

LibMAS 10.20

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DEMINING WORKSITE SAFETY

Responsible National entity:

Libyan Mine Action Centre (LibMAC)
mandated by the Ministry of Defence (MOD)

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**NOTE:**

This document is current at the date shown on this page. The Libyan Mine Action Standards (LibMAS) are subject to regular revision, so users should ensure that they are using the latest version of each document in the standards. The most recent versions of LibMAS are the versions that are posted on the LibMAS pages of the LibMAC website www.lmac.gov.ly

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Foreword

Critical safety, control and quality elements of the International Mine Action Standards (IMAS) have been retained in the Libyan Mine Action Standards (LibMAS), so ensuring that they maintain the principles agreed in IMAS guidelines.

The work of preparing, reviewing and revising LibMAS is conducted by a technical committee with the support of invited international, governmental and non-governmental organisations in Libya. The latest version of each standard can be found LibMAC website.

In all LibMAS the words “must”, “shall”, “should” and “may” are used in the following way. “Must” or “shall” is used to indicate a requirement, something that must be done in order to conform to the LibMAS. “Should” is used to indicate the preferred requirements, methods or specifications, but these may be varied when reasons for doing so are given. “May” is used to indicate a possible method or course of action that should be considered but need not be applied.

In this LibMAS:

- The term “Demining Organisation” refers to any organisation (government, NGO or commercial entity) responsible for implementing demining projects or tasks. Demining Organisations include headquarters and support elements.
- The term “Mine Action Organisation” refers to any organisation (government, military, commercial or NGO/civil society) responsible for implementing mine action projects or tasks. The mine action organisation may be a prime contractor, subcontractor, consultant or agent.

For the purpose of this standard, the words “Demining Organisation” and “Mine Action Organisation” are interchangeable and used to describe the same body.

In this LibMAS the term “worksite” refers to any workplace where demining activities are being undertaken. This covers places where technical survey, clearance and EOD activities are undertaken, including sites used for the destruction of mines and ERW removed during demining operations.

For the purpose of this LibMAS, the words ‘UXO’ and ‘ERW’ are interchangeable and used to describe the same thing, ERW includes AXO. A ‘mine’ is not considered to be a UXO or ERW.

1. Introduction

- 2.1 This standard provides specifications and guidance on the development and implementation of documented procedures which aim to establish and maintain a safe demining worksite.
- 2.2 The need to reduce risk and to provide a safe working environment are fundamental principles of humanitarian demining. Libyan National Health and Safety laws apply to all work conducted in humanitarian mine action. Apart from the legal requirements there is a moral imperative for mine action staff to be treated with humanitarian values by managers at all levels. The purpose of humanitarian demining is humanitarian and it must also be conducted with all possible humanitarian concern for the staff involved.
- 2.3 Mine Action Organisations must develop and maintain management procedures and processes that enable Safety and Occupational Health risks to be identified, evaluated and reduced in a systematic and timely manner. These must be recorded in the SOPs when they are submitted for Accreditation in Libya.
- 2.4 To say that a mine action situation is “safe” does not necessarily mean that all risk has been removed. It presumes that any risk has been reduced to a “tolerable” level. No human activity involves no risk at all, but most have risks we consider “tolerable”, so we accept the risk and drive cars and cross the street, etc.
- 2.5 In humanitarian mine action, risk reduction involves a combination of safe working practices and procedures, effective supervision, appropriate training, equipment of inherently safe design, and the provision of effective personal protective equipment.
- 2.6 Making a demining worksite into a safe working environment is achieved by fencing and marking hazardous areas, controlling the movement of deminers, visitors and the public, establishing and enforcing working distances, using essentially safe procedures, providing PPE, and providing effective medical cover and insurance.
- 2.7 The nature of the ground shall determine the demining worksite layout site, however a consistent arrangement with correct marking shall increase the safety of those involved in the technical survey and clearance operations. The standardisation of all marking systems is paramount to ensure demining worksite areas are unambiguous, to promote consistency and aid safety.

2. Definitions

2.1 Clearance

- a. Tasks or actions to ensure the removal and/or the destruction of all mine and ERW hazards from a specified area to a specified depth.

2.2 Cleared Area

- a. A defined area cleared through the removal and/or destruction of all specified mine and ERW hazards to a specified depth.
- b. The term “clear” or “cleared” refers to an area of ground which is confirmed through a pertinent risk assessment, usually as a result of survey and / or clearance, to be free from mines and / or ERW of a similar size and / or metal content in accordance with the standard of clearance required as detailed in the task Implementation Plan (IP), and / or as stipulated by the LibMAC. Therefore in “clear” or “cleared” ground, mines and / or ERW of a lesser size and / or metal content, outside of the stipulated clearance depth, may remain.

2.3 Fade Out (or Buffer Zone)

- a. Fade out is a term generally used in battle area clearance operations and in particular, the clearance of cluster bomblets (sub-munitions), to describe an agreed distance cleared to confirm that no further pertinent ERW evidence exists. During the clearance of cluster bomblets fade out shall be achieved when the cluster strike footprint has been identified and cleared to the required depth.
- b. Fade out shall be conducted using the same procedures (i.e. surface or sub-surface) under which the evidence was found unless otherwise agreed by the LibMAC. In Libya the minimum Fade out distance is **10 metres** from any pertinent evidence.
- c. Generally, if evidence is located during fade out an assessment shall be conducted by the external monitor as to whether the fade out distance should be amended.
- d. The term 'ERW evidence' refers to relevant explosive ordnance (e.g. submunitions) being cleared although, it may include other evidence such as strike marks, entry holes and craters. This shall be confirmed by the LibMAC.
- e. In Libya the terms 'fade out' and 'buffer zone' are interchangeable and may be used to describe the same thing. The minimum distance to be cleared in all directions (buffer zone) from mines located during demining operations shall be **10 metres** in all directions.
- f. Any variation to the fade out / buffer zone distance **must** be approved by the LibMAC and should be detailed in the relevant Implementation Plan.

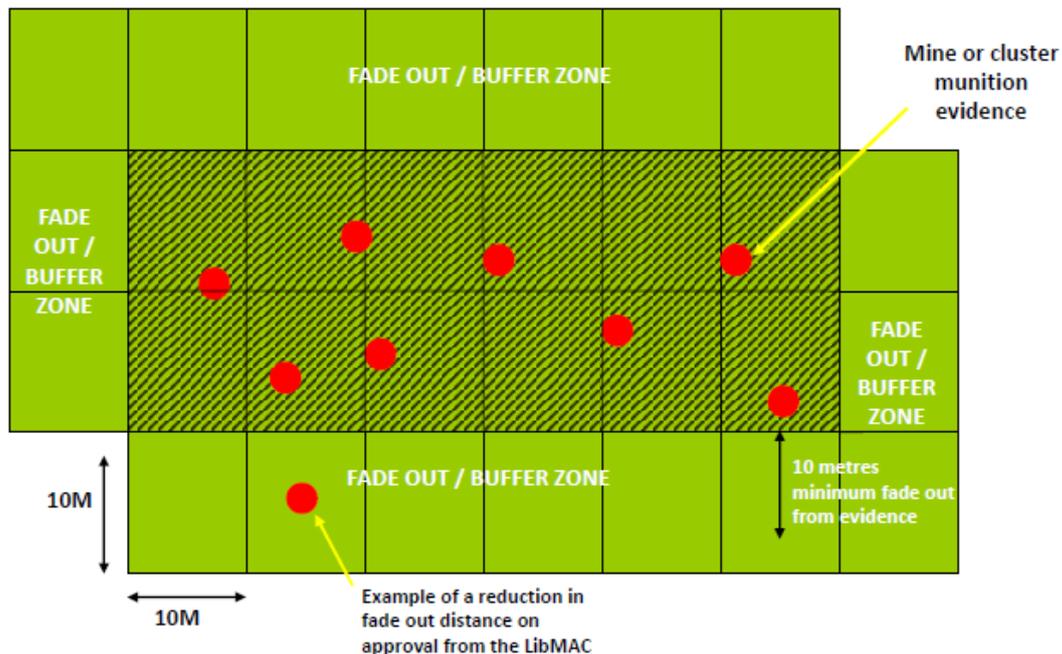


Figure 1: Example of Fade out or Buffer Zone (not to scale)

2.4 Implementation Plan (IP)

- a. For all Mine Action operations, the LibMAS shall issue a Task Order (TO), requesting the Mine Action Organisation to conduct a particular Mine Action task(s). In accordance with the TO, the Mine Action Organisation shall write an Implementation Plan (IP) to facilitate a safe, efficient and effective response.
- b. The IP shall include the task objective, methodology and requirements to achieve the objective, i.e. assets and support.
- c. In situations where the task involves technical survey or clearance, the Mine Action Organisation should conduct a site visit (reconnaissance) prior to writing the IP. The reconnaissance shall involve a ground appreciation and assessment of the mine / ERW threat, to determine the optimum requirements for conducting the task safely, efficiently and effectively. The IP shall be submitted to the LibMAC for review, and for approval to commence the task.
- d. Any subsequent amendments to the IP must be approved by the LibMAC.

2.5 Intrusive Action

- a. The term **intrusive action** is used in battle area clearance operations if **there is a requirement** to move vegetation, rubble, soil or any other object that could be concealing a cluster munition or other ERW which should be located.

2.6 Non-intrusive Action

- a. The term **non-intrusive action** is used in battle area clearance operations if **there is no requirement** to move vegetation, rubble, soil or any other object that could be concealing a cluster munition or other ERW which should be located.

2.7 Risk

- a. Combination of the probability of occurrence of harm and the severity of that harm.

2.8 Residual Risk

- a. In the context of humanitarian demining, the term refers to the risk remaining following the application of all reasonable efforts to remove and/or destroy all mine or ERW hazards from a specified area to a specified depth.

2.9 Risk Analysis

- a. Systematic use of available information to identify hazards and to estimate the risk.

2.10 Risk Assessment

- 2.1 Overall process comprising a risk analysis and a risk evaluation.

2.11 Risk Evaluation

- a. Process based on risk analysis to determine whether the tolerable risk has been achieved.

2.12 Risk Reduction

- a. Actions taken to lessen the probability, negative consequences or both,

associated with a particular risk.

2.13 Tolerable Risk

- a. Risk which is accepted in a given context based on current values of society.

2.14 Safe

- a. The absence of risk. Normally the term tolerable risk is more appropriate and accurate.
- b. Clear or cleared ground may be termed as being 'safe' in accordance with the objective of clearance and tolerable risk.

2.15 Safety

- a. The reduction of risk to a tolerable level.

