Technical Note 09.30/06

Version 1.0
Amendment 1, July 2013

Clearance of Cluster Munitions based on experience in Lebanon

Sub-munition caught up on fence in South Lebanon

Warning

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Foreword

Mine action is carried out in a constantly evolving environment. New threats are being identified, methods and technology improved, field experiences shared and new lessons learned. This environment of constant change requires management and operational procedures which are open to change in the ongoing effort to improve safety, efficiency and effectiveness.

Information sharing is an important part of improving mine action. Information about new threats should be disseminated quickly. New experiences gained and lessons learned should be shared for the benefit of all in mine action. Technical Notes for Mine Action (TN) have been introduced as one of many methods of sharing information.

Technical Notes are advisory documents that draw on practical experience and publicly-available information to provide principles, advice and information relevant to a specific International Mine Action Standards (IMAS) or technical subject. They are designed to supplement IMAS, or act as an independent source of information. TN use the same format as IMAS for consistency and ease of use, and are based on the best available technical information, but their status is advisory only. They have no legal standing and unless such a requirement is specified in a contract or other legal instrument, there is no legal obligation to accept the advice provided in a TN.

TN are compiled by the Geneva International Centre for Humanitarian Demining (GICHD) at the request of the United Nations Mine Action Service (UNMAS) and in support of the international mine action community. They are published on the IMAS website (www.mineactionstandards.org)

Information for inclusion in TN, or comments about current TN is welcomed and may be submitted to the TN manager through the GICHD website at www.gichd.org.

Introduction

Between 12 July and 14 August 2006, a major military confrontation took place between Israel and Lebanon. Israeli Forces (IF) used artillery weapons, direct fire weapons, air-delivered munitions and naval artillery and deployed infantry and armored incursions against Lebanon. Hezbollah used rockets and direct fire weapons against Israel.

An estimated two million cluster munitions[1], mainly variations of the Dual Purpose Conventional Improved Munitions (DPICM), "M", e.g. M 42/ M 77/ M 46 / M 85 series and spin-stabilised generic types, BLU, were fired into South Lebanon during the war. The emerging failure rate in South Lebanon is up to 40 %, in particular for the BLU 63/61 series.[2]

Lessons learned from the Lebanese conflict are important due to the scale of the cluster munitions contamination post-war; the rapid return of large numbers of Internally Displaced Persons (IDP) to contaminated areas; and the rapid response of the United Nations and NGOs to the post war cluster munitions clearance needs over a very short period of time.

This Technical Note for Mine Action (TN) is based on an existing GICHD Advisory Note 1.0, Sub-Munitions and Cluster Bomblets, Render Safe Procedures, and lessons and observations from a GICHD field mission to Lebanon.

Where relevant, National Mine Action Authorities (NMAA) and mine action organisations may choose to incorporate the recommendations and best practices included in this TN into their policies, standards, procedures and operations.

1 Based on analysis of Israeli media reports

2 Interview with Chris Clark, Programme Manager MACC SL, dated March 27, 2007.

Clearance of Cluster Munitions based on experience in Lebanon

1. Scope

This Technical Note discusses planning; clearance methodology; recording and reporting of information and the use of a community liaison officer throughout the design, implementation and recording of the task, as well as methods of neutralisation or destruction which may be selected during the disposal of sub-munitions.

Unless otherwise described, this document concentrates on Battle Area Clearance (BAC) where sub-munition contaminated areas are the main hazard rather than other Explosive Remnants of War (ERW), although it is recognised there may be some other devices found in the process.

This document does not cover hazards other than cluster sub-munitions in any way. Nor does it study in detail the specifics of BAC methodology – although the recommendations are readily transferable. For details of BAC, see IMAS 09.11.

2. References

A list of normative references is given in Annex A. Normative references are important documents to which reference is made in this TN and which form part of the provisions of this TN.

3. Terms and definitions

The words 'should' and 'may' are used to indicate the intended degree of compliance. This use is consistent with the language used in International Mine Action Standards (IMAS), and associated guides.

