AMAS 11

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Mine Clearance Techniques

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Contents

Warning

The Afghanistan Mine Action Standards (AMAS) are subject to regular revision. This document supersedes all versions of the AMAS published prior to the cover date. Users should contact MACCA (mapa@unmaca.org) to obtain the latest approved version of AMAS.

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Amendment Record

Management of AMAS Amendments

The AMAS series of standards are subject to formal review on a yearly basis; however this does not preclude amendments being made within the year for reasons of operational safety and efficiency or for editorial purposes. As amendments are made to this AMAS they will be given a number, and the date and general details of the amendment shown in the table below.

As formal reviews of each AMAS are completed new editions may be issued. Amendments up to the date of the new edition will be incorporated into the new edition and the amendment record table cleared. Recording of amendments will then start again until a further review is carried out.

Amendment Number	Amendment Date	Amendment to Section #	Amendment Details
01	09/03/09	11.7	Refer to page number 8 of this AMAS

Mine Clearance Techniques

11.1 Introduction

11.1.1 Mine/UXO clearance techniques used during each project may differ according to vegetation, soil content and type of mine/UXO etc. The following sequence is recommended for basic manual demining techniques:

11.2 Scope

11.2.1 This chapter provides guidance on conducting the basic mine clearance drills and techniques e.g. using metal detector, trip wire feeler, action on locating a mine/UXO etc.

11.3 Stages of Mine Clearance Operations

11.3.1 Generally the followings stages should occur during mine clearance operations:

a) Visually and manually inspect the area in front of the Base Stick for tripwires, UXO, surface-laid mines, protruding fuses or suspicious objects

b) Using a tripwire feeler to search for tripwires if the minefield is covered by vegetation.

c) Clear vegetation as required, using a small pruning tool or garden shears.

d) Carry out controlled sweeps with a metal detector over the entire width of the clearance lane and forward to a maximum of 50 cm. Ensure that the search epicenter of the detector covers the full width, but no more, of the Base Stick width. Care must be taken to ensure that the detector head is not allowed to move into any area not previously inspected in accordance with sub-paragraph a & b, above.

e) If the detector gives no signal, move the base-stick forward a maximum of 50 cm with 10 cm overlap and repeat the process from sub paragraph (a).

f) Lane marking is to be placed at a maximum every 1m, as the clearance lane progresses and is to be placed at each end of the red painted 1m spacing on the base stick and not outside the white 10cm overlap. Thereby creating a 1m wide marked cleared lane.

g) If the detector gives a signal, mark 15 cm or half of the detector's search head on the safe side of the signal with a mine-marker and use a manual prodder to locate the source of the signal. Once the object is located, a hand-trowel or similar tool is used to excavate the earth around it sufficiently to reveal its identity.

h) If a mine or UXO is uncovered and specified a mine marker shall be placed close the object on the safe side of the object. Stop mine clearance and notify the team leader/supervisor.

i) All other metal objects found should be collected in the deminers' pouch/bucket and delivered to the metal collection point at the completion of the deminers' shift or as required.

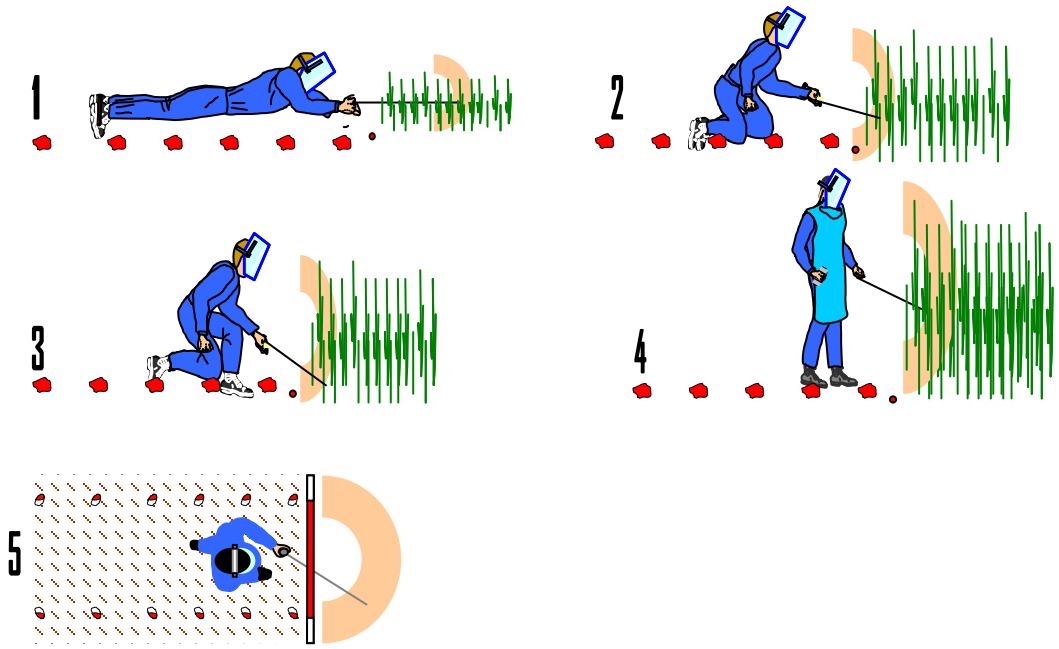
j) During all stages of mine clearance operations, personal protection equipment (PPE) shall be worn. The requirement is either a helmet with full-face protection or a full-face protection visor and a protective jacket or apron. The <u>minimum</u> acceptable standards for this personal

protective equipment are contained in the International Mine Action Standards 10.30 (IMAS 10.30)