2.16 Safety Distance

- a. For the purpose of this standard, the term 'safety distance' shall be used when describing the agreed minimum distance which personnel, Mine detection dogs (MDD), equipment, machines or vehicles shall be situated in order to avoid the effects of an explosion. The safety distance should be calculated by using a recognised EOD Fragmentation Hazard Zone (safety distance) formula (or other approved methods). The primary considerations for confirming the safety distance shall be the hazard (e.g. Explosive Ordnance type and effects) and the protection afforded (e.g. armour, PPE, natural or man-made cover).
- b. Additional considerations such as the tolerable risk to certain personnel such as EOD operators, supervisory and monitoring personnel, demining machines, vehicles and equipment, may influence the safety distance, however, the safety distance shall only be concluded after a pertinent assessment of the hazard and protection has been conducted, and authorisation has been granted by the LibMAC.
- c. When conducting Mine Action operations which involve the rendering safe or disposal of explosive ordnance; the minimum safety distance shall be calculated from the designated safe area (e.g. firing point, control point) to the demolitions point or location of working machines in the case of mechanical demining. This distance may be reduced on authorisation from the LibMAC in certain circumstances; e.g.:
 - No personnel, MDD, essential equipment, vehicles, etc. are at the designated safe area; and/or
 - Personnel within the safety distance are afforded adequate protection from the effects of an explosion; and/or
 - An assessment has concluded that the risk to equipment and vehicles is tolerable.
- d. Certain safety distances are stipulated in this LibMAS. The unit of measurement used when calculating safety distances shall be metric and all distances shall be written in metres (m). These distances are the mandatory minimum distance and shall only be reduced on authorisation from the LibMAC.
- e. For additional details on Demolition and Demining Safety Distances, see sections 10 and 11 below.

2.17 Site (or Worksite)

- a. For the purpose of this standard; a 'Site' (or Worksite) is an approved location where Mine Action operations are proposed, active, suspended or completed. Depending on the stage of operations, the Site may include several Designated Areas.

2.18 Surface Clearance

- a. The term **surface clearance** is used in mine clearance and battle area clearance operations to describe the clearance of mines / ERW or other specified items situated above ground level. Items protruding from the ground / partially buried shall be considered as above ground level (surface).

2.19 Sub-Surface Clearance

- a. The term **sub-surface clearance** is used in mine clearance and battle area clearance operations to describe the clearance of mines / ERW or other specified items situated below ground level.

2.20 Task

- a. For the purpose of this standard; a Task is approval by the LibMAC for Mine Action Organisations to undertake specific Mine Action activities in accordance to an agreed Implementation Plan. Prior to the commencement of demining operations, i.e. technical survey, mine clearance or battle area clearance, a unique Task number (normally generated in the Information Management System for Mine Action - IMSMA) shall be allocated by the LibMAC. A Task Dossier is issued to the Mine Action Organisation by the LibMAC and may contain several Tasks.

3. Tolerable Risk During Demining Operations

- a. For the purpose of this standard, the **tolerable risk** is an accepted level of risk to personnel, MDD's, equipment, machines or vehicles, after considering the mine / ERW hazards associated to the risk.
- b. The tolerable risk shall be determined after a pertinent risk evaluation / assessment has been conducted. In order to determine the tolerable risk to personnel involved in Mine Action operations it may be necessary to separate personnel into categories according to their specific roles.
- c. **Clearance** is tasks or actions to ensure the removal and/or the destruction of all mine and ERW hazards from a specified area to a specified depth.
- d. Risk assessment for demining operations is further described in section 10 onwards.
- e. The following categories shall be used when determining the tolerable risk to personnel during Mine Action clearance operations:

4.3 Directly Involved

- a. Mine Action personnel and dogs who are **conducting, supervising or monitoring** the technical survey, clearance and marking of hazardous areas and explosive ordnance: e.g. Site Supervisor, Deminer/Searcher, MDD Handler, MDD, Demining Machine Operator, EOD Operator, Internal and External Monitors. The term 'directly involved' may be used when describing demining working distances (see section 9 below).

- b. It is generally accepted that there is an **acceptable** degree of risk from mines / ERW during demining to Mine Action personnel and dogs **Directly Involved**.

4.4 Indirectly Involved

- a. Mine action personnel who are supporting the technical survey, clearance and marking of hazardous areas and explosive ordnance: e.g. Medic and Driver.
- b. It is generally accepted that there is a **minimal** degree of risk from mines / ERW during demining to mine action personnel **Indirectly Involved**.
- c. The term 'indirectly involved' may be used when describing demining safety distances (see section 10 below).

4.5 Not Involved

- a. Mine action and other personnel who are not involved in the technical survey, clearance and marking of hazardous areas and explosive ordnance. The term 'not involved' may be used when describing demining safety distances (see section 10 below).
- b. There should be **no known** risk from mines / ERW during demining to mine action and other personnel **Not Involved**.

4. Specification of Clearance Quality

- a. Land shall be accepted as **Cleared** when the Mine Action Organisation has ensured the removal and/or destruction of all mine and ERW hazards from the specified area to the specified depth, and in accordance with the Implementation Plan.
- b. The specified area to be cleared shall be determined by a technical survey or from other reliable information which establishes the extent of the mine and ERW hazard area.
- c. Generally, the priorities for clearance shall be determined by the impact on the individual community balanced against national infrastructure priorities.

5.4

- a. The specified **clearance depth** shall be determined by a technical survey, or from other reliable information which establishes the depth of the mine and ERW hazards and an assessment of the intended land use. In the absence of reliable information on the depth of the local mine and ERW hazard, a default depth for clearance shall be established by the LibMAC. It should be based on the technical threat from mines and ERW in the country and should also take into consideration the future use to which the land is to be put.
- b. The clearance depth shall be an agreed distance using the metric unit of measurement calculated from the 'original' ground level that shall be cleared of mines / ERW or other specified items, according to LibMAC clearance requirements. Therefore, in circumstances where additional soil or materials cover the original ground (i.e. through natural or human disturbance) then this shall be taken into consideration, ensuring that the clearance depth from the original ground level is still achieved. The current clearance depth for Mine Clearance is **13 cm** and for Battle Area Clearance is **30 cm**. **This shall only be reduced on authorisation from the LibMAC.**

5.5 Detector Testing

- a. Detectors shall be tested and adjusted for optimal performance. When conducting detector tests for mine clearance and battle area clearance operations, the pertinent item / test piece shall be positioned at the required clearance depth. The test depth shall be measured from ground level to the top of the item.
- b. The test shall be performed in the same soil conditions that the detectors shall be used. It is recommended that when using detectors to search or assist during surface clearance operations that the pertinent test item is placed sub-surface when performing the test to provide a sufficient 'safety margin' when conducting the detector search.
- c. For additional details on detector testing, **see LibMAS 03.40/1 Detectors.**

5. Demining Worksite Layout Requirements

5.1 The demining worksite must be designed to:

- a. Provide a clearly visible separation of suspected hazardous areas (including demolition areas), cleared areas and areas presumed to be safe because they have been defined as having "no known risk";
- b. Ensure that approved working distances are maintained between individual deminers, machines or Mine Detection Dogs (MDD) and other staff on the demining worksite;
- c. Control the movement of demining staff and visitors (including members of the public) at the worksite;
- d. Control the movement of demining machines and other vehicles;
- e. Limit the number of visitors allowed into suspected hazardous areas;
- f. Take all reasonable precautions to keep demining worksite staff, visitors and members of the local population a safe distance from demolition areas during the controlled destruction of mines and ERW; and
- g. Include measures to prevent structural and environmental damage.

5.2 Safe, suspected and confirmed hazardous areas within the worksite must be separated by providing clear and consistent marking.

5.3 Designated Areas

- a. It is paramount that the location of all Designated Areas at the Site are known to all Mine Action Organisation personnel operating there, and that they are appropriately marked and sited. Designated Areas shall be clear of mines / ERW in accordance to the Implementation Plan. For the purpose of this standard; **Designated Areas** are categorised as **Working Area** and **Administration Area**.

5.4 Working Area

- a. A Working Area is where demining is conducted at the Site and is normally within the Hazardous Area Fragmentation Hazard Zone. A Site may have one or more Working Areas.

5.5 Administration Area

- a. Administration Areas are normally located outside the Hazardous Area Fragmentation Hazard Zone in support of clearance operations. Administration Areas may accommodate personnel, MDD, vehicles, equipment and items removed during demining at the Site.

5.6 Control Point (CP)

- a. The control point (CP) acts as an administration and briefing area and is the point where all visitors shall arrive. Ideally it should be on level, well-drained land and have vehicle access and preferably some shade.
- b. The location of the CP shall be a minimum of 100 metres from the nearest personnel working in a suspect / confirmed mine / ERW hazardous area, unless the LibMAC has authorised a reduction in the distance, i.e. if there is sufficient protective works or natural cover between the CP and working area. This distance shall be increased dependant on the perceived threat that may result from fragmentation should a high order occur. This can be calculated by using an approved EOD fragmentation & evacuation formula.

5.7 PPE Hot Line

- a. The Personnel Protective Equipment (PPE) Hot Line is the designated line from which all personnel shall wear appropriate PPE (in accordance with the demining activities and SOPs), when demining is being performed. The PPE Hot Line shall be marked using white topped or unpainted posts, or white painted posts.

5.8 Control Lane

- a. There may be a requirement to identify a route through a clear area to the Working Area or other designated areas, e.g. direct the movement of personnel or vehicles. White topped or unpainted posts, or white painted rocks, shall be used to mark this at regular intervals.

5.9 Access Lane

- a. A marked passage leading through a **hazardous area** that has been cleared to provide **safe** movement to a required point or area.
- b. During mine clearance operations, the Access Lane shall be a minimum of 1 wide and a maximum of 30 metres in length before the width is increased to a minimum of 2 metres.
- c. During battle area clearance operations, the Access Lane shall be a minimum of 1 metre wide and a maximum of 50 metres in length before the width is increased to a minimum of 2 metres.
- d. To increase safety, it is recommended that Access Lanes are widened to a minimum of 2 metres as soon as possible and **mandatory** that they are widened to a minimum of 2 metres in circumstances where personnel are required to traverse

rocks, undulating ground and other obstacles which may cause additional difficulties when walking, loss of balance, or contribute to them stepping into an uncleared area. **This must be made a priority**

5.10 Vehicle Parkin Area

- a. This should be close to the Control Point and large enough to accommodate the Mine Action Organisation's and visitor's vehicles. All vehicles should positioned in the park so they do not have to manoeuvre to depart in the event of an emergency.
- b. A separate area may also be required for the unloading and loading of machines.
- c. The boundary of the vehicle parking area must be clearly marked and if necessary, a sign posted detailing direction to the site administration and working areas.
- d. The minimum safety distance shall be in accordance to the tables below.
- e. See **LibMAS 10.40 Medical Support for Demining** for details regarding the positioning of the ambulance.