A complete glossary of all terms, definitions and abbreviations used in the IMAS series of standards is given in IMAS 04.10

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

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

The term "shall" is not used in this document given its advisory nature.

Recent discussion at the States Parties Meetings of the UN Convention on Certain Conventional Weapons (CCW) debated the definition of cluster munitions at length and established that "cluster munitions **consist of multiple sub-munitions and containers designed to disperse or release the multiple sub-munitions"[3].** It is also defined in IMAS as "a number of sub-munitions in one container that is aerially delivered". The term 'sub-munition' generically describes any item of ordnance carried in or ejected by a dispenser. The enormous diversity of sub-munitions makes it difficult to define[4] their characteristics and effects. However, EOD technicians are mainly concerned with impact-fuzed sub-munitions having high explosive (HE) fillings, which tend to be referred to as 'bomblets'.

3 From Vera Bohle, Chairperson of the CCW Protocol 5 Discussions (Cluster Munitions).

4 There are ongoing efforts to define "cluster bombs and sub-munitions" both through the Convention on Certain Conventional Weapons, Protocol 5 process, and the humanitarian NGO-led Oslo process to ban the cluster bomb. For the purpose of this document, the simplest definition is used.

A wide variety of launch or delivery systems are used, including missiles, rockets, projectiles and mortars. Sub-munition warheads for these types of land service ammunition are normally called 'carriers', while bombs containing sub-munitions are generally known as 'cluster bombs'. For the purposes of this TN the term sub-munition(s) will be used throughout.

Note: Some sub-munitions are mines and are not designed to detonate on arrival. A fairly wide range of mines such as PFM-1 and PFM-1s can be air-delivered as sub munitions.

4. General sub-munitions

4.1 Types of sub-munition

There are numerous generic types of sub-munition. Some common types are described in detail at Annex B. A thorough understanding of the characteristics of the sub-munitions to be cleared within their generic types is essential for planning and conducting clearance tasks. Such characteristics will affect in particular the choice of clearance methodology, the choice of destruction or neutralisation methods and the overall risk management process which guides such choices.

The sub-munition hazard in Lebanon post-conflict consisted of variants of the dual purpose improved conventional munitions (DPICM) and the spin-armed variants. Significantly in many cases the particular variants of the DPCIM type may be manually neutralized as opposed to other generic types, whilst the spin-armed variant poses a specific threat due to its “**all-ways** acting” fuzing system which functions as an anti-disturbance device.

4.2 Typical operation

Once the dispenser has been fired, launched or dropped, opening is normally determined by a time delay or proximity fuze. The sub-munitions are normally dispensed in one of three ways: base ejection, nose ejection or case rupture. In both nose ejection and base ejection, the fuze usually initiates a small propellant charge, which opens the carrier and pushes the sub-munitions out.

Case rupture, used in some rocket and missile warheads, sometimes involves the use of small linear cutting charges to split the casing, and may also use a propellant charge to eject the sub-munitions. Most (but not all) sub-munitions incorporate a separate arming mechanism (such as wind-driven vanes) which functions, after ejection, as the sub-munition falls.

The majority use some form of stabilisation (normally fins, a streamer or a chute) to bring them into a nose-down attitude, but some are designed to spin in the air stream and use this movement for arming. Since sub-munitions disperse after ejection, the density of the impact footprint is dependent on the speed and altitude at which the dispenser opens. Most sub-munitions are designed to detonate on impact, but some (such as scatterable mines) are victim-operated or incorporate delays.

In a military context, sub-munitions are used to damage airfields, roads and bridging and to attack targets such as infantry, armour and surface to air missile sites. However, strikes often occur in areas which either have a civilian population in close proximity to the target area and/or will impact severely on the return of civilian populations to such areas. The main characteristic of a sub-munition strike is a large area of contamination (typically a “footprint” of 400 - 600 meters) resulting from the deployment of up to 600 (depending on the delivery system) individual sub-munitions, some of which will fail to function.

4.3 Sub-munition failures

Sub-munition failure rates are dependent on a number of factors which can be either due to failures in design (1-5% manufacturer's failure) or failures in deployment (35-37% clearance community failure in the case of Lebanon). These are:

a) design[5];
b) length and condition of storage;
c) drop height and velocity;
d) vegetation at the impact area; and
e) sand/soil conditions at the impact area.

