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Explosive Ordnance Disposal

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Introduction

Explosive Ordnance Disposal (EOD) involves the disposal of Explosive Ordnance (EO), including mines, and Explosive Remnants of War (ERW). However, in accordance with Protocol V of the Convention on Certain Conventional Weapons (CCW), ERW includes Unexploded Ordnance (UXO) and Abandoned Explosive Ordnance (AXO), excluding landmines.

While, in practice, EOD operations include disposal of all EO, including mines, the main focus is on the disposal of ERW and the majority of ERW found during demining operations are small items of UXO and EO such as sub-munitions, grenades and mortar ammunition. However, ERW can also include larger items such as artillery ammunition, guided missiles, air-dropped bombs and caches of AXO. The wide variety of size and complexity of ERW requires special attention to be given to the management of EOD and the qualifications required to deal with the varying devices.

The aim of this standard is to provide specifications and guidance for the management of EOD as part of mine action in Sri Lanka. It covers general principles and management responsibilities for EOD. It does not provide specific technical guidance for the disposal of particular mines and ERW.

Explosive Ordnance Disposal

1 Scope

This standard provides specifications and guidelines for the safe conduct of Explosive Ordnance Disposal (EOD) operations as part of the national mine action programme. It applies to the disposal of mines and other explosive ordnance (EO) found in Sri Lanka during mine action activities.

2 EOD Procedures and Operations

2.1 General Principles

EOD operations involve the detection, identification, field evaluation, render safe, recovery and disposal of EO. EOD may be undertaken as a routine part of mine clearance operations following the discovery of ERW in or near hazardous areas. EOD operations may also be undertaken to dispose of ERW discovered outside hazardous areas. Such operations may involve a single item of ERW, or a number of items at a specified location such as a mortar or artillery gun position. It may also involve stockpiles of ammunition, AXO left in bunkers or ammunition points. The standard does not however address the destruction of stockpiles of anti-personnel landmines in accordance with the Anti Personnel Mine Ban Convention (APMBC).

Demining organisations shall be responsible for the establishment and maintenance of a capability to manage and to conduct EOD in a safe and effective manner. This involves a formal risk assessment of the ERW hazards and the development of a safe and effective EOD capability. Such a capability shall include the preparation of appropriate procedures for neutralisation and disarming, the use of well trained and qualified deminers and EOD operators, and the use of effective and safe equipment, stores and supplies.

The principle that is currently being maintained in Sri Lanka is that the disposal of mines and ERW by detonation is to be conducted by qualified EOD staff of the Sri Lankan Engineer Brigade on request from the demining organisation. The disposal of mines by burning shall be conducted by the demining organisation with representation from members of the Sri Lankan Engineer Brigade. The demining organisation shall however remain in command and control during both situations and shall ensure that the EOD activities conducted are in accordance with this standard.

The principle of disposing of mines and ERW on the same day that it is found should be maintained as far as possible. Organisations shall make arrangements with the Sri Lankan Engineer Brigade HQ at their earliest convenience when a new work site is started to ensure that an EOD team is task and located by the Engineer Brigade as near as possible to provide daily support. In situations where it is impossible the organisation should apply for written permission from the Sri Lankan Engineer Brigade HQ for the safe storage and transportation of mines/ERW. Where the circumstances and situation are as such that the principle of the same day disposal cannot be maintained the destruction of all found mines and ERW shall be done at 'n minimum of once a week when the appropriate written approval is obtained from the Sri Lankan Engineer Brigade HQ.

