LMAC

LEBANON MINE ACTION CENTER

NMAS 09.13

Minefield Clearance

March 2020

Edition 2.1

Lebanon Mine Action Center-LMAC

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Warning

This document has been released on the date shown on the cover page. The National Mine Action Standards (NMAS) of Lebanon are subject to regular review and update, so users are advised to consult the most recent version. To ensure that you have access to the current version, contact the Lebanon Mine Action Center (LMAC) through the www.lebmac.org website or by sending an email to info@lebmac.org.

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The LMAC gratefully acknowledges UNDP support during the preparation of this NMAS.

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Foreword

The National Mine Action Standards (NMAS) of Lebanon were first developed in the form of Technical Standards and Guidelines (TSG). These TSG were edited into the first edition of the NMAS in 2010 and were written to comply with the first edition of the International Mine Action Standards (IMAS). Since then, the scope of the IMAS has been expanded to include more components of mine action and amended to mirror the most recent changes to standards as required in today's operations. These changes, as well as changes in the local context of Lebanon, have necessitated a review and update of the NMAS.

As detailed in the National Mine Action Policy of 2007, the Lebanon Mine Action Center (LMAC) has the responsibility to execute and coordinate the Lebanon Mine Action Program (LMAP) on behalf of the Lebanon Mine Action Authority (LMAA), including the development and amendment of standards. Such standards shall be developed in a participatory approach that shall involve international, governmental, and nongovernmental organizations.

The NMAS are reviewed as needed to reflect amendments in the IMAS as well as incorporate changes to international obligations and local requirements. Such revisions are made available on the LMAC's website www.lebmac.org or can be obtained through contacting the LMAC via the email info@lebmac.org.

Acronyms

CHA	Confirmed Hazard Area
EO	Explosive ordnance (of any kind)
EOD	Explosive Ordnance Disposal
ERW	Explosive Remnants of War
HMA	Humanitarian Mine Action
HTHA	High Threat Hazard Area
IA	Implementing Agency
IMAS	International Mine Action Standards
LMAC	Lebanon Mine Action Center
LMAP	Lebanon Mine Action Program
LTHA	Low Threat Hazardous Areas
MDD	Mine Detection Dogs
NMAS	National Mine Action Standards
NTS	Non-Technical Surveys
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
SHA	Suspected Hazard Area
SOP	Standard Operating Procedures
TS	Technical Surveys
TSG	Technical Standards and Guidelines
UXO	Unexploded Ordnance

Introduction

Demining involving the efficient search and clearance of minefields is a core activity in the land release process In Lebanon. Minefield clearance involves the systematic search and clearance or wide areas and is conducted when there is direct evidence confirming the presence of mine hazards in an area. Whereas Non-Technical Survey (NTS) and Technical Survey (TS) are approved approaches to Suspected Hazard Areas (SHAs), area clearance is the approved approach to Confirmed Hazard Areas (CHA). Not all CHA are minefields. Where the anticipated hazards in a CHA do not include mines, the area clearance approaches described in NMAS 09.11 BAC and/or NMAS 09.31 IEDD should be applied.

Adopting the definition in IMAS 09.10, land shall only be defined as 'cleared' after systematic search and clearance actions have ensured the removal and/or destruction of all mine and EO hazards from the specified area to the specified depth. The procedures and assets used shall minimize risk to the deminers/searchers and shall ensure the safety of the end-users of the land.

The LMAC seeks to promote a culture in which the demining community seeks to achieve safe land release by developing and applying appropriate management procedures, by establishing and continuously improving the skills of managers and deminers, and by ensuring the use of safe, effective and efficient equipment. Although the LMAC is the authority, the LMAC recognizes that the Implementing Agencies (IAs) share our goals, so seeks rational co-operation and only exercises its authority when required.

Area clearance can achieved with the assistance of mechanical assets but, with currently available mechanical equipment, the requirement to remove all EO hazards shall always require a manual search and clearance deployment. While the principles explained herein should be applied broadly, this NMAS provides guidelines for the manual demining of minefields.

Minefield Clearance

1. Scope

This NMAS provides standard principles and guidance for the implementation of manual demining operations in minefields in Lebanon. Its requirements shall be applied by all implementing agencies (IAs) conducting manual demining operations. When the anticipated hazards in a CHA do not include mines, the area clearance approaches described in NMAS 09.11 BAC and/or NMAS 09.31 IEDD clearance should apply.

For the purposes of this NMAS any area of land contaminated with anti-personnel or anti-tank mines shall be classed as a minefield.

2. References

A list of normative and informative references is provided in Annex A.

