.

7.3. Portable Contamination Meter (PCM)

A Portable Contamination Meter (PCM) - Type Mini Monitor fitted with a B-6-H GM Tube, is a small, sensitive but rugged instrument used for the purpose of detecting DU contamination.

[4] This PPE is additional to the PPE requirements contained within IMAS 10.30.

[5] 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.

An Internet search will provide a wide range of suppliers for these instruments.

7.4. Alternative methods

Where dosimeters or PCMs are not available, and there is historical evidence of the use of DU ammunition by one party to the conflict, then all AFVs are to be considered suspect and full precautions taken accordingly.

8. DU clearance methodology

8.1. Detection of DU contamination

8.1.1. Use of PCM

It may not always be possible to identify DU contaminated areas visually. Normal radiological instruments are not sensitive enough to be of any use; therefore it is recommended that a Portable Contamination Meter (PCM) should be used.

8.1.2. Personal Dosimetry and Health Checks

At least one member of each EOD or specialist team is to be nominated as a Control Member and issued with a Thermoluminescent Dosimeter (TLD), which is to be worn whenever EOD duties are being carried out in areas where DU ammunition has been fired. In addition to wearing a TLD, which is to be exchanged each month, collection of a urine sample from the same Control Member of each team is to be arranged, again on a monthly basis. This should be coordinated with a local appropriately equipped medical facility.

The demining organisation should ensure that personnel medical records are annotated that they have worked in a potential DU environment to allow for regular monitoring in the future.

8.2. Personal protection

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.

DU contamination is relatively harmless unless ingested or absorbed into the bloodstream through open cuts. Fragments of the DU penetrator are extremely sharp and liable to cause cuts if handled carelessly.

8.2.1. Simple precautions

The following simple precautions will reduce the risk of DU contamination and serious risks to health:

a) sleeves are to be rolled down and two pairs of gloves, inner cotton or nylon and outer heavy PVC are to be worn. Care is to be taken to avoid sharp objects that may rip the gloves and expose the skin;

b) allow a minimum of four hours to elapse after firing before attempting to carry out range clearance. Fragments of DU penetrator are red hot internally for up to four hours after firing;

c) a respirator is to be worn at all times. This will protect against the ingestion of any DU oxide that is released due to the movement of fragments. In the absence of a respirator, a damp face veil tied around the nose and mouth, or a medical or industrial face mask, will provide adequate protection;

d) do not use the boot to turn over or move fragments. Always use a CV Tool, stick, scoop or similar item as a remote tool; and

e) in order to prevent contamination of personal clothing and footwear, coveralls and overboots are to be worn if considered necessary.

8.2.2. Casualties

The appropriate medical authorities are to be informed of any casualties that occur whilst in a DU contaminated area.

8.3. Collection, disposal and decontamination

8.3.1. Collection

8.3.1.1. Box Preparation

The container used must be a robust metal box of suitable size and without holes. The box must be strong enough to carry the heavy weight produced by even a small quantity of DU and it must be capable of being secured so as to prevent any leakage of the contents. Wooden or cardboard boxes are not to be used as they will absorb contamination.

A 20 mm lining of a suitable material such as sand or earth is to be inserted into the box. This lining is used as a packing medium to hold the DU fragments, absorb any DU oxides and prevent fire. The 20 mm lining should be built up around the sides and on top of each layer of fragments as the box is filled. A final layer of sand or earth is to be added to the top before the box is closed.

8.3.1.2. DU Fragments

When collecting DU fragments, a little earth or sand should be lifted with the fragment. This process assists in masking any oxides that may surround the DU fragments.

8.3.1.3. Box Marking

Once filled with fragments and topped with sand or earth the box is to be closed and sealed to prevent leakage. The box is to then be marked **CAUTION RADIOACTIVE MATERIAL - DU FRAGMENTS** and the appropriate Trefoil sign applied.

8.3.1.4. Manual Transportation

Although DU fragments only represent a low toxicity Alpha source hazard, filled boxes should not be carried close to the body. They should be held away from the body as far as is reasonably possible. Two or three boxes may be carried between two persons using a robust 6 ft pole through the handles.

8.3.2. Disposal

Filled boxes should be moved to a collection point, (fenced off and suitably marked and signed), and stacked ready for removal by a specialist hazardous and radiological waste disposal company.

It should be noted that because DU is so dense it acts as radioactive shielding, as a result the internal boxes in a stack are shielded by the outside boxes. In addition the dose rate at the surface is reduced by distance based on the Inverse Square Law. A relatively small distance will reduce the level of absorbed radiation appreciably and therefore fencing need only be 1 m from the stack.