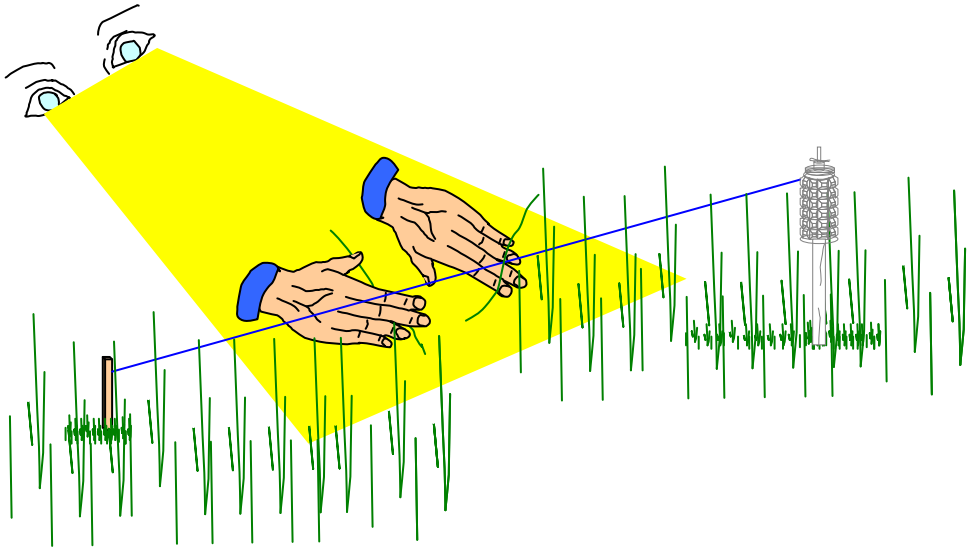
11.3.2 This is an outline procedure only; it is not a detailed drill. All procedures and drills used in clearance operations are to be fully explained in step-by-step detail in the individual Standing Operational Procedures provided by each organization.

11.4 Detection of Tripwires

11.4.1 If the vegetation permits, a tripwire feeler shall be used to locate tripwires. This should be made from light-gauge wire and fabricated in such a way to allow the detection of both loose and tight wires. Starting from a crouched/ kneeling or prone position, the tripwire feeler is moved along the ground, forward of the base stick and raised slowly upwards until above the head. This is completed three times, over the full width of the clearance lane. When clearing in heavily vegetated areas, then the deminer should start from the crouching / kneeling position and move through to the full upright position, thus ensuring that high tripwires are located and not missed.



11.4.2 If the vegetation does not allow the use of a tripwire feeler, the search is completed using the eyes and hands. After a thorough visual check of the area, search the area by slowly moving the hands forward, gently parting any thick vegetation that may obscure tripwires.



11.5 Clearance of Vegetation

11.5.1 The clearance of vegetation shall be done in a safe, controlled method, avoiding any disturbance of vegetation outside the width of the lane. One hand is to secure the tree, branch, or clump of vegetation, while the other uses the cutting tool. All vegetation is to be cut to 20 cm or below and laid either in the adjacent cleared lane or behind the deminer if starting a new lane.

11.5.2 Site-specific vegetation cutting procedures can be authorized by the MACCA/AMAC depending on the threat assessment for that site and the type of vegetation. The cutting procedure is to be mentioned in the clearance plan.

11.6 Use of the Metal Detector

11.6.1 Before commencing the sweep of the area, the metal detector shall be assembled to ensure that it is fully functional, checked, balanced and its sensitivity adjusted to the target specified.

11.6.2 Four complete passes shall be made over the area in front of the base stick; each pass shall cover the full width of the Base Stick and each sweep should not advance more than half of the search head.

11.6.3 The sensitivity of the metal detector shall be checked at least once every **ten minutes**. Details of detector calibration from the manufactures shall be included in the organizations SOP's.