Normative references provide cross-referencing to other standards referred to in this NMAS, and which form an integral part of the provisions of this standard.

Informative references provide a list of documents that may be consulted for a clearer understanding of this standard.

3. Key Terms and Definitions

The following key terms and definitions are used in this NMAS:

- *Cleared land:* Adopting the definition in IMAS 09.10, land shall be accepted as 'cleared' after systematic search and clearance actions have ensured the removal and/or destruction of all mine and EO hazards from the specified area to the specified depth.
- *Deminer/Searcher:* a person responsible for conducting demining operations as directed by the relevant Demining Organization. The word “deminer” is used interchangeably with “searcher”. The tasks of a deminer primarily focus on searching for and detecting hazards in accordance with the NMAS and the demining organization's LMAC approved Standard Operating Procedures (SOPs).
- *Demining organization:* an organization, national or international, accredited by the LMAC to conduct humanitarian demining activities in Lebanon. Demining organizations may also be referred to as *Employers* or *Implementing Agencies* (IAs).
- *Explosive Ordnance (EO)*: all munitions or parts of munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket and small arms ammunition; all mines, torpedoes and depth charges; pyrotechnics; cluster munitions and dispensers; cartridge and propellant actuated devices; electro-explosive

devices; clandestine and improvised explosive devices; and all similar or related items or components that are explosive in nature (adapted from IMAS, 2nd ed., 2014).

- *High Threat Hazardous Area (HTHA):* an area with a confirmed presence of an EO contamination hazard. All areas contained within minefield fencing are generally deemed to be HTHAs. In minefields where the positions and pattern of mine-lines can be confidently identified, the area inside the fencing of the minefield may be divided into HTHA (location of mines) and LTHA.
- *Low Threat Haz*ardous Area (LTHA): an area of land suspected to contain explosive hazards and requiring non-technical survey (NTS) or technical survey (TS).
- *Unexploded Ordnance (UXO):* explosive ordnance that has been primed, fused, armed or otherwise prepared for use or used. It may have been fired, dropped, launched or projected yet remains unexploded due to malfunction, design, or any other reason.

In addition to the above terms, NMAS 04.10 provides a glossary of terms and definitions used across all standards.

As in the IMAS, the terms 'shall', 'should' and 'may' are used across all standards to indicate the required degree of compliance. For any organization working in Lebanon, the use of 'shall' indicates a compulsory requirement. The term 'should' indicates the national preference which may be varied with LMAC approval. The term 'may' indicates a suggestion that is not obligatory.

4. General Principles

Manual mine clearance is conducted in a variety of ways by different IAs and this variation should generally be permitted. Demining procedures may also differ depending on equipment available, the terrain, and the type of hazards present. All procedures used in the search and clearance of minefields shall be accurately detailed in the SOPs that the IA submits for LMAC approval before use.

In all humanitarian demining operations, efficiency should be measured in terms of safety, cost and speed in that order. Increased speed or cost-savings shall not be achieved by compromising safety. Safety refers to the safety of the demining staff as well as the safety of the end-users of the land.

This NMAS describes established manual minefield clearance guidelines. Notwithstanding the varied procedures and equipment that IA's may prefer, compliance with this NMAS is the minimum standard required by the LMAC. Any deviation from the standards herein shall be included in the detailed demining SOPs submitted to the LMAC and the variant(s) must be authorized before use.

4.1 Patterned minefields

Some (but not all) minefields contain lines of mines (mine rows) that were placed in a disciplined pattern. Even when mines are placed in disciplined patterns, the clearance plan

for the area shall make allowance for the fact that the minefield may have been 'repaired' or 'reinforced' with mines placed outside the predictable mine rows.

4.2 Clearance Depth

The minimum default depth of search and clearance in minefields shall be 15 cm unless otherwise stated in the Task Dossier or formally authorized by the LMAC.

When searching for plastic or wooden cased mines, ferrous locators shall not be used. Metal detectors capable of reliably detecting the range of metals that are in the anticipated mines at the required depth beneath the ground surface shall be used.

The metal detector used to search for mines shall be tested in the ground conditions where it will be used at each task to determine whether it can reliably detect the targets at the required search depth. The depth shall be measured from the surface of the ground to the top of the target. The target shall either be a rendered safe example of the mine being sought or a reliable surrogate of the metal content. The target should be positioned vertically and horizontally beneath the ground (and the hole back-filled) to determine whether the detector is capable of locating it when buried at a 15 cm depth whatever the orientation of the target.

Any reduction in the reliable search depth shall only be permitted with formal authorization from the LMAC. The search depth should be increased whenever there is evidence to suggest that some mines may be at a greater depth than 15cm. The IA may increase the search depth without authorization but shall notify the LMAC of the change.