2.2 Qualifications

EOD training and qualifications should be appropriate to the mine and ERW threat encountered in Sri Lanka. The training and qualifications of all EOD operators in Sri Lanka shall be in accordance with SLNMAS 03 and SLNMAS 06. The following is a guide:

 a Level 1 (EOD) qualification enables the trained holder of the qualification to locate and expose and to destroy in situ, when possible, single items of mines and ERW on which the individual has been trained;

- b. in addition to the skills of a Level 1 (EOD) qualification, a Level 2 (EOD) qualification enables the holder to determine when it is safe to move, transport and dispose of single or multiple items of mines and ERW on which the individual has been trained.
- in addition to the skills of a Level 1 and 2 (EOD) qualification a Level 3 (EOD) qualification enables the holder to conduct render-safe procedures and final disposal of any type of explosive ordnance on which the individual has been trained; and
- d. in addition to the skills of a Level 1, 2 and 3 (EOD) qualification, a Level 4 (EOD) qualification is for specialist EOD operators who have been trained and are qualified to destroy the remaining EOD hazards with specialised EOD techniques. Such specialist skills may include the render safe of liquid propellant systems, disposal of Depleted Uranium and the clearance of conventional munitions with improvised firing systems. The Level 4 (EOD) qualification shall clearly indicate the specialist training received by each individual.

Some ERW fall within the guidelines for the above qualification levels but present a specific or additional hazard. Examples are items containing White Phosphorous (WP), missiles, or the requirement for bulk demolitions. Special consideration should be given to the need for additional training, or for specific exclusion from the category of competence.

Where particular items are frequently encountered, specific training in the disposal of these items may be given to enable the operator to deal with them rather than continually refer the problem to the next higher level of expertise.

It should be noted that sub-munitions may be particularly hazardous to deal with and should only be dealt with by level 2 or above qualified personnel.

2.3 Quality and Audit of the Qualifications

The EOD qualifications of the EOD operators of a demining organisation shall be audited by the NMAC during the accreditation process. Performance criteria and performance assessment tools shall be developed as part of the operational accreditation phase in order to assess the level and quality of competence of EOD operators.

CWA 15464:2005 - Humanitarian Mine Action - EOD Competency Standards (5 parts) provides guidance on the competencies needed for EOD levels 1, 2 and 3 and is designed to enhance the process of planning and evaluating EOD operators development and capacity building. Its use can also help improve the assessment of training and competency of operators involved in EOD work.

2.4 Neutralisation and Disarming Procedures

Individual mines and ERW should be destroyed or neutralised in situ when it is not safe to move them to a nearby disposal site. This will, among other things, help to reduce the contamination of the area with metal fragments from an in-situ detonation. The decision, whether to move a mine or ERW, or a particular type, or not, should be based on an assessment by an appropriately trained EOD operator. If the fuze system is such that it is safe to move for nearby disposal, it may be moved. If the fuze system makes it simple to render the mine/munition safe by neutralisation and/or disarming, it should be rendered safe prior to moving it to a suitable location for disposal. A community liaison function that ensures local people know what is occurring should be a routine activity incorporated with EOD operations.

Demining organisations, with an integral EOD capability, shall prepare Standard Operating Procedures (SOPs) for neutralisation and disarming procedures which are appropriate for

the mine and ERW hazards likely to be encountered in Sri Lanka and which are consistent with accepted international EOD practice.

Demining organisations in Sri Lanka may train and utilise team leaders and senior supervisors that are not EOD qualified to safely neutralise, to disarm and to remove the following mines from the working lanes to a previous identified and marked mine/UXO pit at the work site. The training shall be officially and certificates shall clearly indicate what the individual is trained to do:

- Jony 95
- Jony 99
- Rangan
- AP-E
- P4 Mkl and II
- PMB 1
- VS50

2.5 EOD Response

Where ERW is found outside hazardous areas by a member of the local population or other organisations it is normally reported to the local police, nearest military installation, nearest demining organisation and/or a MRE organisation. In the majority of the cases where the ERW is reported to the local police or military installations the EOD response is conducted by a SLA EOD team tasked by the local military unit.

ERW reported to a demining organisation should be removed and/or disposed off as quickly as possible by the demining organisation utilising their EOD capacity. When the demining organisation is unable to do so the organisation shall mark the item clearly and report it to the Sri Lankan Engineer Brigade EOD team that is allocated to them for support or the organisation shall submit a mine/UXO report to the RMAO as described in SLNMAS 13.