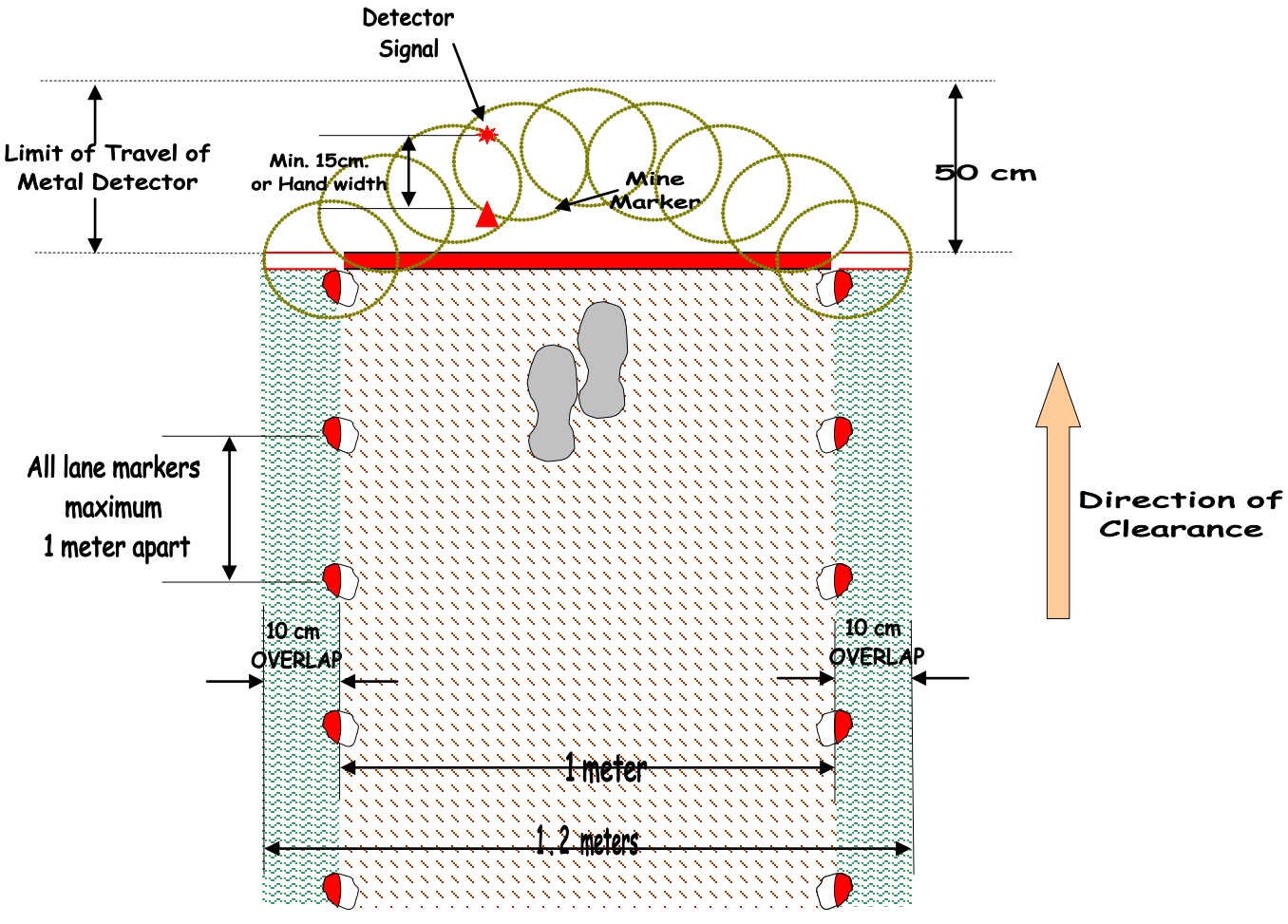


Fig. 4.1 - USE OF METAL DETECTOR AND BASE STICK

11.7 Use of Dual Sensor Detectors

11.7.1 Dual sensor detectors such as the HSTAMIDS, which combines metal detection with ground penetrating radar (GPR), offer the operator an ability to distinguish between "possible mines" and "metal clutter." "Possible mine" calls receive positive indications from both sensors, the metal detector and GPR, while "metal clutter" calls receive a positive indication from the metal detector only. This can provide significant productivity gains when deployed with SOPs which allow for lane preparation and the quick excavation of "metal clutter" calls.

11.7.2 The dual sensor detector provides a productivity gain by reducing the amount of time spent on signal excavation or full excavation. Accordingly the detector gets its biggest return when used in areas of high metal contamination. Methods of deployment shall depend largely on the types of targets. Dual sensor detectors may be used as stand-alone systems or in conjunction with other detectors.

11.7.3 A comprehensive and unambiguous marking system shall be used in clearance operations utilising dual sensor detectors. This system shall be detailed in an organisations SOP's.

11.7.4 Stand alone detection of AT mines only or AT/UXO only. Where the threat is assessed to be AT only or AT/UXO only, after having physically surveyed the area, it may be acceptable to walk on the un-cleared ground to prepare lanes ahead of detector deployment. Lanes may be laid out and vegetation cut. This means that the detector operator is not losing time through repeatedly picking up and putting down tools as he advances down the lane. All signals found should be isolated and called as either "possible mine" or "metal clutter". Once the lane is completed the "possible mine" calls should be investigated using normal signal investigation drills. The deminer should then go back and deal with the "metal clutter" calls using a quicker excavation process. Lanes may be left metal free or "metal clutter" signals may be left beyond the national standard depth or assessed threat depth, whichever is the greater. The person doing the signal investigation is not necessarily the one who operated the detector and made the initial calls.