5.11 Stores and Equipment Area

- a. Where all equipment is securely stored. Usually part of, or adjacent to, the Control Point.

5.12 Medic Area

- a. A designated area at the Site where a qualified Medic shall be located during clearance operations and where medical treatment may be administered to a casualty/s in the event of a Demining Accident.
- b. The Medic Area may be collocated with the Control Point or other Administration Areas and the area should be flat, dry and shaded.
- c. The Medic Area may be collocated with a Medical Treatment Area.
- d. The ambulance may be located at the Medic Area and the Medic shall ensure that sufficient medical equipped is available at all times.

5.13 Medical Treatment Area

- a. The Medical Treatment Area is a place where medical treatment is conducted by a qualified Medic.
- b. The Medical Treatment area may be collocated with the Medic Area, or separate.
- c. There may be one or more Medical Treatment Areas however the Medic shall **always** be situated in order that he / she can reach the relevant Medical Treatment Area to administer medical treatment to a casualty(s) within **5 minutes** of being alerted to the situation. For additional information see **LibMAS 09.40 Medical Support to Demining**.

5.14 Explosives Storage Area

- a. When not in use all explosive materials shall be stored in a secure and marked Explosives Area a minimum safety distance of **50 metres** away from other designated areas. Exemptions from this minimum distance may be approved in

cases where security is an issue, and approval is to be requested from the LibMAC. Explosives and accessories shall be kept dry, shaded and stored in accordance to the **LibMAS 10.50 Transport and Storage of Explosives**.

5.15 Rest Area

- a. Rest Areas are to be sited for use by demining personnel during their breaks and should provide sufficient space for resting, preparing and/or storing necessary equipment, and other applicable necessary reasons. The area should be dry and shaded if possible. Safety distance and PPE requirements shall be considered when positioning Rest Areas, to ensure that personnel are not at undue risk when located at the rest area.

5.16 Latrine

- a. To prevent people inadvertently straying into hazardous areas, and for hygiene purposes, a latrine should be designated for each demining site, particularly if there is no alternative facilities. Latrines should be safely and conveniently located, i.e. in the vicinity of the control point, and should be adequate for the number of personnel on the site. There may be a requirement for more than one latrine.

5.17 Metal Collection Area

- a. Pertinent metal located and removed during clearance shall be placed in the Metal Collect Area(s) which should be situated at a convenient location at the Site. The dimensions of the pit shall be a minimum of 1 metre square and a suitable depth to ensure that the contents of the pit are below the surface, to prevent spillage.
- b. In circumstances where there are difficulties in achieving the required depth then, an earth or sandbag wall may be created around the edge.
- c. In circumstances where it is not possible or practical to site a Metal Collect Area then metal shall be removed to a designated approved area on a daily basis.
- d. Prior to the Suspension or Completion of the Site the contents of the Metal Collect Area shall be moved to a LibMAC approved area for disposal.
- e. In order to facilitate quality control, metal collection areas shall not be located in areas cleared that day and shall be regularly checked by the supervisory staff to ensure that they do not contain any mines / ERW.

5.18 Mines / ERW Storage Area

- a. The purpose of the Mines / ERW Storage Area is for temporary storage of Mines / ERW located at the Site. This is to be separated from other Administration Areas and should be situated outside the Working Area.
- b. In order to maintain greater control it may be preferable to locate safe mines / ERW within the Explosives Storage Area.
- c. The dimensions of the area shall be a minimum of 1 metre square and a suitable depth to ensure that the contents of the area are below the surface, to prevent spillage. In circumstances where there are difficulties in achieving the required depth then, an earth or sandbag wall may be created around the edge.
- d. All mines / ERW removed during demining shall be placed within the area unless removed to another approved location at or away from the Site for storage or disposal.
- e. Only mines / ERW which is found in a safe condition or has been rendered safe, neutralised or disarmed may be stored in the Mines / ERW Storage Area, which shall be marked as hazardous until the items have been removed.
- f. All items shall be checked by a qualified EOD Operator prior to placing them in the Mines / ERW Storage Area and recorded in a Site register.
- g. The Site Supervisor shall endeavour to dispose or remove from the site, all Mines / ERW located that day.

- h. **Mines / ERW remaining at the Site at the completion of daily operations which is confirmed to be a hazard (e.g. containing functional component parts – primers/boosters, detonators or main charge) shall be reported to the LibMAC that day.**
- i. Prior to the Completion or Suspension of the Site, the contents of the Mines / ERW Storage Area shall be destroyed at the Site or moved to a LibMAC approved area for disposal.

5.19 Mines / ERW Scrap Storage Area

- a. All mines / ERW located at the Site which is Free From Explosive (FFE), shall be placed in the mines / ERW Scrap Area.
- b. A qualified EOD Operator shall ensure that all items in the Mines / ERW Scrap Storage Area are FFE.
- c. The Mines / ERW Scrap Storage Area is to be separated from other Administration Areas and should be situated outside the Working Area.
- d. The dimensions of the area shall be a minimum of 1 metre square and a suitable depth to ensure that the contents of the area are below the surface, to prevent spillage.
- e. In circumstances where there are difficulties in achieving the required depth then, an earth or sandbag wall may be created around the edge.
- f. In circumstances where it is not possible or practical to site a Metal Collect Area then metal shall be removed to a designated approved area on a daily basis.
- g. All mines / ERW removed during clearance which is FFE shall be placed within the area unless removed to another approved location away from the Site for storage or disposal.
- h. Prior to the Completion or Suspension of the Site, the contents of the mines / ERW Scrap Area shall be moved to a LibMAS approved area for disposal.

5.20 Demolition Area

- a. A safe location for the disposal, by explosive demolition or other approved means, of mines / ERW. The demolition area must be at a safe distance from the worksite in order to avoid any fragmentation falling into cleared areas where quality control or sampling is planned.

5.21 Sentry Points

- a. Located at strategic points at Demining Sites and Demolitions Area, as required. When functioning, Sentry Points are manned by trained personnel, providing a visible presence and early warning with regards to the operations conducted. Sentry Points shall have communications with the senior personnel at the site.

5.22 Detector Test Area

- a. A performance test must be conducted for each detector prior to the commencement of demining operations to confirm that it is functioning correctly (i.e. in accordance with the manufacturer's manual) and capable of locating the pertinent target at the required clearance depth. If the detector fails to meet the required standard it shall not be used.
- b. Each Demining Site (i.e. mine clearance and battle area clearance) shall have a testing area(s) in order to ascertain that the detectors are serviceable, calibrated to the manufacturer's standard and capable of locating the pertinent target at the required clearance depth, prior to operational deployment.
- c. The Testing Area shall comprise an equal soil type to the Working Area and shall be divided into two areas. The dimensions of each area shall be at least 1 square metre and shall afford sufficient space to perform the test with the relevant detector.

- d. If necessary, the Test Area shall be excavated to remove any pertinent metal which may interfere with the calibration and testing procedure.
- e. The first area shall be **totally** free of pertinent metal, whereas the second area shall be free of pertinent metal with the exception of the relevant test item (specific Site threat), placed at the required clearance depth e.g. FFE mine or ERW component part.
- f. The test item shall be placed in the ground and covered with soil.
- g. The test depth shall be measured from the ground surface to the top of the item and the test item shall be accessible to enable an effective QA inspection. To facilitate this, cord may be attached to the item or the item placed in a plastic container (unsealed at the top and filled with soil) prior to burial.
- h. Following the normal setting up and calibration, the detector is to be initially passed over the metal free area where no indication is to be heard or seen and then over the area with the test item has been buried where a visual and / or audible indication should be noted.
- i. When conducting the performance test, against the test item, the detector shall be moved over the target at least twice, in two opposite directions, to account for the orientation of the test item. The detector must be capable of locating the test item when moved over the target in both directions at the required depth.
- j. The Test Area shall be clearly marked and depending on the variety of detectors and operational requirements, there may be a number of Test Areas at the Site.

5.23 Helicopter Landing Site (HLS)

- a. When a helicopter casualty evacuation is available, a HLS should be established before demining starts at the worksite. The size of the HLS and cleared air approaches must be as required by the organisation providing the air casualty evacuation service. The HLS should not be directly beside a suspected hazardous area.

5.23.1 HLS Requirements

- a. The following are the minimum requirements for establishing a HLS in support of a demining worksite:
 - The HLS must be at least 300m from the nearest mine/ERW hazardous area.
 - The surface conditions must be firm enough to prevent the helicopter bogging down or creating excessive dust. The area should be as free as possible of stones and loose debris. The bearing strength of the surface should be sufficient to withstand the dynamic and static loading of the particular helicopter. The HLS must have a levelled surface.
 - The minimum size of the touch down and take off
 - area should depend on the type of helicopter, for example it should be no less than 25 metres x 25 metres for the Super Puma AME or 32 metres x 32 metres for the Mi8 non-medical helicopter (one and half times the rotary diameter). The area around the landing zone should be cleared of obstacles that could damage the aircraft.
 - The approach and departure path of the landing site should be clear of obstacles above the approach angle. The direction of approach or departure should be over the lowest objects and predominate wind direction should be taken into consideration. High terrain power lines and other obstacles should be taken into consideration.
 - Wind indicator is recommended. Smoke grenade may be used but should not be put on the leeward side to avoid obscuring the touch down point (red smoke should not be used as it may be considered as indication a hazard).

- The safety area must be provided and is to be no less than 3 metre width surrounding the touch down and take off zone. The safety area must be clear of objects.
- All demining personnel should be taught how to safely approach a helicopter and to protect their eyes from dust.
- The HLS shall be marked with letter “H” and the dimensions be determined by the organisations providing the air emergency evacuation service, in coordination with the LibMAC. As a guideline, the “H” should be a minimum of 2 metres x 2 metres, visible from all directions and at a distance of 1000 metres from high points.
- The material used to mark the “H” such as rocks / sand bags shall be painted white which will assist in the visual recognition of the site. The material used shall be levelled with ground so they shall not obstruct the landing of the copter. The ground shall be free of any objects, which could become airborne and damage the aircraft. Periodical checks of the HLS shall be completed to ensure that there is no large amount of garbage has collected at the site.
- When considering night lighting for a HLS, use as much light as possible, preferably flashing lights or spotlights. Two vehicles should be positioned 35 m apart and 35 m downwind of the centre of the landing point with their headlights beam.
- A reconnaissance of the proposed HLS shall be conducted by the organisation providing the emergency evacuation service to confirm its suitability, prior to the LibMAC approving its use.