8.3.3. Decontamination

8.3.3.1. Surface decontamination

Decontamination of the ground surface by the removal of spent but unbroken penetrators or rounds can be achieved by physical removal of the items. The same precautions as for DU fragments (Clause 8.3.21.2) should be used in the event of jacket rupture, and the fragments should be stored whilst awaiting specialist removal in accordance with Clause 8.3.2.

8.3.3.2. Target decontamination

Decontamination of targets can be achieved by vigorously throwing several shovelfuls of sand or earth at the target in the area of penetration. This removes any traces of DU oxide on the surface and any residual DU fragments in the target can then be collected. Using the PCM, check the area immediately below the target for contamination and collect any contaminated sand or earth. Any fragments or contaminated sand or earth must be boxed in accordance with the procedure laid down in Clause 8.3.1.

8.3.3.3. Jammed penetrators

Occasionally a partial penetration of a target resulting in a jammed penetrator may occur. The surface is to be decontaminated in accordance with the procedure laid down in Clause 8.3.3.1. The penetrator is then to be left for between 7 to 14 days. During the weathering process the penetrator will shrink and can then be removed with a sharp knock.

8.3.3.4. Cross contamination

Having taken all precautions to prevent injury and contamination in the area of operations it should be remembered that clothing and footwear may have become contaminated and could remain so for a considerable period of time. Any item suspected of being contaminated should be cleaned immediately and checked using a PCM.

Normal personal hygiene of washing the face and hands or taking a shower will overcome any further possibility of cross contamination.

9. Safety brief

Demining organisations should ensure that all of their managerial, demining, administrative and support staff are briefed as to the hazards of DU if they have to move in a potential DU environment. (Their EOD or specially qualified personnel should already be trained in the hazards of DU). Although such personnel will not be actively involved in the clearance of DU hazards, they may inadvertently place themselves in a potentially hazardous situation by examining targets hit by DU munitions.

The following safety brief [6] should be made available to such personnel:

DU is a heavy metal, which is used primarily in anti-armour ammunition in the main armament of battle tanks, and in the cannon of some ground attack aircraft. It is only slightly radioactive and it has a chemical toxicity similar to lead.

There is no appreciable hazard when the DU round is intact, even after firing, but there is a minor hazard when the DU round strikes a hard target. This can result in DU dust and fragments around the target to a radius of 50m. There is only a risk if particles are eaten, breathed in or enter the body through an open wound. Even then, there is only a very slightly increased risk of cancer, or liver failure, over the next 50 years.

You should be aware that it will not be possible, without special instruments, to detect whether a damaged target has been struck by DU. The following precautions should be taken.

a) *Do not enter or climb onto a damaged hard target, or loiter within 50 metres, unless you are working in co-operation with an EOD technician.*

b) *If your work requires you to work within 50 metres, wear a facemask and gloves, and roll your sleeves down. Cover any cuts and abrasions with waterproof dressings. Spend as little time as practicable on the task.*

c) *Do not eat, drink or smoke near the damaged target. After completing your task, wash and shower as soon as practicable. Remove your outer clothing and, if feasible, replace it. Otherwise, have it laundered. Do not eat, drink or smoke until you have done so.*

d) *If you suspect you have been exposed to DU, inform your medical support team.*

10. Responsibilities

10.1. National mine action authority

The National Mine Action Authority is responsible for warning all mine action agencies of any armoured conflicts that have taken place, and any history of the use of DU rounds. The Authority should be aware of these Notes, and make copies available, through the National Mine Action Centre, to all mine action agencies, including those involved in Mine Awareness.

10.2. Demining organisations

The manager of any mine action team should also be aware of these notes, and if the use of DU ammunition is suspected or proved, should include the recommendations of these notes in SOPs. The manager is also responsible for ensuring the presence of a trained EOD staff member, or for sending a staff member for specific training in DU hazards. Where a National Mine Action Authority of Mine Action Centre have not been established, managers are responsible for establishing amongst themselves a code of practice to ensure the safety of mine action staff and locals.

10.3. Demining personnel

All mine action staff working in areas of potential DU contamination, should make every effort to keep themselves free from DU dust hazard by conscientious use of protective equipment, and strict observation to SOPs and the dictates of common sense.

[6] Developed from the DU Safety Brief given to NATO troops prior to deployment to the Balkans.

Annex A
(Normative)
References

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

a) IMAS 04.10. Glossary of demining terms.

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.mineaction.org). 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. 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.

1.9. 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)