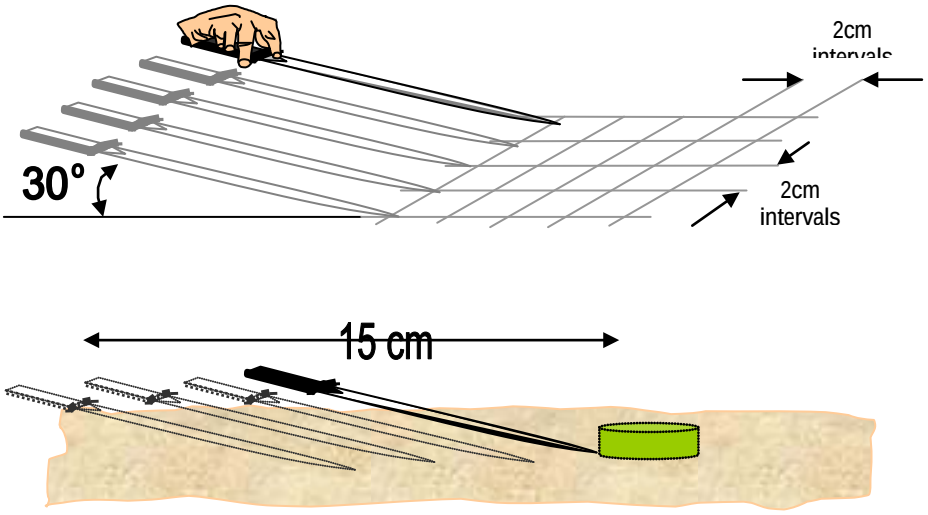
11.7.5 Stand alone detection of AP mines only. Where the threat is AP mines it shall not be possible to walk on the un-cleared ground to prepare the lanes. Operators may consider working the lane side-on, as per short-leash MDD drills, or straight ahead as per normal manual demining drills. The side-on approach does allow some lane preparation from safe ground and is generally the more productive approach. Whichever method is selected, the operational concept remains the same. In the first detector sweep signals are marked for "possible mine" or "metal clutter." "Possible mines" shall be investigated first using normal signal investigation drills. "Metal clutter" calls shall be investigated next using a quicker drill. Lanes may be left metal free or "metal clutter" signals may be left beyond the national standard depth or assessed threat depth, whichever is the greater. The person doing the signal investigation is not necessarily the one who operated the detector and made the initial calls.

11.7.6 Composite drills. There may be occasions when it is decided that better results are achieved through the use of another detection system. An example is the detection of minimum metal AT mines at depths below the metal detector capability of the dual-sensor detector. A more sensitive detector shall be used on the first pass to identify and isolate all signals. The dual-sensor shall then simply check each signal found and calls "possible mine," "metal clutter" or "undetected." The "possible mine" and "metal clutter" calls shall be investigated as described in the paragraphs above. In the case of an area with AT mines only or AT/UXO only, then shallow excavations may be made above the "undetected" calls until the detector is able to make its discriminatory call. In very hard soil conditions this will still save time and improve productivity.

11.7.7 Quality Assurance considerations during task planning If the clearance process is selected that leaves lanes metal-free then the QA process shall simply check that the lane is metal-free immediately after the lane has been completed. If the process is for metal to be left behind from "metal clutter" calls (e.g. after excavation to the national standard or maximum perceived threat depth, whichever is the greater), then the organisation shall confirm the QA procedures with the MACCA. If full excavation to an agreed depth would be acceptable then there is no reason why signals left below that depth should prevent the lane from being declared clear during QA.

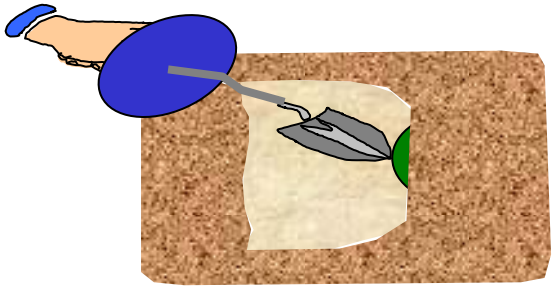
11.8 Prodding and Excavation

11.8.1 Once an accurate signal point has been established with the metal detector, the prodder or hand-trowel is used to identify the cause of the signal through prodding or excavation. Prodding or excavation is to commence 15 cm to the rear of the signal point and to a width of 20 to 30 cm (depending on the size of the signal). The prodder, at an angle of 30 degrees, is then inserted into the ground at intervals of 2 cm and to a depth of 10 cm. The prodder is to be used with an even motion, avoiding any excessive force or stabbing. In hard ground, resulting from extremely dry conditions, water may be used to soften the ground before prodding commences



11.9 Use of the Trowel (Excavation or Sapping)

11.9.1 After the location and size of the mine or metal object has been established, the hand-trowel is used to excavate the soil to reveal its identity. Once a small hole is made 15 cm back from the mine/object, the trowel is held on its side and used to slowly remove the soil up to the mine/object. The soil is removed to a depth of at least 13 cm, whilst avoiding any downward pressure with the trowel.