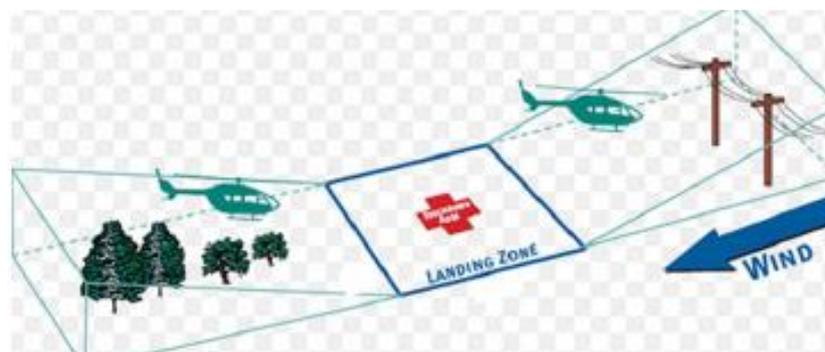


Figure 2: Example of a HLS

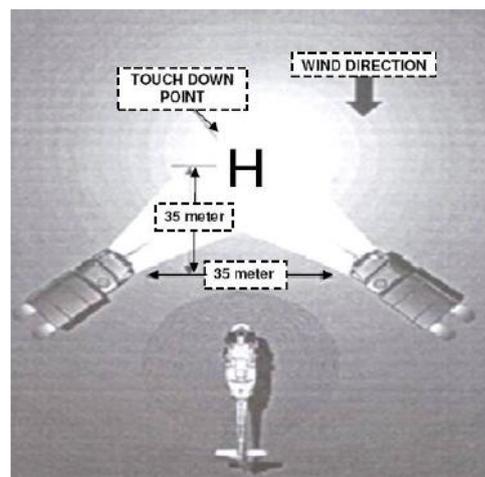


Figure 3: Example of Night Lighting for a HLS

6. Site Reference Point and Bench Mark Requirements

6.1 Reference Point (RP)

- a. This has also be known as a Landmark, and is a fixed point of reference outside the hazardous area. It should be an easily recognised feature (such as a building, cross-roads or a bridge) which is used to assist in navigating to one or more Benchmarks.
- b. The Reference Point description, location and the safe route to the Bench Mark should be included in relevant report, i.e. survey, hazardous area, suspension or completion.
- c. There may be a requirement to identify Intermediate Points when the Reference Point is located at a vast distance from the Bench Mark, the terrain is featureless, there are a number of obstacles or multiple changes in direction along the route.

6.2 Benchmark (BM)

- a. A fixed point of reference used to locate a marked and recorded hazard, hazardous area, suspended or completed demining site.
- b. It should be located a short distance outside the hazardous area / boundary of the site.
- c. The BM may be collocated at the RP if it is suitably sited / close to the hazardous area / boundary of the site, however is normally separate from the RP.
- d. When located separately from the RP, its description and direction from the RP shall be recorded on the relevant report, i.e. survey, hazardous area, suspension or completion.
- e. Natural objects or be manmade materials may be used as a BM, and when constructed, the materials used must endure the environmental conditions.
- f. The BM shall be clearly visible in normal daylight at a safe distance from the direction of approach.
- g. During survey and clearance, a temporary BM may be used, i.e. marked large tree, or large rock, however on completion of a demining task a permanent BM shall be constructed in accordance with **LibMAS 10.20/1 Demining Site Marking Systems**.

6.3 Start Point:

- a. This is a clearly identifiable fixed marker and the point where demining begins. All demining site working area measurements are taken from this point and depending on the location of cleared mines / ERW, it may be decided to position additional start points for ease of mapping during or on suspension / completion of operations.
- b. The initial Start Point should be clearly visible from the Bench Mark otherwise Intermediate Points shall be located for ease of navigation.

6.4 Start Line

- a. This is the line from where demining begins and marks the divide between the safe and hazardous area. This may be located on the boundary line and should be moved forward after a substantial amount of area is cleared.
- b. In circumstances where limited clearance has been conducted (e.g., investigation lanes during technical survey) the start line should remain in position.

6.5 Boundary Line

- a. It is a fixed line located from the start point which forms the perimeter of the known hazardous area or cleared boundary lane, providing a definite location of the safe area.
- b. As clearance progresses, the minimum necessary markings (e.g., turning points, intermediary points) shall remain in place to identify the boundary line for navigation and post clearance marking purposes.
- c. The Start Line, which may be initially located on the boundary line, should be moved forward after a substantial amount of the area is cleared and subsequently, mark the divide between the cleared and hazardous area.

6.6 Boundary Lane

- a. This is a cleared and marked lane a minimum of two metres wide along the boundary of the hazardous area which is utilised when there is no confirmed safe boundary from which to start clearance.
- b. Where possible, a Boundary Lane is to be cleared around the entire perimeter of the hazardous area.
- c. If there is no requirement to clear a boundary lane, then it may be decided to mark a control lane outside and parallel to the Boundary Line.
- d. Depending on the requirement to restrict movement of demining personnel, equipment and vehicles in the immediate area around the boundary, it may be decided that a control lane is not necessary.

7. Setting Out the Boundary Line and Lane

- a. When determining the position of the Boundary Line, the use of existing linear features such as roads, paths, cultivated land etc. should be considered. When there is a requirement to clear a boundary lane, the boundary line shall mark the rear edge of the cleared lane and the start line with therefore be the front edge. The Boundary Lane shall be a minimum of two metres in width.

8. During Demining Operations

8.1 Demining Lane

- a. This has also been known as a 'Clearance Lane', 'Working Lane' or 'Safety Lane', and is the lane where one or more clearance personnel, dogs or machines are operating. During manual mine clearance and maybe during battle area clearance operations, the Demining Lane width is maintained using a base stick.
- b. During manual mine clearance operations, the Demining Lane shall be clearly marked along the edges with red topped posts or red painted rocks at a maximum of 2 metre intervals and at all turning points. In addition, hazardous area marking tape (red/white) or red cord may be used to assist in demarcating the edges. Tape or cord is shall be attached to the Base stick when in use. The Demining Lane shall be a minimum of 1 wide and a maximum of 30 metres in length before the width is increased to a minimum of 2 metres. Therefore, the maximum distance for a 1-metre-wide Demining Lane shall be 30 metres.
- c. For battle area clearance operations an efficient method of marking during the clearance process is cord, which may be deployed from reels or by another means. The cord shall be coloured red, unless another colour is authorised by the LibMAC.
- d. When utilising Demining Lanes, they shall be marked along the edges at regular intervals with red topped posts, red painted rocks or other authorised markers. In addition to this, or as an alternative, hazardous area marking tape (red/white) and / or red coloured cord may be used.
- e. The minimum requirements for demarcating battle area clearance Demining Lanes and the uncleared area during operations, is approved marking tape / cord positioned along the edge(s) and / or approved markers at a maximum of 10 metres along the edge(s). Approved markers, i.e. red topped posts or red painted rocks, must be positioned along the edge(s) before the cord / tape is removed. The type of marking may vary between organisations and shall be detailed in an approved SOP. The Demining Lane shall be a minimum of 1-metre-wide and a maximum of 50 metres in length before the width is increased to a minimum of 2 metres.

- f. To increase safety, it is recommended that Demining Lanes are widened to a minimum of 2 metres as soon as possible and mandatory that they are widened to a minimum of 2 metres in circumstances where personnel are required to traverse rocks, undulating ground and other obstacles which may cause additional difficulties when walking, lose of balance or contribute to them stepping into an uncleared area. This must be made a priority.
- g. At the cessation of daily mine clearance and battle area clearance operations, the Organisation is to ensure that the cleared area is distinguishable from the uncleared area and that the working area is demarcated using red topped posts or red painted rocks.

8.2 Demining Area or Box

- a. This has also be known as a Clearance Area or Box. They are normally used during battle area clearance operations to demarcate the Working Area where systematic search and clearance is conducted. The size of the area / box is decided by the Mine Action Organisation and may be determined by a number of factors including the level of ERW contamination, the threat, terrain and available resources. Obvious boundaries such as roads, fences, walls or fields may be used to define the Working Area
- b. Depending on the procedures conducted, e.g. surface or sub-surface battle area clearance, the Demining Area or Box may be divided into Demining Lanes prior or during clearance.

8.3 Cleared Area or Lane

- a. An area or lane that has been cleared of all mines and / or ERW to the required standard.

8.4 Intermediate Line

- a. This is a line forward and parallel to the Start Line or Base Line demarcating where Demining Lanes and Demining Areas / Boxes end and begin. The distance from the Start Line / Base Line to the Intermediate Lane and between any consecutive Intermediate Lanes shall be a maximum of 50 metres. Any deviation to this must be authorised by the LibMAC. Intermediate lines may be numbered for ease of navigation.

8.5 Intermediate Lane

- a. This is a cleared lane forward and parallel to the Start Line or Base Line which connects Demining Lanes and Areas / Boxes for safety and command / control purposes. The rear edge of the Intermediate Lane is the Intermediate Line. The distance from the Start Line / Base Line to the Intermediate Lane and between any consecutive Intermediate Lanes shall be a maximum of 50 metres. Any deviation to this must be authorised by the LibMAC.

8.6 Mines / ERW Located:

- a. Mines / ERW are not removed or destroyed immediately they shall be marked and their location recorded. During mine clearance operations; if mines / ERW are located within the same 1-metre-wide Demining Lane, the lane shall be closed off, a new lane commenced, or the Demining Lane redirected. Alternatively, the mines / ERW may be destroyed in situ or removed and the Demining Lane may continue.
- b. Prior to the cessation of mine clearance and battle area clearance daily operations, mines / ERW located shall be destroyed or removed unless approval to leave them has been granted from the LibMAC.
- c. All mines / ERW located, removed, and destroyed, shall be reported to the LibMAC on the same.