4.3 Clearance Lanes

Manual mine clearance is generally conducted in one meter wide lanes with a safety overlap of 10cm on both sides. When detailed in the IA's SOPS that have been approved by the LMAC, a suitably rigorous 'lateral search' pattern can be appropriate to use when searching linear areas, such as road verges.

Search in a clearance lane may be conducted using either hand-held metal detectors or an area excavation procedure. Any search systems that is used shall have been detailed in the IA's SOPs and pre-authorized by the LMAC.

Prodding to detect mines (rather than using a prodder to help expose a mine that has already been detected) has been proven to be an inherently unsafe method that shall not be used in humanitarian mine action in Lebanon.

Further information about clearance lane marking can be found in NMAS 08.40 Marking Hazards.

5. Visual Search

The deminer should make a close visual inspection of the working area as work progresses. The visual search is to try to see hazards or parts of hazards or other clues to their presence, such as:

- tripwires, cords;
- disturbance to the ground;
- suspicious objects (inconsistent in the surroundings);
- mine/ UXO indicators such as packaging; and
- animal remains.

Often, part of the top of a hazard may be exposed and visible after undergrowth has been removed. Whenever this is the case, the deminer should presume that there may be other mines close to the visible hazard and conduct a thorough search up to and around the visible hazard before exposing it.

6. Detection of Tripwires

When searching for tripwires, they are generally detected by eye so the person conducting the search should face into the area to be searched. If the vegetation permits, a tripwire feeler that is designed to assist the detection of both slack and taut wires may be used.

When the vegetation does not allow the use of a tripwire feeler, the search should be conducted using the eyes and hands. After a thorough visual check of the area, the search is conducted by slowly moving the hands forward and gently parting any thick vegetation that may obscure tripwires. The deminer should not pull vegetation and should avoid touching any trip wires.

Tripwire feeling and vegetation cutting may be a combined procedure when appropriately detailed in the IA's authorized SOPs.

7. Manual Vegetation Removal Using Hand Tools

When there is a requirement to cut vegetation by hand, the deminer should not cut vegetation further than 50 cm in front of the base stick. Vegetation should be cut across the complete width of the lane, including the overlap to the sides whenever it is safe to do so. Cut vegetation as the work is conducted. Cuttings may then be collected in designated areas as detailed in the IA's LMAC approved SOPs.

The deminer should be constantly looking through the vegetation for any indication of hazards. Tall vegetation should be cut systematically from the top downwards in a safe and controlled manner in lengths of not more than 50 cm. Large or heavy vegetation should not be allowed to fall into un-cleared areas.

Vegetation should eventually be cut as close to the ground as possible (without touching the ground) and the cuttings removed to ensure that the subsequent visual and detector search of the ground can be conducted efficiently.

When the controlled use of a detector during vegetation removal is clearly explained in the organization's LMAC approved SOPs, the approved detector may be used to check the vegetation before and during the cutting process.

8. Use of the Metal Detector

When searching and clearing minefields, the only time that a ferrous locator may be used is when it is reliably known that ALL of the mines present are ferrous metal-cased anti-tank mines. This is so rare that ferrous locators should not be used in minefields without the prior approval of the LMAC.

The search and clearance of minefields with metal detectors may be followed by the BAC search of the area with ferrous locators capable of locating deeply buried ferrous EO when this is included in the authorized task Clearance Plan.

Before use, each metal detector shall be checked to ensure that it is functioning correctly and is capable of locating the most difficult to detect of the anticipated mines. The metal content of plastic cased mines varies, so the most difficult to detect mine may not be the mine that has the smallest outside dimensions. The detector should also be checked after each use to ensure that it is still functioning correctly.

The detector shall be used to search the width of the search lane including the safety overlap at the sides of the lane, covering an area up to 50 cm ahead of the base stick. The search head shall be advanced with an overlap that ensures full ground coverage and detection at the required search depth. The search head should be moved over the entire search area in a controlled pattern before returning to pinpoint the position of any indications. This allows the identification of linear indications before any signals are pinpointed, marked and investigations are made.

When the area in front of the base stick has been searched and cleared, the base-stick should be moved forward to a position 10cm inside the area already searched and cleared.

8.1 Detector Signal Pinpointing and Marking

All metal detector signals inside the search area (including the overlap) should be pinpointed and investigated. The pinpointing procedure for the metal detector in use shall be fully detailed in the IA's approved SOPs.

When appropriate, a magnet may be passed over the ground above the signal and, if anything is attracted to the magnet, the area checked again with the detector to determine whether there is still a signal in that position.