Excavating to locate mine

11.9.2 If an object is not located after using the prodder, the cause of the metal detector signal may be either a deeply buried mine or small metal object (bullet. fragment etc.). The hand-trowel must still be used to remove the soil and locate the metal object. The maximum depth of excavation is to be decided by the team leader and the use of the land. The minimum depth of

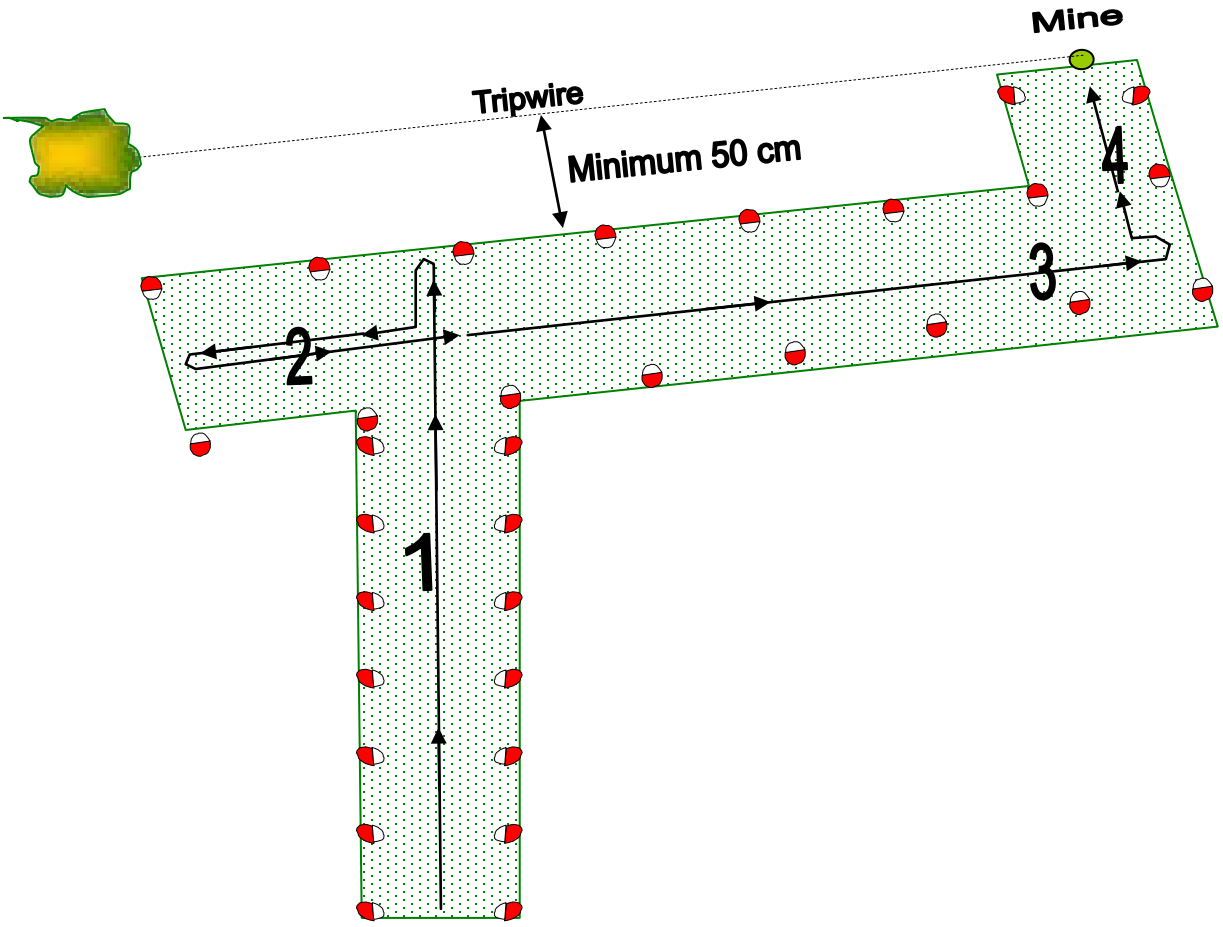
excavation is 13cm. The amount of excavation is to be kept to a minimum and should only be sufficient to identify the item being excavated.

11.9.3 Anti-vehicle mines may need to be fully excavated on all sides to allow pulling drills to be carried out if they are moved for demolitions.