9. Demining Working Distances

- a. Demining working distances are sometimes referred to as safety distances, however to distinguish between the two in LibMAS, it is generally accepted when determining the 'working distance', that the risk from mines / ERW to demining personnel, MDD and machine operators 'directly involved' in demining is tolerable due to the nature of their work.
- b. Personnel, MDD and machine operators 'directly involved' are normally located at or in close proximity to the 'working area' during demining operations, including technical survey and clearance of routes/roads.
- c. Section 3.1 above describes 'directly involved'.
- d. During mine clearance and battle area clearance operations, the greatest risk is generally borne by the deminer who conducts the manual search and investigation of mines / ERW and is often in close proximity of these hazards. The risk from mines / ERW to MDD may also be higher than MDD handlers, demining supervisors and monitors, as MDD are involved in the search process of suspected or confirmed hazardous areas.
- e. Demining machine operators inside the vehicle should be afforded protection against the effects of a mine and/or ERW explosion (depending on the threat), and although there may be a risk from minor injury (i.e. indirect effects of an explosion) it is generally deemed tolerable as long as the necessary safety precautions are in place and pertinent T&E of the machine is completed.
- f. To reduce the risk of harm to a tolerable level for personnel and MDD 'directly involved' in demining, Mine Action Organisations must enforce appropriate minimum working distances between them.
- g. Working distances should be decided by making a detailed and documented risk assessment taking into account the hazards anticipated at the worksite, the conditions at the site and the protection provided.
- h. Section 17 below includes an example of the principles for preparing a detailed risk assessment to determine appropriate working distances to use during manual demining operations.
- i. Other methods may be used, subject to approval by LibMAC, and the principles used to determine working distances appropriate for manual demining may also be used when determining appropriate distances between MDD or demining machines.

10. Demolition Safety Distances

- a. Demolition safety distances are distances between the explosive ordnance to be destroyed, rendered safe or moved, and all mine action personnel, MDD, essential equipment, etc. at the demining worksite including, the indigenous population, valuable infrastructure, etc. Safety distances are also appropriate for demolitions sites.
- b. Additional safety must be utilised when necessary for limiting the effects of an explosion such as tamping, sand bag protective works, trenches, and/or damage and harm, such as walls and bunkers.
- c. Demolition safety distances are calculated using EOD Fragmentation Hazard Zone (safety distance) formula (or other approved methods) and are used when conducting explosive ordnance rendering safe and demolitions procedures. They should also be used when calculating the safe distance when there is a requirement to move explosive ordnance suspected as being a UXO and/or booby-trapped (i.e. pulling procedure).
- d. During the preparation of demolitions there is generally a tolerable risk to personnel 'directly involved', i.e. handling explosive materials, testing and deploying firing cables.
- e. During the last stages of explosive ordnance disposal or removal, which may involve activities such as connecting detonators to firing circuits, lighting safety fuse, attaching apparatus to explosive ordnance (i.e. for pulling), or manual render safe procedures; all non-essential personnel who are not involved in the conduct, supervision or monitoring of this process shall be at a safe distance, or afforded adequate protection from the effects of the explosion.
- f. It is generally accepted that there is a tolerable risk to personnel 'directly involved' in the last stages of explosive ordnance disposal or removal.
- g. Safety distances that are required for EOD operations may not be practical or necessary when conducting other manual demining procedures. This is because other manual demining procedures only involve the search, detection and investigation of mines / ERW and the risk to personnel, MDD and machines is deemed tolerable during these activities, as long as the minimum required safety measures are in place, according to the Mine Action Organisation's SOP and LibMAS.
- h. If there is a requirement to destroy, render safe or move mines / EREW then this shall be conducted by a qualified EOD operator and appropriate safety distances must be enforced.
- i. LibMAS 09.30 provides guidance on the safe conduct of EOD operations, including demolition safety distances.
- j. When determining safety distances, consideration must be given to the type of ordnance, effects, location (i.e. surface or sub-surface), the ground condition, and protective works. Particular consideration must be given to primary and secondary fragmentation as this may be projected the greatest distance during the explosion. Generally, the minimum recommended distance should be increased whenever it does not affect operational efficiency to do so.

11. Demining Safety Distances

- a. Demining safety distances are used for demining procedures other than demolitions (as detailed in section 10 above).
- b. Demining safety distances are applied to ensure that mine action and other personnel 'indirectly' or 'not involved' in demining are at a safe distance when operations are conducted at a demining site, including technical survey and clearance of routes/roads.
- c. Demining safety distances may also apply to personnel and MDD normally 'directly involved' in demining however are required to move to a safe distance, as there is an increased risk from mines / ERW due to the demining activities conducted, i.e. mechanical demining, or other reasons, i.e. animals traversing, or a fire in the suspected or confirmed hazardous area.
- d. Sections 3.1 and 3.2 above describes 'indirectly' and 'not involved'.

12. Control of People Entering Inside the Safety Distance

- a. Demining operations are often conducted in areas easily accessible to the indigenous population, who may intentionally or unintentionally encroach the designated demining site safety distances. The Mine Action Organisation's procedures must prevent the unauthorised entry of people with the safety distances and in particular the suspected or confirmed areas where demining is conducted. This should be achieved by:
 - Informing the local population, Mine Action Organisation staff and visitors to the demining worksite regarding the extent of the worksite, the safety distances and marking; and
 - Physically controlling entry into the worksite during demining operations, which is particular important during demolitions and mechanical demining. This may involve positioning warning signs and deploying sentries.
- b. Warning systems may include:
 - Warning signs on approach routes (roads, tracks or paths);
 - Risk reduction education delivered to people living or working near a demining worksite, and to the local authorities in the area;
- c. The demining operations should be organised so that they minimise disruption to people who need to move through the demining site. It may be unrealistic to prevent the public from entering these areas for the duration of the task.
- d. Where the position of a worksite means that a frequently used road or path passes inside the safety distance at the site, the following measures should be considered:
 - If the worksite is small, the demining unit should pause operations regularly in a way that minimises disruption to the public and operations; or
 - If the worksite is large, the Mine Action Organisation should consider making a temporary road or path diverting the public around the site.

12.1 Traffic control

- a. Where any road or track used by vehicles passes within the safety distance at a demining worksite, traffic should either be diverted through a safe area or controlled using traffic control points. Local authorities should be advised of any requirement for traffic control during demining and their advice and assistance should be sought. Staff at traffic control points should have communication with the worksite supervisor.
- b. Demining worksite supervisors should establish systems to allow demining operations to continue close to roads and tracks that are used. These systems must not jeopardise the safety of demining personnel or the public, and should cause minimum disruption.

13. Use of Personal Protective Equipment (PPE)

- a. All personnel who enter the safety distance at a demining worksite while demining is happening must wear PPE that meets the requirements of LibMAS 10.30. When no demining operations are occurring, the wearing of PPE should be at the discretion of the supervisor at that worksite.

14. Radio Frequency (RF) hazards

- a. On demining worksites where the risk assessment has identified hazards that may include electrically initiated explosive ordnance, precautions should be taken against electro-magnetic radiation hazards such as radio frequency (RF) transmission that may induce an unintended detonation. The precautions should include:
 - Vehicles with radios mounted should remain outside the boundary of any uncleared suspected hazardous areas. If vehicles must move inside, radios must be switched off; and
 - Staff who are carrying communication equipment must turn that equipment off if they have to approach any device that may be electrically initiated.
- b. Communications equipment should not be used close to any electrically initiated detonators unless the detonators are stored separately from explosives and in a way that prevents their initiation.
- c. For additional details pertaining to hazards associated with electrical detonators see **LibMAS 09.30 Explosive Ordnance Disposal**.

15. Demining Accidents

- a. Procedures for the response to a demining accident must be established and formally documented in the demining organisation's SOPs. The SOPs should document:
 - The Mine Action Organisation and capabilities needed to respond to a demining accident, including the procedures, training, and equipment needed (see LibMAS 10.40 Medical Support to Demining); and
 - Procedures for the investigation and analysis of an accident, including procedures for corrective action when that is found to be necessary (see LibMAS 10.60 Investigating Demining Accidents).

16. Responsibilities

16.1 Libyan Mine Action Centre (LibMAC)

- a. LibMAC must ensure that the Mine Action Organisation's SOPs make all worksite provisions for the safety of staff that are required under Libya's laws and these Standards.
- b. LMAC should also:
 - Ensure that the demining worksite meets minimum requirements by conducting QA checks, or arranging for an accredited organisation to conduct QA on its behalf;
 - Ensure that safety distances are established based on a risk assessment; and
 - Ensure that the reporting and investigation of demining accidents is conducted efficiently with a view to improving worksite safety.

16.2 Mine Action Organisation

- a. The Mine Action Organisation must:
 - Maintain documented SOPs for which they hold Operational Accreditation.
 - Ensure that they hold adequate insurance against death, disablement and injury for all staff;
 - Provide and maintain safe work places, machinery and equipment, and adopt safe work practices and procedures;
 - Provide adequate supervision and training;
 - Provide, at no cost to the employee, adequate PPE and protective clothing;
 - Provide, at no cost to the employee, adequate health care and emergency medical support in case of accidents;
 - Write a safety policy in SOPs and bring this information to the attention of every employee in the employee's first language; and
 - Report, investigate and act upon any accidents that occur.

16.3 Mine Action Organisation Employees

- a. Mine Action Organisation employees must:
 - Take all reasonable care for their own safety and that of others at the worksite;
 - Obey instructions given for their own safety;
 - Obey Libya's laws and the LMAS on conduct and safety on worksites; and
 - Report to their superior any situation which they have reason to believe presents a safety concern and which they cannot correct themselves.

17. Determining Demining Working Distances for Manual Demining

17.1 General

- 17.1.1 This section provides guidance on determining appropriate working distances between manual deminers during demining operations at a demining worksite, however may be used as a guide for MDD and mechanical demining operations.
- 17.1.2 Working distances for manual demining are intended to prevent severe or disabling injury to other demining personnel 'directly involved' in demining at the working area, in the event of an unintended detonation of a mine or ERW during demining. The working distance is determined with consideration to the threat (i.e. type of mines / ERW, and their condition), the terrain and climate, the likelihood of a mine / ERW explosion during demining, the likelihood and type of injury to personnel during an explosion, other safety considerations such as the ability to appropriately supervise and monitor working deminers, operational efficiency and effectiveness.
- 17.1.3 Working distances generally reduce however may not eliminate the possibility of harm during an explosion. However, the likelihood of an unintended mine / ERW should be greatly reduced if SOPs are strictly adhered to during demining operations.
- 17.1.4 A working distance should not be considered as a safety distance because it does not reduce the risk of secondary injury (to others) to zero. Demining working distances must ensure that the risk of secondary injury from an unintended detonation is reduced to a tolerable level. The imposition of working distances that reduce all risk of secondary injury to zero would not be practical. While a risk of a severe secondary injury should not have tolerated, due to the nature of the work a risk of minor secondary injuries that do not result in disability is considered unavoidable.