A signal marker should be placed before the closest point of the signal, or isolation markers may be used to mark the extremities of a large signal.

8.2 Investigating a Detector Signal

The following are the general recommendations for the safe investigation of a marked detector signal.

In hard ground, water may be applied to the ground before and during the signal investigation. Depending on the size and orientation of metal within the target mine, signal investigation should start at least 15 cm back from the nearest point of the signal by making an excavation at least as wide as the largest anticipated mine in the area. The ground should be removed to the required search depth before approaching the signal from the side in an excavation procedure that shall be fully detailed in the IA's pre-authorized SOPs.

As the investigation progresses, the metal detector should be used to determine whether the signal has moved. When safe, magnets may also be used to try to attract ferrous scrap that may have been the source of the metal detector indication.

When a mine is found, the deminer should proceed in the manner detailed in the IA's authorized SOPs.

9. Full area excavation

In some places within a minefield, the use of metal detectors to search may be ineffective or inefficient. When this occurs, the detector search procedure shall be replaced with full area excavation to the required clearance depth.

Full area excavation may be required when:

- the ground is highly contaminated with metal, making it impossible to reliably pinpoint separate signals;
- the search area contains mineralized or magnetic ground and ground-compensating detectors are not available, are unable to cancel the ground signal, or lose effective search depth when canceling the ground signal;
- the maximum search depth required is beyond the range of the metal detectors;
- the metal detectors are rendered unreliable by electrical interference (e.g. from power lines); and
- there is a requirement to investigate or remove obstacles, e.g. trenches, bunkers, mounds, rocks, fences.

Area excavation procedures shall be fully detailed in the IA's pre-authorized SOPS and shall ensure full ground coverage to the required clearance depth.

Within the same task area, metal detectors may be confidently used in some areas and area excavation in others. The IA shall ensure that procedures able to reliably ensure the search

depth are used over the entire minefield task area unless discrete areas have been approved for 'reduction' by the LMAC. In pursuit of efficiency, the LMAC shall consider requests for area reduction inside tasks recorded as CHA. When both the IA and the LMAC are convinced that this would not be a reduction in safety for end-users or staff, it should be permitted but no area that is reduced without systematic search and clearance shall be recorded as having been cleared.

Because area excavation procedures usually involve moving the ground surface back from a trench that advances, the excavation depth could vary and can be difficult to QC. For this reason, the IA's internal QA of area excavation procedures shall be increased to a level that gives full confidence that the search depth has been constantly maintained.

When more than one search procedure is used in a minefield, the areas searched with each procedure shall be accurately recorded and should be marked on the ground to assist external QC.

10. Metal free

When metal detectors are used to search an area, all non-hazardous metal found should also be removed from the ground and placed in the metal collection area to assist with QC. In mined areas the metal detector shall have had its sensitivity 'set' to reliably detect the anticipated targets at the required depth. Internal QC should be conducted using the same model of detector at the same sensitivity setting.

External LMAC authorized QC may be conducted using another model of metal detector or the same model at another sensitivity setting. When any metal that is smaller than the metal-content of the smallest anticipated mine at the task is discovered during external QC, that shall not constitute a non-conformity unless the metal discovered presents an EO hazard. See NMAS 07.12 for details about the QC inspection of cleared land and non-conformities.

11. Action on Locating Mines and EO

The appropriate action to take when an explosive hazard has been located during minefield clearance depends in part on the deminer's level of training and shall be fully detailed in the IA's pre-authorized SOPs.

The following general constraints apply.

- During mine clearance operations, no person should be allowed to pass beyond a located hazard in a clearance lane until the hazard has been removed or destroyed.
- The Site Supervisor shall be responsible for ensuring that all actions relating to the removal or destruction of the EO are carried out in accordance with the LMAC approved SOPs by a suitably EOD trained and experienced person.

- When there is any reason to suspect that a discovered item may be all or part of a booby trap or IED, the hazard shall be pulled from a safe distance before appropriate further action is taken.
- The controlled destruction of located mines and EO should be conducted during or at the end of each working day unless otherwise approved by the LMAC. Only suitably trained and experienced EOD staff shall conduct demolitions or render safe procedures.

When planning demolitions at a task site, the IA should request authorization from the LMAC at least 30 minutes in advance. The LMAC may authorize the demolition or authorize for the hazards to remain at the task site overnight. When authorized to leave EO hazards at the task site overnight, the hazards shall be accurately marked, reported on the daily work sheet and the weekly progress report, including an explanation of why they have been left on site. The items shall be destroyed or removed as soon as possible thereafter.