It is the rate of the failure of sub-munitions to function as designed due to a combination of the above factors which creates the hazard to both communities and those organisations dealing with the threat.

Note: There has been up to 100% failure in Iraq and Tajikistan due to low-altitude release[6], Experience in the Republic of Croatia shows 30% failure rate in bomblets and they are found on the ground, on trees, underbrush and also deep in the ground at a depth of up to 36 cm in soft agricultural soil[7].

Post conflict areas which are severely affected by unexploded sub-munition contamination show that up to 15%[8] of devices have failed to function and combinations of the above factors may increase that figure to 100% as well. Anecdotally this has been the case in Kosovo, Laos, Lebanon, Tajikistan, Iraq and Afghanistan. The combination of failure rates (even at the conservative manufacturers' estimates of 1 – 5%) and the high number of cluster bomb strikes means that tens if not hundreds of thousands of sub-munitions remain unexploded - posing a significant threat to communities, reconstruction and development opportunities post conflict.

4.4. Impact of sub-munitions post conflict

As a result of the sub-munition failures, the impact of sub-munitions post conflict is felt in four main areas:

a) Rapid return of Internally Displaced Persons (IDPs): although in many countries sub-munitions remain an ongoing hazard to people in general, it is the rapid return of IDPs that impacts not only on the casualty rate but on the speed, intensity and overall difficulty of the emergency clearance operations required to support such a return. The rapid return often features uncoordinated, unreported and therefore unrecorded clearance activity, during which vital information may be lost. This can make post-emergency clearance operations much more difficult.

b) Livelihood: in particular access to agricultural fields may be blocked by sub-munition contamination affecting economic revenue. The impact can also be heightened at various times of the year depending on the crop cycle.

c) Infrastructure: bridges, roads and villages can be blocked, reconstruction made difficult and emergency access constrained by the presence of sub-munitions;

5 For example, in the case of the M42 the drag ribbon may become detached in flight, hence the bomblet may not become armed. Or the detonator shutter does not move into the armed position due to incorrect assembly; for example, the detonator shutter spring is missing and or the slide is jammed.

6 Andy Smith – member of the IMAS Review Board.

7 Davour Laura, member of the IMAS Review Board.

8 UNIDIR Study Laos, 2006

d) Population: in the process of enduring a physical threat to their social and economic lifestyle, the population of a sub-munition contaminated environment is affected by all of the above. DPICM sub-munitions are extremely sensitive to movement and also have a degree of fascination in design and appearance which provides a lethal attraction to male adolescents and children in general. In Lebanon since the end of the conflict, 178 civilian casualties and 22 fatalities have been recorded, mostly due to sub-munitions. Of these some 75% of the recorded accidents occurred while young males conducted house reconnaissance on return to their homes.

5. Operational planning

5.1 General

Planning for the conduct of BAC and sub-munitions disposal consists generally of three phases: pre-emergency planning; emergency planning and post-emergency responses. In this case, the emergency refers to the conditions existing immediately after the cessation of hostilities or conflict in which cluster munitions have been used, and not to the period of conflict itself. Some of the lessons learned from the Lebanon experience in particular are relevant to the pre and emergency planning phases. These are described below:

5.2 Pre-emergency planning

The pre-emergency planning[9] phase would typically occur during a conflict where there is known to be a threat of sub-munition use. Many countries have actual contamination which occurred decades ago, e.g., Vietnam and Laos and the principles of pre-emergency planning may not be relevant unless applied in special circumstances such as opening up new areas for returning populations.

Key elements of a pre-emergency planning process are the use of documents such as contingency planning models, rapid response to landmine and ERW crisis previously tested through coordination exercises[10] and the use of model documents such as Concept of Operations papers which can be easily modified. These allow early development of tender documents and the early issue of contracts allowing agencies to rapidly prepare and deploy on ceasefire.