17.2 Mine and ERW Hazards

- 17.1.5 The greatest hazard to demining personnel in close proximity to an anti-personnel (AP) mine detonation is the blast-wave. The front of the blast-wave decelerates rapidly, so limiting the extent of the hazard. The extent of the hazard presented by the blast-wave is directly related to the size of the mine's high explosive content.
- 17.1.6 The danger area presented by the blast-wave of the largest AP blast mines generally extends to less than 10 metres. The risk of ruptured ear-drums from a blast-wave extends to a greater distance, and may approach 25 metres for the largest AP I blast mines. Tympanic membrane injury is usually minor and temporary, with little or no permanent hearing loss.
- 17.1.7 As a guide, the blast hazard associated with AP mines reduces very rapidly so that deminers who are a metre away and wearing approved PPE often have no severe blast injury. The blast-debris associated with AP blast mines generally presents a danger area of less than 10 metres. Consequently, there is a small risk of secondary injuries to other worksite staff when an AP blast mine is initiated up to 10 metres away. The blast hazard and blast-debris danger area associated with large anti-tank (AT) blast mines can be far more extensive.
- 17.1.8 The hazardous area associated with AP fragmentation mines extends to the limit of

the fragmentation that they spread. This varies with different mines, and is generally related to the mine's design, the amount and type of its explosive content and its position relative to the ground when it detonates.

- 17.1.9 The fragmentation associated with most fragmentation mines spreads in a 360° radius from the point of detonation. The fragments usually slow down rapidly, but the speed of the fragments from the same mine varies considerably. The risk of being struck by a high-speed fragment is reduced both by distance and by the spread of the fragments. The greater the distance between the mine and the deminer, the less likely any injury is to be severe.
- 17.1.10 The variety of threat posed by ERW devices is too great to summarise, however risk assessments must consider the type of ERW and effects, its location (i.e. surface or sub-surface), and the likelihood of unintentional initiation of the ERW during the demining procedure. When the hazards in an area do not include mines, LibMAS 09.11 Battle Area Clearance should be applied in accordance with the working and demining safety distances detailed in table 2 below.

18. Assessment of Risk

- 18.1 As demining on a particular site progresses the information on which the first risk assessment was based may alter, risk assessments must be reviewed on a regular basis to keep pace with these changes.
- 18.2 A risk assessment for the determination of working distances for known mine and ERW devices involves an assessment of the following:
- The likelihood of an unintended detonation; and
 - The likelihood of severe injury resulting from an unintended detonation.
- 18.3 More detail is provided in section 19 below.

19. Likelihood of Unintended Detonation

Some factors that can affect the likelihood of an unintended detonation of a mine or ERW occurring are described below.

19.1 Condition of the Mine or ERW

- A few mines and ERW have very sensitive fuzes, or initiation systems. Knowing the anticipated devices and the way they operate is essential in order to avoid approaching them in an inappropriate manner.
- With all mines and ERW, the condition of the device can make accidental initiation more or less likely. If it is known that a device has decayed in such a way that it is no longer capable of detonating, the hazard posed by that device may be ignored in the risk assessment. Conversely, if it is known that a device has been damaged or decayed in such a way that the initiation mechanism is unstable, it should be presumed that there may be a higher risk of initiation.
- To reduce the increased risk of injury that this implies, the use of demining procedures that increase the distance between the deminer and the hazard should be considered. Using mechanical demining processes that prepare the ground and initiate unstable hazards may be appropriate.

19.2 The Demining Worksite

- d. When the hazards and their condition are known, the risk they represent must be reviewed in relation to the worksite. The ground conditions at the worksite may increase or reduce the risk of an unintended detonation. For example, if the ground is hard there may be a high risk that excavation with a particular procedure or tool will cause an initiation. Undergrowth or other obstructions that restrict the vision of supervisors may require a variation in the procedures that would be used elsewhere.

19.3 Demining Procedures and Tools

- e. In any given situation, some demining procedures and tools may pose a greater risk of an unintended detonation than others. The use of long-reach vegetation cutting tools in an area where tripwires or functional tilt-fuzes are anticipated is an example.
- f. The demining procedures and tools that are appropriate at a particular worksite should be determined with reference to the hazard, its condition, and the worksite.
- g. All demining tools must be assessed and approved for use by the LibMAS, and the Mine Action Organisation must request approval from the LibMAS for the introduction any new demining tools and procedures.

19.4 Other Factors

- h. Worksite climate, weather and the risk of disease can make it more likely that demining personnel and MDD are uncomfortable, unwell or simply tired. Demining personnel and MDD must be appropriately clothed, fed and rested, and must have their health checked regularly enough to give confidence that no deminer or MDD works when unwell or when tired enough to lose concentration.

20. Likelihood of Severe Injury

- a. An injury may be considered **minor** when it does not result in any loss of function or in disability. All injuries that result in loss of function or disability are considered **severe**. The risk of severe injury faced by the deminer who initiates an unintended detonation is far greater than that faced by other demining staff at the worksite.
- b. Unintended detonations that cause severe or disabling injury during manual demining are not common however may occur. The likelihood of severe or disabling injury occurring is reduced to the lowest possible level by good training, using appropriate demining procedures and by the provision of disciplined supervision.
- c. The likelihood of severe injury should also be assessed with reference to the procedures and tools that will be used, the PPE that is issued and the working distances that shall be enforced.

20.1 Procedures and Tools

- 20.1.1 The cause of demining accidents can often be directly or indirectly related personnel not adhering to SOPs, and the use of unapproved procedures or tools. Some factors which may increase the risk of severe injury in an unintended detonation during demining are:

- Positioning the deminer closer to the device than necessary;
- Encouraging the use of excessive or imprecise force when exposing a device; and
- The disintegration of the tool causing additional injury.

20.1.2 To keep the likelihood of severe injury to a minimum, procedures and tools that avoid these failings must be used.

20.2 Personal Protective Equipment (PPE)

20.2.1 After the application of supervised procedures and tools designed to prevent an unintended detonation occurring, there remains a small risk of an explosive accident. The main purpose of PPE is to provide practical protection to the person most at risk of causing an unintended detonation. The secondary purpose of PPE is to protect against the risk of secondary injuries resulting from an unintended detonation initiated by other demining staff.

20.2.2 Because PPE is a secondary safeguard, the PPE selected should never restrict movement, comfort or concentration in a way that makes an unintended detonation more likely to occur.

20.2.3 Appropriate PPE to reduce the risk of primary and secondary injury is described in LibMAS 10.30 Personal Protective Equipment.

20.3 Demining Working Distances

20.3.1 Demining working distances do not provide any protection to the deminer who initiates the unintended detonation. The assessment of appropriate working distances should be concerned to reduce the risk of severe secondary injury (to others) to the minimum acceptable level. The attempt to remove all risk of minor secondary injury would generally involve imposing impractical procedures, PPE and working distances, so should be avoided.

20.3.2 The range of the blast hazard and the fragmentation hazard presented by other ERW should be assessed on a case by case basis

20.3.3 For addition details regarding working distances, see section 9 above.

21. Method of Risk Assessment

- a. The risk assessment is essential in order to determine appropriate working distance in a demining worksite. In some cases, working distances may vary between different parts of the same worksite. When this occurs, the variation must be clearly communicated so that demining staff are always aware of which working distances apply where they are. The risk assessment for a demining worksite should be updated regularly as more information becomes available. The way to determine appropriate working distance is included in detail below.

21.1 Determination of the Mine or ERW that Poses the Greatest Hazard

- a. The **first step** in a risk assessment is the identification of the mine or ERW that poses the greatest hazard at a worksite. When the type or condition of the devices likely to be encountered is unknown or uncertain, a worst case scenario should be presumed and the risk assessment reviewed when more information

becomes available.

- b. The largest or most potentially damaging mine will not always present the greatest risk of secondary injury or the greatest hazard. For example, when working in a mixed AP and AT minefield, there may be no reason to expect that an AT mine could be unintentionally detonated during any of the procedures used. In this case, the AP mines might present the greatest danger-area and AP mine working distances should be applied.
- c. If functional AP fragmentation mines are present at a worksite, they often present the greatest risk of secondary injury to demining staff. However, when AP fragmentation mines are in a condition such that no tripwires remain or their fuze system is reliably inoperative, there may be no reason to expect that an AP fragmentation mine could be unintentionally detonated during any of the procedures used. In this case, the working distance for the danger area associated with the next greatest hazard should be applied.

21.2 Assessment of the Risk of an Unintended Detonation Occurring

- a. The **second step** in the risk assessment process is an assessment of the likelihood of an unintended detonation occurring at the worksite.
- b. The risk of an unintended detonation occurring is assessed as **high, increased, or normal**, as defined here.
 - **High risk.** The condition of the hazard is such that it could be initiated during the correct application of standard manual demining procedures.
 - **Increased risk.** The worksite conditions complicate the application of standard manual demining procedures in a way that could be predicted to result in an unintended detonation.
 - **Normal risk.** There is no reason to believe that the application of standard manual demining procedures will result in an unintended detonation.

21.3 Assessment of the Risk of a Detonation Causing Severe Injury

- 21.3.1 When the risk of an unintended detonation occurring has been assessed, the risk of severe injury resulting from it must be determined and minimised.
- 21.3.2 The likelihood of severe injury occurring depends on the distance between that detonation and the demining staff. The required distance varies with the mine or ERW that presents the hazard. In all cases, a deminer within a metre of the unintended detonation is at an unacceptable risk of sustaining severe injury.
- 21.3.3 When the risk of an unintended detonation of any mine or other ERW is **high**, the risk of severe injury to any deminer conducting demining procedures at close quarters is unacceptable because the primary protection for all deminers is the application of procedures and tools that make an unintended detonation unlikely.
- 21.3.4 If there is a **high risk** of an unintended detonation, manual demining at close quarters must not be conducted until the risk of an unintended detonation has been reduced to **increased or normal**. Equipment, procedures and tools should be selected that will reduce the risk of an unintended detonation. Mechanical demining that results in the planned detonation or disruption of the **high risk** hazards should be considered
- 21.3.5 If there is an **increased risk** of an unintended detonation, attempts should be made to change the worksite conditions such that the risk of an unintended detonation is

reduced to **normal**. It may be appropriate to use demining machines to prepare the area. When the worksite conditions cannot be improved, the use of manual demining procedures and tools that increase the distance between the deminer and the hazard to reduce the risk of the deminer suffering severe injury should be considered.