Where ERW is reported to a MRE team the MRE organisation shall submit a mine/UXO report in detail to the RMAO and also arrange with the local demining capacity to respond with their EOD capacity to remove and/or dispose of the item(s).

When the RMAO receive mine/UXO reports the office shall submit a request to the HDU through the Sri Lankan Engineer Brigade to conduct the EOD response as quickly as possible.

UXO spot tasks shall be reported by the demining organisations in their weekly progress report to the RMAOs as mentioned in SLNMAS 13.

3 Methods of Destruction

Two methods for the destruction of mines/ERW may be utilised in Sri Lanka, namely:

- a. Detonation.
- b. Open burning.

The method used in the disposal of particular explosive ordnance depends upon its type of explosive filling and design, therefore knowing the explosive filling is the first step towards determining the best method for its destruction.

The methods utilised by the demining organisation shall be fully described within the organisation's SOP.

3.1 Detonation

Demining organisations shall prepare SOP for the effective and safe destruction of relevant mines and ERW. These should include the destruction of mines and ERW in-situ, or mines and ERW, including AXO, recovered and destroyed individually. Destruction of bulk AXO should be advised and conducted by suitably trained EOD operators.

Special attention shall be given to ensuring the containment of blast and fragmentation effects resulting from the destruction of mines and ERW. EOD operators shall be conversant with all protective works techniques, calculations and construction methods. Organisations are to include protective works measures in their EOD SOP. The implementation of sufficient safety distances and the isolation of any danger area by the use of sentries and warnings are of utmost importance and shall also be clearly specified.

Sites chosen for bulk destruction shall be located sufficiently far away from populated areas so as to represent no risk.

SOPs shall contain details of the organisations procedures/methodology for calculating and implementing danger areas. See Annex A.

Electrical initiation of explosive charges shall be the preferred method of initiation.

All safety precautions and safety rules applicable to the destruction of mines and ERW by means of detonation shall be clearly defined in the organisations SOP.

3.2 Burning

This is generally used with propellant (bagged or loose), smoke, pyrotechnic and lachrymatory munitions but it is also suitable for the plastic-bodied AP mines found in Sri Lanka after the fuses are removed.

The AP mines can be burned individually or in a group of not more than 50 mines at a time in a burning pit.

The detonators/boosters may also be burned but separately from the AP mines.

The burning of the mines shall be described in detail in the demining organisation's SOP.

Safety distances, sentries and warning signs shall be maintained during the burning process.

3.3 Military presence during demolitions and burning

As mentioned under paragraph 2.1 that the Sri Lankan Engineer Brigade shall be present during the demolition process, the demining organisations are to ensure that their presence is arranged in time and that the soldier in charge certifies the destruction of all the mines/UXO by signature.

3.4 Reporting

All EOD tasks are to be recorded in the weekly progress report. See SLNMAS 13: Reporting and reporting formats.

4 Siting of disposal sites and the estimation of explosion danger areas

4.1 Disposal Sites

A disposal site is an area authorised for the destruction of mines and ERW found during demining operations. These in turn are referred to as demolition grounds and burning grounds and may be co-located on a disposal site.

Disposal sites shall be sited to ensure that the hazards associated with destruction operations are reduced to a tolerable level and the environment should be protected.

Disposal sites shall be identified by the demining organisations in accordance with the destruction activity that they want to perform and the safety distances related to the estimated explosion danger area.

4.2 Approval of disposal sites

Demining organisations shall identify and approve their own disposal sites on condition that it is done by a suitable qualified Level 3 EOD operator. Such approval shall be based on professional ammunition technical knowledge and after the completion of a documented appreciation by the organisation. The demining organisation shall submit the SOP for the use of the disposal site with the required maps and overlays to the RMAO for registration.

4.3 Standard Operation Procedures

The SOP shall clearly describe the location of the disposal site, the use and limitation of the disposal site, the standard rules and regulation regarding the site and the standard site/range orders when the site is in use.