12. Missing Mine Procedures

In minefield clearance, mines may be found to be missing from the established pattern as work progresses. The IA shall have given details of their 'missing mines' procedures in the SOPs submitted to LMAC for approval before use.

The missing mines may have detonated without leaving an obvious crater. Other reasons for their absence include:

- removal by local people;
- migration due to weather; or
- having become buried deeper than detector search depth by soil movement.

Whenever it is possible that the mine may be deeper than anticipated, a one meter area around where the mine was anticipated shall be searched to an increased depth.

When the context makes mine movement possible, the area along which the mines may have migrated shall also be searched. Depending on the Task Dossier and the LMAC authorized task Clearance Plan, the original task boundaries may need to be revised to include those places where mines may have migrated. Any change to task boundaries should be agreed with the LMAC and authorized before the search area is reduced. Changes that extend the search area may be made without prior LMAC authorization but must be reported as soon as possible to the LMAC, with reasons for the extension given

In the IA's minefield clearance report for any minefield where anticipated mines are missing, the Site Supervisor should give probable reasons for the mines being absent.

13. Pulling Procedures

The IA shall include details of their pulling procedures and equipment in the SOPs that they submit to the LMAC for approval before use.

Pulling procedures may only be conducted by appropriately trained and experienced staff who are, or who are supervised by, a suitably trained and experienced EOD person.

An appropriate safety distance for the mine or EO being pulled shall be used and an appropriate wait time after pulling shall be enforced.

14. Roles and Responsibilities

14.1 Role of the LMAC

The LMAC shall:

- accredit IAs before assigning any minefield clearance tasks to them in accordance with NMAS 07.30 Guide for the Accreditation of Mine Action Organizations and Operations;
- assess the IA's minefield clearance SOPs and, when appropriate, approve their use;
- assess the IA's proposed demining equipment and assets and, when appropriate, approve their use;
- allocate minefield clearance tasks to appropriate IAs, specifying the boundaries of the area to be cleared and the minimum search and clearance depth;
- notify the IA of the required standards for QA and QC to be applied;
- monitor the work of IAs to assure quality operations;
- perform external QC on assigned minefield tasks prior to Land Release; and
- collect, analyze and store all relevant data related to minefield clearance operations.

14.2 Role of IAs

In their capacity as minefield clearance organizations, IAs shall:

- acquire LMAC accreditation to conduct minefield clearance operations;
- submit appropriate and effective Standard Operating Procedures (SOPs) for minefield clearance operations to the LMAC and receive approval before their use;
- comply with all relevant NMAS;
- perform internal QA/ QC on tasks allocated to them; and
- ensure appropriate and timely data gathering, documentation, and reporting.

The documents listed below constitute normative references, which form an integral part of the provisions of this standard.

- Current LMAC and IMSMA reporting formats (request copies from the LMAC);
- NMAS 08.40 Marking Hazards;
- NMAS 07.11 Guide for Land release;
- NMAS 09.11 Battle Area Clearance;
- NMAS 09.31 IEDD;
- NMAS 09.50 Mechanical Demining;
- NMAS 12.10 Mine/ ERW Risk Education;
- NMAS 13.10 Mine Victim Assistance; and
- NMAS 04.10 Glossary of Mine Action Terms, Definitions, & Abbreviations used in the Second Edition of the NMAS.

In addition to the normative references listed above, the following informative references may be consulted:

- Lebanon National Mine Action Policy;
- Convention on Cluster Munitions;
- Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which May Be Deemed to be Excessively injurious or to Have Indiscriminate Effects; and
- The 1997 Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on Their Destruction, which is often abbreviated to the Anti-Personnel Mine Ban Treaty or the Ottawa Convention.

NMAS 09.13, Edition 2.1: Amendment Record

The NMAS are subject to a comprehensive or partial review by the Review Board periodically. Changes in the context as well as safety requirements and efficiency considerations may necessitate amendments to individual NMAS standards more frequently. If this occurs, such amendments shall be given a number, dated, and detailed in the table below. The amendment should also be indicated on the header under the NMAS edition number.

Whenever the formal review of the NMAS is completed, a new edition shall be issued. Amendments that have taken place before the review date shall be incorporated in the new edition and the amendment record table cleared. Consequently, the recording of amendments shall start again until the next review.

The most recent revisions of the NMAS shall be posted on the Lebanon Mine Action Center (LMAC) website on www.lebmac.org.

Number	Date	Amendment Details
1	March 2020	Minor revisions throughout for clarity and consistency with new NMAS.
2	March 2020	Changes to permit possible area reduction during CHA clearance, when authorized by the LMAC.