- 21.3.6 Demining may be conducted when there is an **increased risk** of an unintended detonation but demining must only be conducted at a demining worksite when the risk assessment determines that, using the procedures, tools and PPE selected, there is a tolerably low risk of severe injury from any unintended detonation.
- 21.3.7 A **normal risk** of an unintended detonation is the normal situation at a demining worksite. A **normal risk** of an unintended detonation automatically means that there is a **low risk** of severe injury to all demining staff because there is a low risk of any injury at all. The risk of severe secondary injury occurring is then very low indeed, and the working distances required to make this residual risk tolerable need to be balanced against the need for communication, supervision and efficiency.
- 21.3.8 The preliminary risk assessment must be reviewed and updated as work progresses so that all information about the hazards, their condition and their context can be reflected in the choice of equipment, procedures and tools that are used, and in the safety distances applied.

21.4 If an Unintended Detonation Occurs

- 21.4.1 If an unintended detonation occurs, a clear and objective review of the worksite risk assessment in the light of the full circumstances surrounding the unintended detonation must be made.
- 21.4.2 If the unintended detonation could have been avoided, this may lead to a revision of the procedures and tools being used. If no one was injured in the unintended detonation, this may be seen as a justification of the conclusions in the original risk assessment and the review of the risk assessment may result in no changes.
- 21.4.3 Even when a deminer is injured, there is usually no reason to revise the working distances unless there are secondary injuries to other staff. Even if this occurs, the revision of working distances should not be automatic. It should be based on an assessment of the likelihood of the circumstances surrounding the accident being repeated and any changes to the demining procedures and tools that can be made to prevent recurrence.

22. Demining Working Distances at a Manual Mine Clearance Site

- 22.1 Tables 1 includes the minimum demining working distances at a manual mine clearance site where mines present the greatest hazard. Greater demining working distances should be considered when it is possible to use them without reducing efficiency.
- 22.2 If any of the following apply, the distances shown under the heading “**Increased risk**” in Table 1 should be applied as the minimum:
- Hazards are in an unknown or unpredictable condition;
 - There is reason to believe that hazards may be booby trapped or have anti-lift

devices fitted;

- c. The procedures in use have not been proven in a similar context; and
- d. The likelihood of an unintended detonation has been assessed as increased.

- 22.3** When the risk assessment determines that ERW present the greatest hazard, demining working distances appropriate for the risk of an unintended detonation of the ERW hazard should be determined and applied.
- 22.4** When there is no reason to believe that the procedures and tools in use could cause an unintended detonation of any of the hazards present, the working distances appropriate for the **normal risk** associated with the smallest AP blast mine should be adopted.
- 22.5** Having determined which, mine presents the greatest hazard with regard to its type, condition and context, the demining working distances shown in table 1 below must be applied as a minimum. Any further reduction must be documented in the risk assessment with reasons for the variation stated in writing, for approval by the LibMAC. Mine Action Organisations should apply greater demining working distances when deemed appropriate, based on a pertinent risk assessment. The reason for the increase must be documented and should be detailed in the demining site implementation plan (IP).
- 22.6** Table 2 below details the minimum demining working and safety distances for a battle area clearance site, and table 3 for a mechanical demining site.

23. Minimum Safety Requirements

- 23.1 The following table details the minimum safety requirements to be enforced at a manual mine clearance, battle area clearance, and mechanical demining sites:

MINIMUM DEMINING WORKING AND DEMINING SAFETY DISTANCES FOR A MANUAL MINE CLEARANCE SITE				
Serial	Situation	Demining Working Distance (metres)		Minimum PPE
		Normal Risk	Increased Risk	
1	Between personnel directly involved in demining in suspected or confirmed anti-personnel blast mine areas (HE up to 200 gm).	10	15	Full
2	Between personnel directly involved in demining in suspected or confirmed anti-personnel blast mine area (HE more than 200 gm).	15	20	Full
3	Between personnel directly involved in demining in suspected or confirmed anti-personnel fragmentation mine areas.	20	25	Full
4	Between personnel directly involved in demining in suspected or confirmed anti-personnel	25	30	Full

	bounding or directional fragmentation mine areas.			
5	Between personnel directly involved in demining in suspected or confirmed anti-tank/vehicle mine areas.	15	50	Full
6	Between supervisory and monitoring personnel and personnel directly involved in demining in suspected or confirmed hazardous mine areas.	-	-	Full
Serial	Situation	Demining Safety Distance (metres)		Minimum PPE
6	Between the explosive storage area and other designated areas.	50		N/A
7	Between unprotected assets in designated areas and the personnel working in suspected / confirmed mine areas.	100		N/A
8	Between personnel not wearing PPE and personnel working in suspect / confirmed anti-personnel, anti-tank/vehicle mine, and ERW areas.	100		N/A
9	Between the Control Point and personnel working in suspect / confirmed anti-personnel, anti-tank/vehicle mine, and ERW areas.	100		N/A
10	Between unprotected assets, i.e. vehicles / machines / equipment, and personnel working in suspect or confirmed anti-personnel, anti-tank mine and ERW areas.	100		N/A

Notes to table:

- PPE shall be in accordance with LibMAS 10.30.
- Any reduction to these distances must be authorised by the LibMAS. They must be increased as required, and any amendments to these distances must be recorded and should be included in the demining site Implementation Plan (IP).
- PPE shall be worn by all personnel forward of the designated 'PPE hotline' while demining is being conducted.
- The 'PPE hotline shall be a minimum of 100m from the nearest working asset, unless a reduction is authorised, i.e. if there is sufficient protective works or natural cover between the PPE hotline and working area.
- The type of mine selected to determine the minimum demining working and demining safety distance should be the most hazardous functional mine that could be initiated using the demining tools and procedure that will be used.
- The risk assessment used to determine the minimum demining working and demining safety distance must be reviewed if any of the information used in the assessment changes.
- If devices presenting a greater hazard than expected are discovered, the appropriate demining working and demining safety distance for the increased hazard must be adopted unless there is no reason to anticipate the presence of more of those devices in the area.
- These distances should not be applied during demolitions or any other procedure during which mines are deliberately detonated (such as mechanical demining). Demining working and demining safety distances are detailed in table 3 below.
- Generally, demining working distances do not apply to those supervising and monitoring deminers while they work. It is a safety requirement that supervisory and monitoring staff may approach any working deminer as part of their work, and should avoid distracting deminers from concentrating on their work. If there is a need to communicate with the deminer then it may be necessary to wait or request the deminer to stop working. Supervisory and monitoring staff should not approach closer than one metre from a working deminer. **Note:** other personnel such as important visitors to

worksite may be authorised to observe working deminers, however they must be accompanied by supervisory or monitoring staff.

10. Explosives must be securely stored at the site with adequate protection.

Table 1: Demining Working and Demining Safety Distances for a Manual Mine Clearance Site

MINIMUM DEMINING WORKING AND DEMINING SAFETY DISTANCES FOR A BATTLE AREA CLEARANCE SITE			
Serial	Situation	Demining Working Distance (metres)	Minimum PPE
1	Between demining working teams in suspected or confirmed hazardous areas.	50	Ref. SOP
2	Between personnel directly involved in non-intrusive actions in suspected or confirmed hazardous areas.	-	Ref. SOP
3	Between personnel directly involved in intrusive actions (except for excavation) in suspected or confirmed hazardous areas.	5	Full
4	Between personnel directly involved excavating the ground in suspected or confirmed hazardous areas.	25	Full
5	Between supervisory and monitoring personnel and personnel directly involved in demining in suspected or confirmed hazardous areas.	-	Same level as personnel demining
6	Between personnel directly involved in demining in suspected or confirmed hazardous areas and personnel without PPE.	100	N/A
Serial	Situation	Demining Safety Distance (metres)	Minimum PPE
7	Between the explosive storage area and other designated areas.	50	N/A
8	Between the Control Point / Admin Area and personnel working in suspect / confirmed ERW areas	100	N/A
9	Between unprotected assets, i.e. vehicles / machines / equipment, and personnel working in suspect or confirmed ERW areas.	100	N/A
Notes to table:			
1. In accordance with table 1, notes to table, points 1-2 and 4-10. PPE may however not be required for personnel forward of the 'PPE Hotline' if battle area clearance procedures conducted all personnel to work without PPE.			
2. The type of ERW selected to determine the minimum working distance should be the most hazardous functional ERW that could be initiated using the demining tools and procedure that will be used.			

Table 2: Demining Working and Demining Safety Distances for a Battle Area Clearance Site

MINIMUM DEMINING WORKING AND DEMINING SAFETY DISTANCES FOR A MECHANICAL DEMINING SITE			
Serial	Situation	Demining Working Distance (metres)	Minimum PPE
	Between personnel wearing PPE and a machine working in suspected or confirmed anti-personnel blast mine areas.	100	Full
	Between Personnel wearing PPE and a machine working in suspected or confirmed anti-personnel fragmentation, anti-tank mine and ERW areas.	200	Full
	Between personnel / MDD not wearing PPE and a machine working in suspected or confirmed anti-personnel blast mine areas.	200	N/A
1	Between personnel / MDD not wearing PPE and a machine working in suspected or confirmed anti-personnel fragmentation, anti-tank mine and ERW areas.	300	N/A
2	Between supervisor / monitor / remote control machine operator behind an approved blast and fragmentation screen and machine working in suspected or confirmed anti-personnel, anti-tank and ERW mine areas.	50	Depending on screen level of protection
3	Between working machines in suspected or confirmed anti-personnel blast mine areas.	50	N/A
4	Between working machines in anti-personnel fragmentation, anti-tank mine and ERW areas.	100	N/A
5	Personnel 'visually' inspecting machines for mines or ERW, after operating in suspected or confirmed hazardous areas.	-	Full
6	Between personnel wearing with PPE and personnel 'visually' inspecting machines for mines or ERW, after operating in suspected or confirmed hazardous areas.	50	Full
7	Between personnel not wearing PPE and personnel 'visually' inspecting machines for mines or ERW, after operating in suspected or confirmed hazardous areas.	100	N/A
8	Between supervisory and monitoring personnel and personnel 'visually' inspecting machines for mines or ERW, after operating in suspected or confirmed hazardous areas.	-	Full
Serial	Situation	Demining Safety Distance (metres)	Minimum PPE
7.	Between the explosive storage area and other designated areas.	50	N/A
8.	Between the Control Point / Admin Area and machine working in	100	N/A

	suspected or confirmed anti-personnel blast mine areas.		
9.	Between the Control Point / Admin Area and machine working in suspected or confirmed anti-personnel fragmentation, anti- tank mine and ERW areas.	300	N/A
10.	Between unprotected assets, i.e. vehicles / machines / equipment, and machines working suspected or confirmed anti-personnel blast mine areas.	100	N/A
11.	Between unprotected assets, i.e. vehicles / machines / equipment, and machines working suspected or confirmed anti-personnel fragmentation, anti- tank mine and ERW areas.	300	N/A

Notes to table:

1. In accordance with table 1, notes to table, points 1-3, 5-7 and 10.
2. The type of ERW selected to determine the minimum working distance should be the most hazardous functional ERW that could be initiated using the demining tools and procedure that will be used.
3. The 'PPE hotline shall be a minimum distance from the nearest working machine, in accordance with mine / ERW hazard detailed in this table, unless a reduction is authorised, i.e. if there is sufficient protective works or natural cover between the PPE hotline and working area.
4. The type of mine selected to determine the minimum demining working and demining safety distance should be the most hazardous functional mine or ERW that could be initiated using the demining tools and procedure that will be used.
5. These distances should not be applied during demolitions.