4.4 Maps and grid references

Maps shall be sent to the national authority with the draft SOPs. These shall include:

- a. a map of the general area upon which the name and area of the disposal site are shown along with the boundary grid references. This information should be repeated in the body of the SOP; and
- b. a larger scale sketch map of the disposal site showing its layout. This sketch map shall be included as an Annex to the SOPs. The layout of the disposal site shall be worked out with careful regard to safety and once approved shall not be changed without the approval of the NMAC.

4.5 Locations of sentries and observation posts

Sentries shall be sited so that they control all possible access routes into the disposal site. Sentries will normally be located on the edge of the disposal site in Splinter/Fragment Proof Shelters (SPS). When SPS are not available the sentries shall be located outside the danger area.

4.6 Marking of the disposal site

Disposal sites shall be marked with notice boards positioned outside the danger area on all possible approaches into the site. Notice boards shall provide notice to the local communities of the purpose of the site, the warning systems in place (sentries and other warning systems), the hazards associated with the site (both during destruction operations and afterwards) and the possible consequences of ignoring warnings. Notices shall be written in the local language(s) and use symbols for those who cannot read. Disposal sites

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4.7 Location of the firing point

When the firing point is located near the point of detonation inside the danger area it shall be within a SPS. When this is not possible the firing point shall be located outside the danger area.

4.8 Communications

Good communications are essential to safety. The following communication links shall be established prior to destruction operations commencing:

- a. between the firing point and any emergency services, for example fire, medical or police, Communication links may be through a higher headquarters; and
- b. between the firing point and the sentries. There shall also be a back up system for example horns, sirens or whistles.

The SOPs shall list all the emergency callsigns/telephone numbers and lay down accident reporting requirements.

4.9 Explosive limits and estimation of the explosion danger area

Explosive limits shall be established for each disposal site. Explosive limits are determined by two main limiting factors:

- a. <u>maximum fragmentation range</u>. This determines the explosion danger area and all persons and equipment shall be either outside this area or under shelter in SPS. The perimeter of the disposal site shall contain the explosion danger area. TN 10-20-01/2001 provides guidance on the calculation of estimation of explosion danger areas. The size of the disposal site will therefore provide the explosive limit. No open detonation shall be permitted with a Net Explosive Content (NEC) above the limit where fragments may travel further than the perimeter of the disposal site. The table from TN 10-20-01/2001 indicating the danger areas is attached as Annex A for your convenience; and
- b. ground shock and noise effect. The 'tolerance' level of the local communities to the effect of shock and noise on themselves and their property has to be determined. This may impose lower explosive limits than the maximum fragmentation range.

4.10 Personnel limits

The number of persons present shall be the minimum required to ensure safety and efficiency. Certain tasks are subject to mandatory minimum personnel limits, which should be included in the detailed procedures for these tasks.

4.11 Spectators

Spectators shall be allowed at official demonstrations only. Spectators (or their organisations) shall be required to sign a standard indemnity form before the

demonstration commences. The procedures for dealing with visitors to the disposal site shall be defined in the SOP.

4.12 The control of destruction operations

See Annex B for the regulations regarding the control of destruction operations.

5 Responsibilities

5.1 The Sri Lankan National Mine Action Centre

The NMAC shall:

- a. establish and maintain national standards for EOD procedures;
- b. establish and maintain national standards for the qualification of EOD operators;
- c. establish and maintain the capability to accredit demining organisations involved in EOD operations;
- d. ensure the appropriate disposal sites are identified by demining organizations as required, that all disposal sites are registered at the NMAC and the guidelines and procedures (SOP) for their safe and efficient use are approved;
- e. establish and maintain the capability to monitor the effectiveness and safety of demining organisations involved in EOD operations;
- f. establish national systems for EOD incident reporting; and
- g. where necessary, seek assistance from other national governments in accordance with bilateral and international arrangements to obtain the specialist expertise and information necessary to establish safe and effective national standards for EOD procedures and EOD operations.