This should also be the time to discuss and develop liaison with various authorities, ministries and other agencies that may be involved in rapid returns of IDP and refugees and to ensure a coordinated approach to the emergency humanitarian interventions. Clear responsibilities of coordination and reporting should be identified and resolved at this stage.

5.3. Emergency response

Emergency response capabilities are dependant upon the availability of the specialist assets on the ground immediately after the conflict has ended. Anyone who can do anything will respond - often with consequences post-emergency if actions are not fully recorded for future planning efforts.

Planning seeks to identify the hazard, the location and the impact of that hazard in order to plan an effective response. Emergency response to sub-munition contamination is typically influenced by issues such as clearing roads, working in conjunction with the returning population and

9 In Lebanon, for example, this was sometimes referred to as Level 1 Emergency Clearance and was a reflection of the sometimes uncoordinated efforts of UNIFIL, Lebanese Armed Forces and other organizations to remove the initial threat as refuges and IDP returned in overwhelming numbers to their contaminated homes, business and fields.

10 SRSA in conjunction with UNMAS run an annual coordination exercise where these responses are rehearsed and trialed.

responding to immediate needs. Whilst this is obviously a humanitarian imperative it should be accompanied by clearly established reporting procedures of who did what and where, with accurate positioning of the finds.

This data should then be maintained at a central location where the national planning staff can analyse what was done in the emergency response phase with a view to tasking in the post-emergency response. Even if this cannot be done during the emergency response period, the data should be collected to allow analysis at a later stage. All agencies conducting sub-munition clearance should attempt to meet this need because failure to do so severely affects the capacity of the national authority to respond.

5.4 Post-emergency response

Once tasking has caught up with the operational intensity of the emergency phase, the mine action response moves into the post-emergency phase. It is essential to establish a system of prioritisation as well as an efficient and effective method of clearance. In the post-emergency phase, where assets are generally in place, tasking is conducted in a more deliberate manner and in accordance with the priorities identified nationally, within the regional and local context.

In this phase, the national planning authority should allocate areas of operation based on the capacity of assets, establish set priorities based on the community need and depending on the clearance hazard, conduct a visual surface search (with instrument assistance where necessary) followed by subsequent or concurrent sub-surface search clearance tasking. This approach is covered in more detail in Paragraph 10, Clearance Methodology.

5.4.1 Community liaison

Key to the planning is the involvement of the community in the decision-making process about task prioritisation. One way to achieve this is through the establishment of a Community Liaison Officer (CLO). Experience in Lebanon has shown that early involvement of CLOs with communities, the national or designated demining authority and the demining agencies, has been instrumental in gaining full support from the community in the clearance efforts. All agencies or national authorities should include a CLO in their staffing.

The CLOs should be provided with all the necessary means to conduct their role, including use of vehicles, access to telephones, and a full understanding of the role and importance of involving communities in decisions about their lives. An example Terms of Reference for the CLO is included at Annex C. Use of the CLO builds on existing knowledge and awareness of the need for a coordinated approach between community and clearance agency both at local and national level.

5.4.2. Usable land

Usable land may be defined in many ways. In Lebanon it was defined as that land which was currently used for the movement of population, cultivation and grazing. It is the “current” use of the land which influences the prioritisation of tasking. An analysis of the crop cycle of the affected areas may also be used to provide further data for the prioritisation process, affecting what might be current and future task planning. The involvement of the CLO in this process is vital to ensure an integrated community, national authority and humanitarian demining response. An example of a simple Crop Cycle Analysis can be seen at Annex D.

The definition of “usable land” may change over time. This will impact on current and future operational tasks.

6. Mine risk education

Mine risk education[11] (MRE) is an integral part of the sub-munition clearance effort. In the context of sub-munitions, it is relatively simple to update core safety messages to cover the sub-munition hazard and utilize the existing risk education methodology.

The role of MRE in all phases of planning should be considered fully as well as in the clearance response. A coordinated public awareness and media campaign will often be the first line of defence in raising awareness of hazards that will exist post-conflict. In the emergency phase, it is a valuable means of protection where clearance assets cannot cope with the amount of work and the impact of population on tasks. In the more common post-emergency response phase risk education is an integral part of the overall mine action package.