11.9.4 All mines/UXO that prove difficult to excavate shall be destroyed in-situ (by detonation only).

11.10 Action on Locating a Tripwire

11.10.1 The deminer shall stop his mine clearance activity and notify the team leader. **The team leader** is responsible for ensuring that both ends of the tripwire are located and cleared. A one meter wide lane should be cleared parallel to the tripwire, no closer than 50 cm to the wire, to locate both ends of the wire. At no point is the tripwire to be disturbed. **Note: All mine clearance in the area (on that site) shall be stopped until the ends of the tripwire are checked and action is taken to render the hazard harmless.**



11.11 Action on Locating a Mine

11.11.1 The deminer is to stop his mine clearance activity and notify the team leader through the chain of command. The Team Leader/Supervisor is responsible for all actions relating to the destruction of the mine in-situ.

11.11.2 The lane is to be cordoned and mine clearance activities will be started in a new lane.

11.11.3 As a general rule all buried mines should be destroyed in-situ. However, an exception to this rule will be the case where mines are mechanically sifted or sieved from bunds and earth mounds. In this case they may be remotely moved a short distance with the use of an accredited mine grab or claw to a demolition pit and then destroyed. Destruction of located mines/UXO will be carried out at the end of each day or at a prearranged time daily. Mines should not be stored or transported overnight before their destruction. All mines should be destroyed on the day that they are found unless a specific safety hazard (or lack/limited amount of explosives) prevents this. Any mines or UXO located and not destroyed on the day are to be marked and

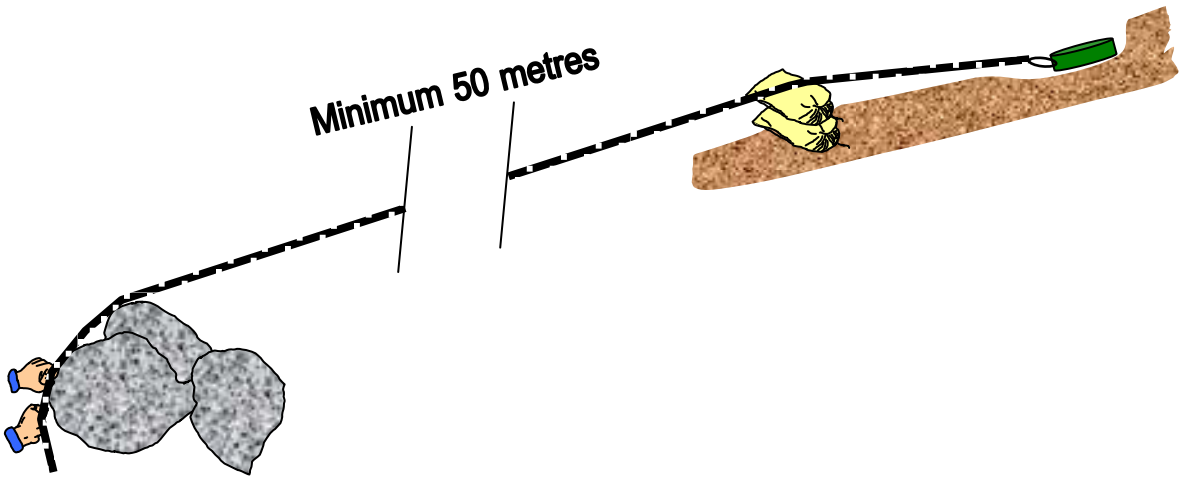
11.11.4 The MACCA/AMAC notified as to the reason why it cannot be destroyed that day.

11.12 Action on Locating a UXO

11.12.1 The deminer is to stop his mine/UXO clearance activity and notify the team leader/supervisor. **The Team Leader/Supervisor** is responsible for all actions relating to the removal or destruction of the UXO.

11.13 Pulling Procedure

11.13.1 When it is necessary to remotely pull a mine or UXO, **the Team Leader/Supervisor** is responsible for the pulling sequence. All personnel not involved in the pulling operation are to be withdrawn to a safe area. A pulling cable shall be rolled out from a safe point, a minimum of 50 m away (further, if appropriate to the type of UXO or mine), to the location of the mine or UXO that is to be pulled. This cable is always to be rolled out before it is attached to the mine or UXO.



11.13.2 Once all personnel have returned to the safe area, a hook is attached to the mine or UXO. The item is pulled in a slow, continuous movement, avoiding any sharp, jerking action. All personnel in the safe area should adopt the prone or a sitting position, during the pulling procedure. A minimum wait-time of 60 seconds is to be allowed before approaching the mine or UXO. The type of mine or UXO being pulled will dictate requirements for extended wait times.

11.13.3 The original position of the mine or UXO is then to be inspected with a metal detector and prodder for any sign of other mines, UXO or anti-lift devices.

11.14 Missing Mine Procedures

11.14.1 In a number of instances there will be occasions where mines will be found to be missing from the established pattern during the clearance of the mine rows. This may be due to number of reasons: removal by local people, migration due to weather, burial due to subsidence of soil,

detonation and burning. In all these cases the area where the mines were has to be searched to confirm and ensure that no mines have been left.