5.2 Demining Organisations

Demining organisations shall:

- a. gain from the NMAC accreditation for EOD operations;
- b. establish and maintain SOPs for EOD operations which comply with this national standards and which reflect local conditions and circumstances;
- c. ensure that the EOD operators are competent and suitably trained;
- d. identify and approve appropriate disposal sites and registering of the disposal sites at the NMAC in accordance with this standard;
- e. apply SOPs for EOD operations in a consistent, effective and safe manner; and
- f. ensure that the affected community is fully cognisant of all EOD activities in the area and the implications for the community, (particularly related to the depth of clearance).

Annex A Multi-item demolition danger area tables (fragmentation)

The Danger Areas shown in this table have been pre-calculated for ease of use:

AUW¹	R = 634 x (AUW) ^{1/6} (meters)	R = 444 x (AUW) ^{1/6} (meters)	R = 130 x (AUW) ^{1/6} (meters)	Remarks
(kg)	Public Access	Controlled Access	No Fragmentation Hazard	
(a)	(b)	(c)	(d)	(e)
1	634	444	130	
2	712	498	164	
3	761	533	187	
4	799	559	206	
5	829	581	222	
10	931	652	280	
20	1045	732	353	
30	1118	783	404	
40	1172	821	445	
50	1217	852	479	
60	1254	879	509	
70	1287	901	536	
80	1316	922	560	
90	1342	940	583	
100	1366	957	603	
150	1461	1023	691	
200	1533	1074	760	
250	1591	1114	819	
300	1640	1149	870	
350	1683	1179	916	
400	1721	1205	958	
450	1755	1229	996	
500	1786	1251	1032	
1000	2005	1404	1300	
2000	2250	1576		
3000	2408	1686		Controlled
4000	2526	1769		Range and Bare
5000	2622	1836		Explosive Range converge at this
10000	2943	2061		point.
20000	3303	2313		

Note: The IMAS danger area support tool, included on the IMAS website and IMAS CDs may also be used to determine the fragmentation danger radius.

 1 AUW = All Up Weight. The NEC (Net Explosive Content) has been used for the R = 130 x (NEC) $^{1/3}$ column calculations, as this formula should be used for bare explosive or

munitions with no fragmentation hazard.

Annex B Control of destruction operations

1 On arrival before destruction operations commence

1.1 Fire making and smoking materials

The destruction operations supervisor shall apply the fire making and smoking materials restrictions and advise all personnel of smoking break arrangements.

1.2 Briefings and nominal roll

The destruction operations supervisor shall:

- a. check the nominal roll and brief all personnel on the task. This shall include a safety and emergency support brief;
- b. establish the medical point for the medic and all medical equipment. This shall be in an SPS if inside the danger area;
- c. brief the sentries on their duties and the communication requirements. Post the sentries and position any warning signs or symbols;
- d. detail the routes for vehicles and personnel; and
- e. detail the parking area. All vehicles shall be parked outside the danger area while destruction operations are in progress.

1.3 Safety checks

The destruction operations supervisor shall:

- a. check the communication links to any higher authorities, external support agencies and to the sentries;
- b. check that vehicle routes are clear of any hazardous items and if any are present arrange for their disposal. This shall be checked before destruction operations commence and after each serial;
- c. ensure that vehicle routes do not cross firing cables unless the cables are adequately buried;
- d. nominate a safety vehicle. This is to be equipped with a stretcher and blankets. It is to remain available for the evacuation of casualties throughout the destruction operation;
- e. if the destruction operation involves burning or there is the risk of fire ensure that adequate fire fighting cover (personnel and equipment) is available on site:
- f. check the demolition pits (where applicable) for any hazardous items and if any are present arrange for their disposal. The destruction operations supervisor shall check for hazardous items before destruction operations commence and after each serial He/she shall establish a safe route into the pits (using sandbag steps as necessary) and ensure that working areas are stable and safe;

- g. Ensure that personnel do not walk or stand over undercuts into the sides of pits; and
- h. where appropriate for example with NG based explosives, establish hand washing facilities and give instructions that all persons who handle such explosives shall wash and scrub their hands before they eat or drink.