Lessons learned from mine clearance over the last decade on the integration of risk education activities should be reviewed and applied in the context of sub-munition. Community liaison in demining terms has been referred to as the involvement of the community in demining decisions before, during and after mine action activity. In the Lebanon context it can clearly be seen that the importance of community liaison has been understood and transferred to the sub-munition clearance context in an effective manner, implemented through the CLO.

7. Clearance methodology

7.1. General

Generally speaking, clearance methodology is a function of ongoing risk assessments made at both national planning and tasking level and on the ground by field operators. A sub-munition clearance task may consist of three differing methods; a visual (surface) clearance, a visual (surface) clearance aided with instrument search capabilities and a sub-surface and surface combined search. These are explained in more detail below.

In most instances, a combination of these methods will be employed in a task or in subsequent operations. Choices are influenced by:

a) Ground use (usable land for example) – urban, rural (grazing) or rural (agricultural)

b) Terrain – access to the area, the type of terrain – hilly, rocky, soft etc

c) Impact on population – the population contained within the hazardous area or in the surrounding areas

d) Weather – at the time of the initial conflict and at the time of the clearance task

e) Season – as above, it has a bearing on the hazards posed by sub-munitions through vegetation, condition of ground, wind and rain etc.

f) Crop cycle – as above

g) Sub-munition hazard – especially important in relation to the decision to make a surface clearance.

11 Used in this context as Sub-Munition risk education, i.e., conforming to the concept of landmines and Explosive Remnants of War risk education, but commonly referred to as MRE.

h) Military history an understanding of the military conflict, the conflict as it changed over time and military activities in and around the area build scenarios for task planning.

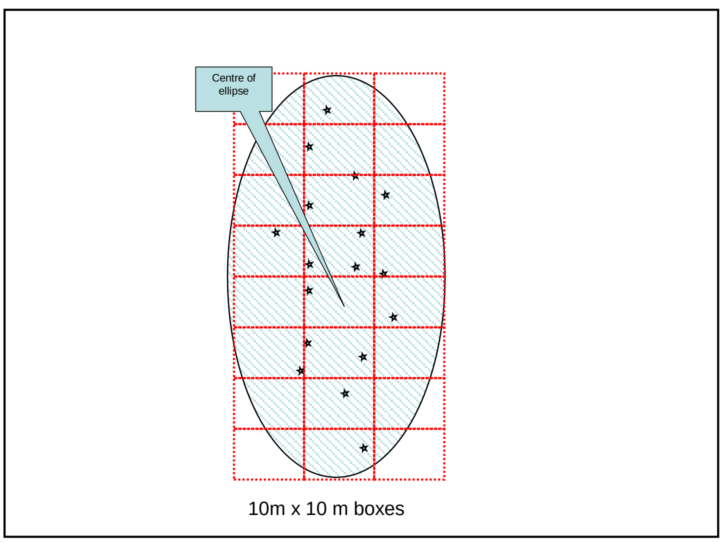
i) Clearance history – again this is very important and is particularly affected by the ability to record and report clearance activities previously conducted.

The selection of a surface/visual clearance rather than immediate sub-surface clearance where applicable, is a function of clearance tempo versus risk mitigation. It will always be a topic of much discussion and concern. In reality, the use of surface search methodology in the right context and supported with accurate recording and reporting has been an effective means of providing quick impact and support to populations in immediate post conflict situations.

Where possible, the clearance response should be conducted with a focus on first removing the immediate threat of exposed unexploded sub-munitions by clearing the surface threat, then following up surface clearance with a sub-surface clearance depending on the factors described above. In all instances the extent horizontally and the depth of clearance should be decided by national authorities based on an appreciation of the ground situation. Generally, a standard should be set to search a certain distance past the last seen sub-munition and to search to a particular depth. This should be determined by evidence of penetration below ground and may change due to ongoing risk assessment. In all situations, the decision-making of this assessment should be fully documented.

One example of how response planning might be conducted focusing on visual (surface) search first is described at Annex E, Battle Area Clearance Plan (sub-munitions). This example is drawn from Lebanon. This system uses the principle of "working from the inside out", where an estimation of the centre of the strike is made, and clearance starts from the centre of the strike outwards.