11.14.2 It is the responsibility of the Site Supervisor or the Team Leader to establish the cause of these missing mines during either the initial survey of the minefield or during the clearance phase.

11.14.3 If during the survey phase of the minefield the area appears to be leveled and without any evidence of movement such as subsidence or washout due to weather then the mine rows will probably be intact and normal clearance methodology will be put into practice.

11.15 Single Missing Mines

11.15.1 If during normal clearance of a mine row the deminer encounters an area where a mine would normally be and there is no evidence of ground movement, burning, detonations, surface laid mines or mines removed by local people then a full missing mine drill will be conducted. The Site Supervisor / Team Leader and the deminer will, during the clearance of the row establish the pattern of the mines and the average distance they are apart i.e. one mine every one meter. If during the clearance another mine is not located 1 meter from the last located mine then the deminer must assume that the mine has moved, is missing or buried deep and therefore is to conduct a full missing mine drill to confirm that the mine is not in actual fact a deep buried mine. This will be achieved by conducting the following drill.

11.15.2 When the deminer has reached the location of the next expected mine and establishes that there is no signal, he shall dress back 50cm from the expected location of the mine and conduct full excavation down to 13cm the full width of the base stick up to and then past the expected location of the next mine to a distance of 50cm, thus making a 1m x 1m box where the mine should be. During this full excavation the deminer shall regularly check with the detector the excavated area to confirm that the mine is not buried deep. Once the deminer has excavated the full 1m x 1m box over the assessed area of the missing mine he is to check with the detector the base of the excavated pit to confirm another 13 cm clearance depth. This will effectively achieve a clearance depth of 26cm. If a signal is heard at this stage then the deminer shall check the signal, until that signal is discounted.

11.15.3 Once this has been achieved and the deminer has established that the mine is missing and not buried deep, he is to place a missing mine marker where he thinks the mine would have been and continue with normal clearance up to where the next mine is or should be. If the deminer locates the mine then he continues with his clearance as per the organizations SOPs, however if once again he encounters no signal then the missing mine drill is repeated. If in the case of multiple missing mines within the same mine row, the drill shall be conducted for a minimum of three (3) times to which this drill will cease and the situation assessed by the Site Supervisor.

11.16 Multiple Missing Mines

11.16.1 There will be occasions where more then three mines in a row could be missing, this as mentioned above could be due to a number of reasons. Once the third missing mine drill has been completed it will be the responsibility of the Site Supervisor / Team Leader to establish why the mines are missing and how best to confirm the remainder of the row that more mines are not missing. It is not practical to conduct full excavation along the row until a mine is located, therefore the Team Leader/Supervisor shall consult with the MACCA/AMAC how this area is to be cleared. If there is no evidence that the mines have migrated due to weather or subsidence then there is a possibility that local people might have removed these mines. In this situation it is recommended that this section of the mine row be cordoned off and the row breached further along. The area cordoned off can then be the cleared/verified using MDD assets at a later date. If during this verification the MDD located a mine then this whole section will have to be cleared manually.

11.17 Multiple Missing Mines Due to Natural Earth Movement:

11.17.1 During the clearance of the Mine Row the Team Leader/Site Supervisor is to closely monitor the area to establish whether there has been any movement due to weather. If the deminer encounters missing mines then the Team Leader/Supervisor shall check the area and reassess his clearance method. Once again the deminer shall conduct his missing mine drills to establish the reason for these missing mines. In the case of natural movement, the mines would have either migrated or could be buried deep due to subsidence. In the case of natural movement it is recommended that the area be cordoned off and cleared/verified using MDD assets at a later date. If during this clearance/verification the MDD locates a mine then this whole area will have to be cleared by other means.

11.17.2 When the Team Leader/Site Supervisor alters the Clearance Plan due to a change in the lay of the land or an area where a large number of missing mines is located he is to consult with the MACCA/AMAC Operations. Any anomalies within the minefield are to be ascertained in the Additional Information box on the Completion Report.

11.18 High Metallic Areas

11.18.1 In areas where the metallic content of the soil is high, the metal detector may be ineffective. The detector procedure shall then be removed from the mine clearance sequence and replaced with a complete prodding and excavating procedure to a minimum depth of 13 cm from the natural ground level.

11.19 Mountainous Rocky Terrain with Loose Rock Areas

11.19.1 In areas where the ground is mountainous and rocky and the metal detector drill cannot be used, prodding and excavating drills shall be used. The Team Leader/Supervisor must make an appraisal regarding the approach and clearance methods used for each particular site and problem encountered.

11.20 Clearance of Obstacles

11.20.1 In areas with obstacles that contain a threat of mines or UXO, a procedure for clearing obstacles shall be used. The following are considered as potential obstacles:

b) Former trenches in defensive positions

c) Any ditches in mined areas

d) Fortified wire entanglements

e) Abandoned vehicles

f) During the clearance of minefields, obstacles should be identified and specials clearance drills should be adopted. Obstacles should ideally be cleared 360 degrees around or along its axis on both sides.