1.4 Unloading of munitions

The destruction operations supervisor shall:

- a. order the unloading of munitions. Serviceable and unserviceable items shall be kept separated. A nominated individual shall control the accounting and issues for each serial:
- b. ensure that vehicles keep to hard standing surfaces or tracks. Create sandbag 'stepping stones' for personnel as necessary;
- c. ensure vehicles do not approach within 30 metres of the demolition pits or of unpacked munitions or explosives; and
- d. ensure engines are switched off during loading and unloading.

1.5 During disposals

1.5.1. Supervision and control

The destruction operations supervisor shall remain free to supervise all activities. He/she shall not become responsible for the activities of one group or area to the exclusion of others.

The person nominated to control the accounting and issues for each serial shall remain free to guard the munitions for destruction, and explosives.

1.5.2. Safety

1.5.2.1. **General**

Observe all safety precautions.

1.5.3. Preparation of the demolition or burn

Safe areas away from the edge of the pits shall be selected for the unpacking and preparation of munitions and explosives. Serviceable and unserviceable items shall be prepared in separate areas:

- a. protect sensitive items when unpacked. Do not step on or over munitions or explosives, this includes detonating cord;
- b. do not contaminate explosive preparation areas with explosive residue during preparation;
- c. safely dispose of all explosive contaminated material; and
- avoid the inclusion of packaging materials in stacks as much as possible.
 Check all surplus packaging as Free From Explosives (FFE) and remove to a central empty package point.

Position undercuts and stacks positions in the pits so that the blast and fragmentation/debris effects are minimised and directed away from sensitive areas.

Test the firing cables before each serial.

1.5.4. Stack configuration

In terms of the stack configuration, the destruction operations supervisor should aim for:

- a. the minimum use of serviceable explosive to ensure the complete destruction of the item(s) being destroyed;
- b. making the best use of the explosive fillings of items to effect their destruction;
- c. the correct mixture of high capacity and low capacity items in mixed stacks;
- d. no air gaps between separate items and the minimum amount of metal/material between explosive fillings;
- e. stacks and their explosive chains to be stable enough and sufficiently shielded so as not to be affected by detonations in other pits; and
- f. avoiding placing unbagged earth directly onto stacks. Tamp with sandbags as this facilitates digging out partial explosions.

1.5.5. Preparation of the detonating cord

Ensure that detonating cord:

- a. is as straight as possible and not crossed over;
- b. has taped junctions of at least 100 mm and spare ends of at least 300 mm. The cut ends should be taped over to prevent moisture ingression, prevent spillage of loose explosive and thereby reduce the risk of a misfire due to detonating cord failure; and
- c. all junctions should be outside the pit and the main lead should extend at least two metres out of the pit. This facilitates dealing with misfires.

1.5.6. Tools and explosives

Tools and explosives shall be carried in separate marked boxes. Loose items shall not be carried on the person. Detonators shall be carried in totally enclosed, marked metal boxes.

1.6 At close of work

The destruction operations supervisor shall:

- a. search the disposal area, ensure that it is free from any hazardous components and free of all litter contamination;
- b. ensure that empty packages are re-inspected, sealed and marked as FFE;
- reconcile the closing stocks of munitions and explosives with the record of what has been destroyed. Do not allow personnel to leave the disposal site until all discrepancies have been satisfactorily investigated and explained;
- take a declaration from each person in the destruction party that they have no explosives, munitions or accessories in their possession before they leave the disposal site; and



Amendment record

Management of SLNMAS amendments

Amendments to this document will be published periodically. An accurate record of amendments is to be maintained in the table below.

Any comments, suggestions or proposed amendments to this document should be addressed to: The National QA Coordinator, Sri Lanka National Mine Action Centre (SLNMAC), Colombo.

Serial	Date	Para	agraph	Amendment	Remarks
No.	Date	Old	New	Amendment	Remarks