Another system used in Lebanon is the 10m x 10m box pattern, which is a grid overlaid on a strike area. In this way, each particular box can be recorded and managed as is appropriate to the situation. This allows very detailed analysis to be conducted by the management team and also allows the accurate recording of the type of clearance conducted on each box. Boxes are usually numbered in a grid format, i.e. alphabetically and numerically, e.g. A1, B1, B2, B3 etc to allow for easy referencing and reporting.



Grid pattern 10 x 10 m boxes allows detailed analysis of the site

7.2. Visual/surface clearance

Visual/surface clearance is about clearing the surface and above the surface, e.g. in trees, fencing and/or these sub-munitions caught in urban constructions as well as at ground level.

Where this method has been selected and executed in a planned and coordinated manner, as it has been on at least two occasions post-conflict (i.e., Lebanon and Kosovo), it is a quick and effective means to remove the immediate hazard in an area, i.e., the visual threat. It is hazard and terrain dependant. For example, it may be more useful in built-up urban areas or rocky hard ground where unexploded sub-munitions are lying on or above the surface of the ground.

In many emergency response scenarios this is the kind of clearance methodology employed, although not always planned. Where it is not planned, clearance agencies responding to the immediate threat are removing surface items which create an immediate hazard to the population. Due to the operational intensity of the situation, they are quite often not doing so in a methodical manner. This can create problems in future planning because information may not have been recorded and follow up activities may be missed as a result of lack of information.

In all instances where visual searches have been conducted, it is essential that accurate recording and reporting of the task is conducted for follow-up tasking if necessary. This allows for a coordinated operational management response throughout the management cycle.

7.3 Surface clearance (instrument-assisted)

This is conducted as above but with the support of metal detectors or bomb locators to search areas (vegetation, soft ground etc) where visual search is not possible. In Lebanon, instrument-assisted surface clearance has the added benefit of generally providing a default sub-surface clearance depth of up to 5 cm[12].

7.4 Sub-surface clearance

Sub-surface clearance has been the most commonly used method in the past. It is slower than the above, yet provides a more reliable clearance of the hazard at the surface and sub-surface level concurrently. It does not require such a high level of risk assessment as the visual/surface methodology because all of the area surface and sub-surface is cleared at the same time. It is an inherently safer methodology for the operator and may not require follow up action.

8. Recording and reporting

8.1 General

Sub-munition strike areas are difficult to define. Sub-munition strikes are generally recorded as a Suspected Hazard Area (SHA)[13]. In the first response stages, several individual sub-munition strikes may be recorded as separate SHAs. This can have a distorting effect on perceived contamination assessment as the aim of recording the initial hazard should be to record the centre of the ellipse or the pattern of strikes related to a single cluster munition or carrier shell. The disposal of individual sub-munitions over an area may similarly have a distorting effect. These points are described in more detail below.

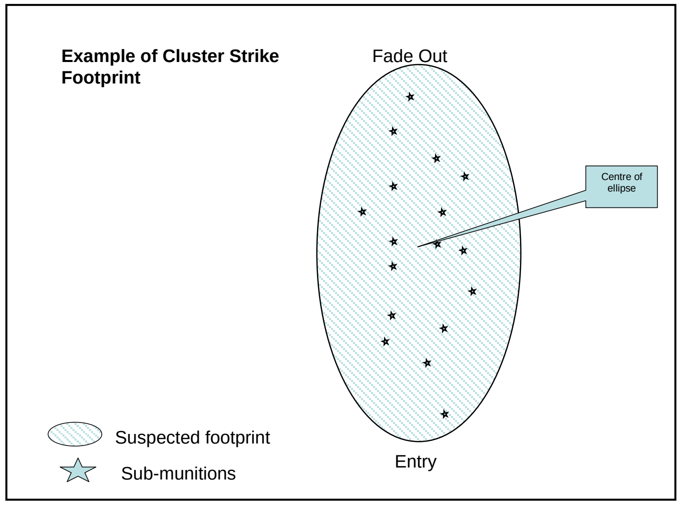
12 Discussion with Chris Clark, MACC SL, 22nd June 2007