Table 3: Demining Working and Demining Safety Distances for a Mechanical Demining Site

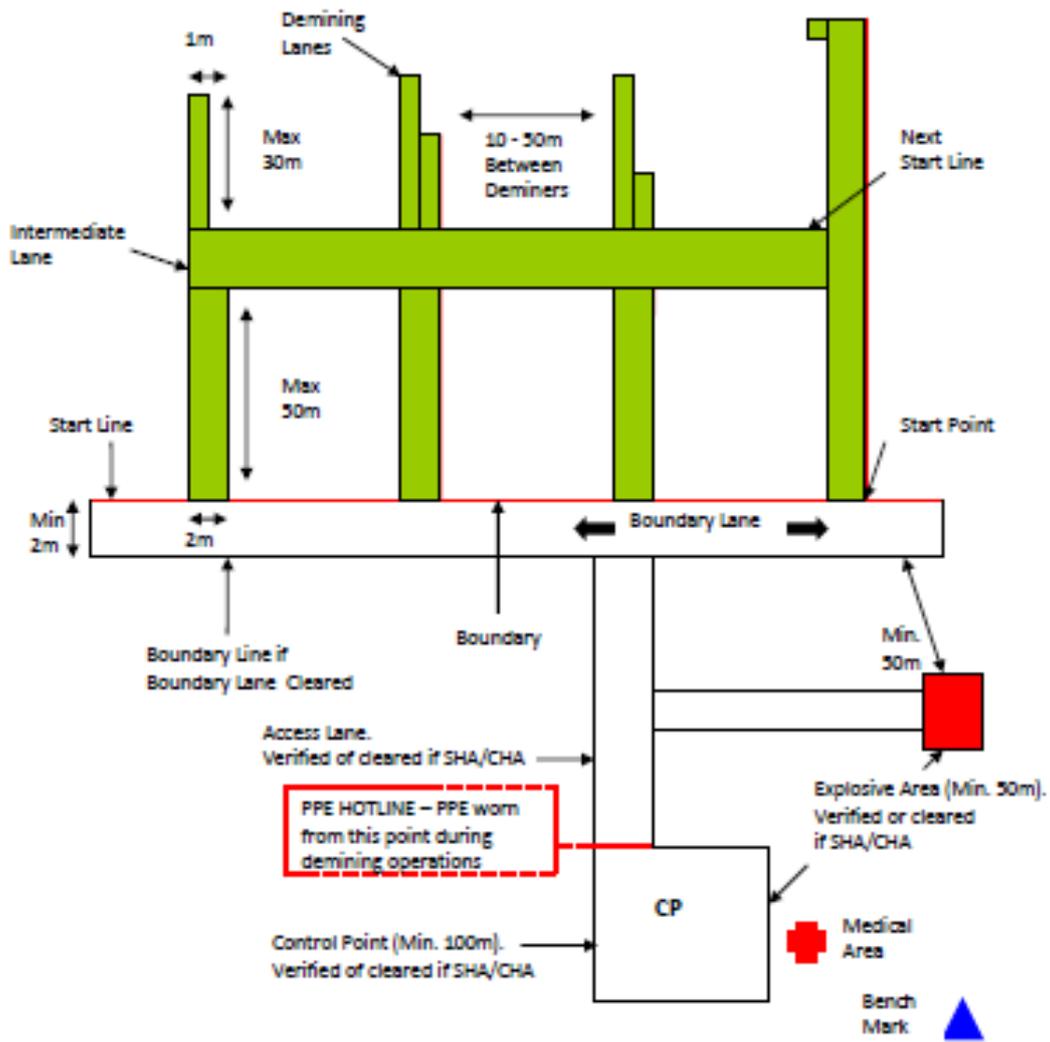


Figure 4: Example of a mine clearance site layout

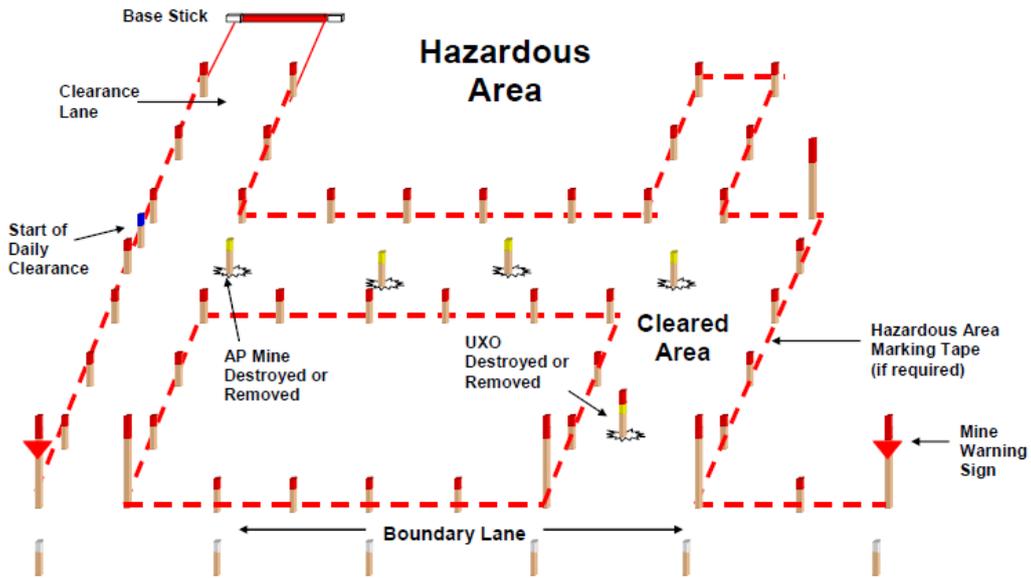


Figure 5: Example of a manual mine clearance site working area
(Note: rocks may be used instead of wooden posts)

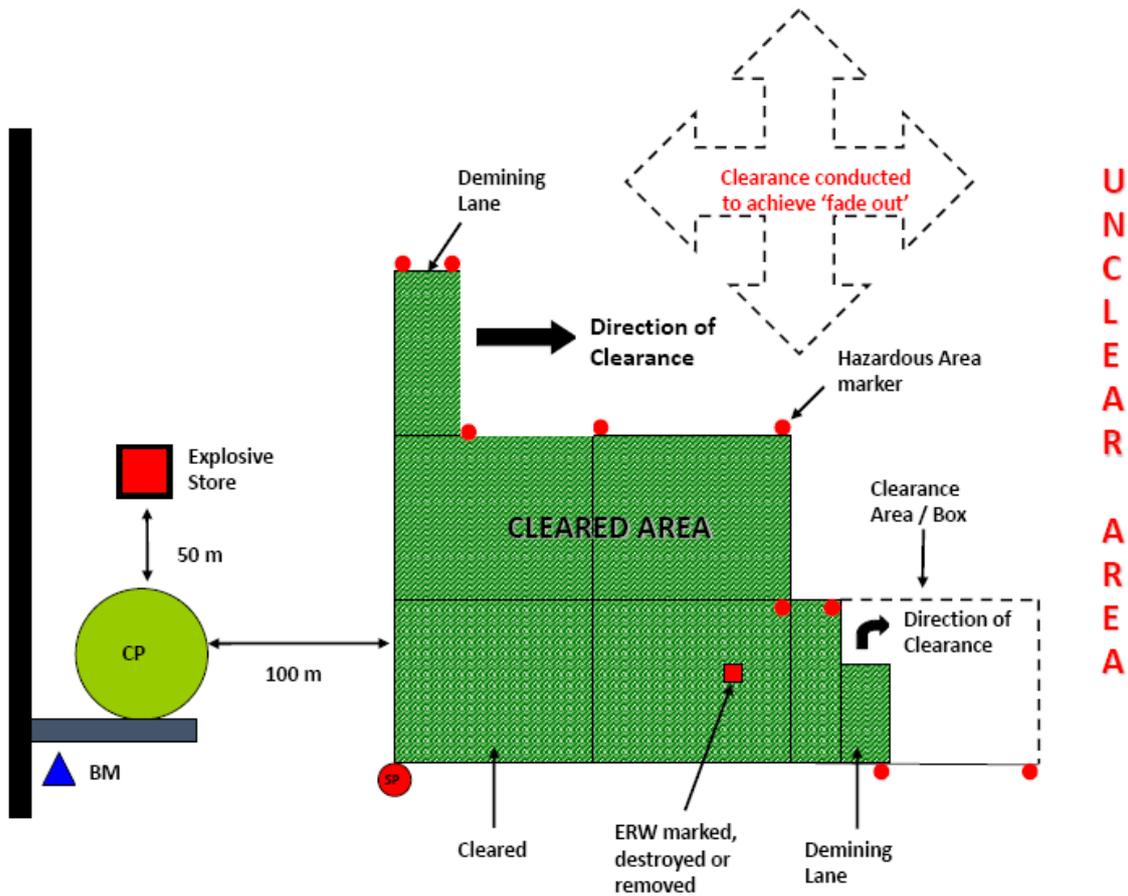


Figure 6: Example of a battle area clearance site layout

24. General References

- a. International Mine Action Standards (IMAS), in particular, 10.20, Safety and Occupational Health – Demining Worksite Safety.
- b. LibMAS 09.30 Explosive Ordnance Disposal, 10.20 Demining Worksite Safety and 10.20/1 Demining Site Marking Systems and 10.40 Medical Support to Demining

25. Record of Amendments

Ser.	Date: D/M/Y	Standard	Section / Paragraph	Amended by: Name / Position / Org.	Comments
1	27/10/15	10.20 Demining Worksite Safety	All	Doug Ware, Chief of Ops/QA, UNMAS	Revised and add. details to existing Standard.
2	04/11/15	10.20 Demining Worksite Safety	2.3 Fade Out (and Buffer Zone)	Doug Ware, Chief of Ops/QA, UNMAS	Inclusion of 'Buffer Zone'
3	16/11/15	10.20 Demining Worksite Safety	All	Doug Ware, Chief of Ops/QA, UNMAS	Revised and add. details to existing Standard.