11.21 Burning

11.21.1 Unclear areas may be burnt prior to mine/UXO clearance, at the discretion of the supervisor and in co-ordination with local authorities, to increase visibility for the deminers and increase mine/UXO clearance rates and safety. However, team leaders/supervisors shall exercise good judgment, as burning unclear areas may cause damage to neighboring agricultural land, or alter the stability of unexploded ordnance. A minimum wait time of one day (24 hours) should elapse between burning an

area and manual mine/UXO clearance taking place on it. In all cases, a suitable firebreak should be constructed and AMAC and local services (if available) are to be informed, during the burning operation. A minimum wait time of four (4) days shall elapse between burning an area and MDD clearance taking place. The authorization shall be taken from the AMAC.

11.22 Working Hours

11.22.1 No deminer is to work for longer than 60 minutes before taking a break. 30 minutes working is recommended. The working time may change depending on the climate (heat, cold and rain) and the vegetation. The working time is subject to the team leader/Supervisors judgment in each situation.

11.22.2 A normal working day for a deminer should not exceed 9 hours including traveling time to and from sites with a minimum of 5 hours actual working excluding the rest period within the minefield. During hot and cold the overall working period should be reduced. If the climate is such that it is felt uncomfortable to undertake demining (cold or rainy days, demining should cease or only be undertaken in short sequences with frequent breaks. The Team leader/Supervisor shall use sound judgment when establishing or modifying the regular working hours.

11.23 Deminer's Equipments:

11.23.1 The minimum equipment to be provided to each deminer for the conduct of manual clearance is to include

a) Metal Detector

b) Excavation tool (Garden Trowel)

c) Prodding tool.

d) Tripwire feeler

e) Saw type vegetation cutting tool.

f) Shears type vegetation-cutting tool

g) Wire cutters

h) A stiff brush

i) Tools and materials for the cleaning and maintenance of hand tools.

j) A base stick.

k) A bag suitable for carrying the tools, less the metal detector.

l) PPE and protective clothing. Individual deminers are to have their own PPE.

m) A bag for the collection of scrap metal

n) A magnet

o) A mash Hammer

p) P. A entrenching Tool (Small Shovel)

q) A small Pick

r) Working Gloves

s) Tarpaulin

t) Mine Markers

11.23.2 The equipments issued to deminers are required to be checked and approved by the MACCA/AMAC. During the accreditation process, the demining organizations shall not to change the type or quality of deminers' equipments without the approval of the MACCA/AMAC.

11.23.3 **Note: The Standard Tool kit list, which is produced/ approved by MACCA, should be used as reference.**

11.24 Briefing Boards and Maps

11.24.1 Briefing boards and site maps are to be maintained for all static demining worksite. Briefing

11.24.2 Briefing Boards and Maps are to include the following information

a) Sketch map of the site showing:

   1) Perimeter of the hazardous area

   2) Key topographical features.

   3) Locations of marking systems

   4) Cleared and unclear areas; these may be further defined by areas cleared during technical survey or by MDD or mechanical assets.

   5) Clearance lanes in progress.

   6) Locations of mines or UXO located to date.

   7) North Indicator and legend.

b) Dates work started, days worked and expected completion date.

c) Date of last demining accident plan practice (Causality Evacuation Drill).

d) Progress to date in terms of area cleared in relation to the area to be cleared, and mines and UXO located and disposed off.

Annex – A Example of Site and Safety Brief

Site Brief

Below is an example of what may be included in a site brief, which are normally given to visitors in demining worksites:

a) History of the site including include; who laid the mines, effect on local communities and any accidents to people or livestock.

b) Clearance plan for the site including what areas are to be cleared, what kind of asset to be used, work timeframe and any problem and constraints.

c) History of clearance on the site to date including days worked, area cleared, mines/UXO removed, problem encountered and expected completion date.

d) End user of the cleared land.

e) Site layout including site marking system, cleared and unclear areas, out of bounds areas, location of site medic, latrine, rest area and other control areas.

Safety Brief

The following is an example of the details that may be included in a safety brief:

During the visit of a live mined area, you are required to comply with the following rules:

a) You must obey all instructions given to you by myself or any staff member appointed to escort you.

b) You must remain with your escort at all times. You are not permitted to move around the site by yourself.

c) Only walk in the areas indicated by your escort.

d) Do not touch or pick up any items on the ground.

e) Smoking is only permitted in the rest area as previously indicated.

f) In the event of an accident or incident follow the instructions of your escort or myself and remain calm.

g) Before leaving the command post towards the mined area, you shall be required to wear PPE.

h) If you have portable telephones or radios, you are required to turn them off.

i) While you are on the site, the deminers may be required by safety rules to stop work.

j) Please attempt to keep your time on the site itself to minimum and to ask questions or carry out any discussion after you have moved off the site.

k) Do not move back and forth, while taking photo.

l) Keep a distance of 5 meters between two persons.

m) Do not go beyond cleared area.