13 Information Management System for Mine Action Version 4.0

8.2 Sub-munition strike footprint

In ideal circumstances, the sub-munitions will have created a semi-ellipse pattern of sub-munition strikes. Whether the sub-munitions have functioned or not, the pattern may usually be seen through discovery of unexploded sub-munitions or evidence of explosion of individual or multiple sub-munitions. For example:

Standard sub-munitions strike footprint (optimum)



The sub-munitions strike itself may be described as having an entry point (where the first of the sub-munitions from one cluster bomb or carrier begin to detonate) and a fade out (where the last of the sub-munitions are found). In general, clearance organisations will search out to an agreed distance (e.g., 25 metres in Albania, 50 metres in Lebanon etc) from the fade out, with the basic shape of the ellipse forming as finds are recorded.

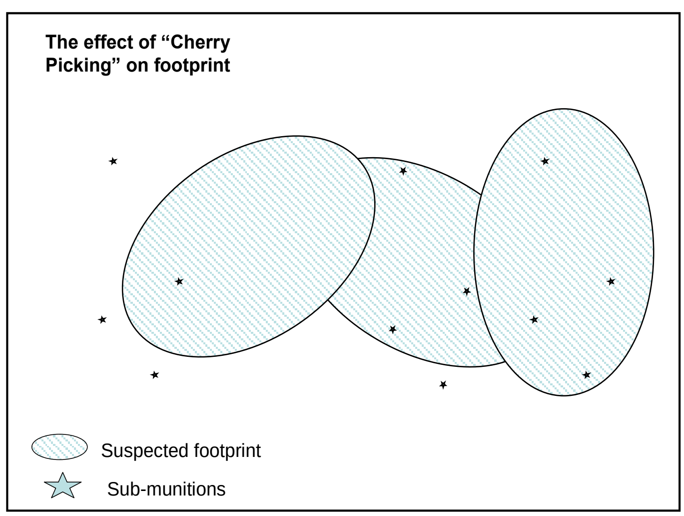
The more time that passes after the sub-munition strike, the more difficult it may be to identify a strike pattern.

When sub-munitions strikes occur on steep ground, the pattern of impact detonations may be visible, but those that did not detonate on impact may have moved downhill well beyond the original strike area. In areas with heavy rainfall or snowmelt, runoff water may move the munitions into gullies. Provision should be made to extend the search appropriately in these circumstances.

In emergency response phase where there is a lack of accurate recording of actions and hazards, the true picture of the particular strike maybe lost. This is caused by “cherry picking” or overlapping strikes.

Several strikes over a particular area also have a distorting effect where the patterns merge together. For example:

Overlapping strikes



When many individual strikes have been reported, it may be found upon completion of the task that several SHAs have been dealt with in the clearance of a certain area. This takes careful review and management by planning and operational tasking staff to ensure that accurate data is recorded, that SHAs are removed and that the true picture is reflected.

Accurate recording and reporting of clearance conducted along with an auditable record of risk assessments made on site are essential to follow up with future sub surface clearance plans. Completion and suspension reports should be the basis for further planning, analysis and tasking.

8.3 Recording and reporting

In general, all suspected sub-munition strike areas should be recorded with a view to identifying the footprint and the centre point of the ellipse (if possible to ascertain). This would generally be the basis of a strike zone grid reference.

Such information should be recorded by the central data collection facility (generally the information management section in the National Authority) as a SHA.

In Lebanon this central grid reference is recorded using the UTM[14] system of coordinates and links SHA to the task. Agencies are tasked to conduct clearance on the sites, based on prior reconnaissance by operational and planning staff at National and agency levels and with the full input of the CLO to ensure community priorities are being met.

Records of clearance activity carried out on a task should be recorded and reported using standard documentation. In Lebanon much use is made of “suspension reports” which are used to record (in most cases) where visual/surface search was conducted and when it is likely that a further task or continuation of the task will occur with sub-surface search activity.

IMSMA Version 4 allows the national authority or implementing institution to produce its own reports, incorporating what is needed in a country-specific scenario. Based on the Lebanon experience, Suspension and Completion reports where sub-munitions clearance activity is recorded should make a very clear statement of:

a) The clearance plan – the risk management process
b) Type of clearance
c) Depth of clearance
d) Findings
e) Equipments used
f) Accurate record of clearance including types of clearance
g) Accurate record of individual sub-munitions (supporting the general picture of the strike zone or ellipse)
h) Marking
i) Fencing
j) Digital mapping / sketch
k) CLO comments, including usable land, community needs and where possible observation on failure rate.
l) Process of follow up for the suspension task

14 Universal Transverse Mercator, a map referencing system using grids. In Lebanon, the term “UTM” itself is used to refer to the grid referencing system based on the Universal Transverse Mercator, which indicates the possible centre of the ellipse of sub-munition strike.

Although in general, all surface clearance tasks should be recorded as “Suspensions”, in some cases “Completion reports” may be provided which include all three variants of search; surface, instrument assisted and sub–surface. In this case as with suspension reports, the recording of the clearance process and the clear demarcation of what was done where and how, will be important elements of the report. An example of such mapping based on the Lebanon experience is included at Annex F.

9. Disposal of sub- munitions

9.1 Planning and disposal considerations

There are five common methods applicable to the safe disposal or destruction of sub-munitions. The method selected will be dependent on the specific type of sub-munition and the operational scenarios. The decision as to which method to employ should be made by the clearance Team Leader, in conjunction with his EOD Technician.

1) destruction by detonation in situ;
2) deflagration[15] (burning) by the use of point focal charge in situ;
3) deflagration by the use of a pyrotechnic torch in situ;
4) use of alternate techniques; and
5) manual disarmament of the fuze.

Of these five methods, (1) is the most common; (2) and (3) can only be conducted by experienced staff with the correct equipment. Methods (4) and (5) should only be attempted by experienced Level 3 EOD[16] technicians with current operational experience or training on the particular ordnance. EOD levels are further described in IMAS 9.30, Explosives Ordnance Disposal.

Regardless of the method chosen, there are numerous planning and disposal considerations dependent on the type of sub-munition encountered. Some, or all, of the following should be considered:

a) some types of sub-munition may not arm if the release altitude is too low;
b) the relatively high mass and narrow shape of some sub-munitions means that they may penetrate soft ground and become buried;
c) armed sub-munitions may fail to function if the angle of impact is too great, or if their fall is broken by vegetation or soft ground;
d) sub-munitions incorporating stab-sensitive or all-ways acting fuzes can be particularly dangerous;
e) partially impacted mechanisms can be sensitive since the firing pin may be touching, or imbedded in, the stab-sensitive detonator;
f) some types of sub-munition, such as DPICM, are subject to high failure rates and may therefore be encountered in large quantities;

15 Deflagration is defined in IMAS 04.10 as the “conversion of explosives into gaseous products by chemical reactions at or near the surface of the explosive”. In other words using a small explosive or pyrotechnic charge in a certain manner so as to cause the high explosive filling to burn rather then detonate. When attempting to induce a deflagration, the operator must always manage and plan for the risk that the high explosives filling may in fact burn to detonation.

16 A Level 3 EOD technician is defined in IMAS 9.30 as “a deminer who has had specific EOD training in the disposal by detonation of larger UXO, such as rocket and tank gun ammunition, and artillery ammunition up to 240 mm; this includes HEAT charges. Under the supervision and direction of a qualified supervisor, a Level 3 (EOD) deminer should be qualified to render safe UXO for safe removal from the demining worksite, and to undertake their final destruction."

g) large numbers of unexploded sub-munitions at a contaminated site often substantially complicates an otherwise straightforward clearance operation. Small numbers could indicate the presence of more sub-munitions over a wider area;
h) unexploded sub-munitions are often found above ground in vegetation or lodged in manmade structures;
i) thick-walled varieties can produce heavy fragments, lethal at substantial ranges;
j) sub-munition dispensers often incorporate hazardous components such as ejection charges and linear cutting charges;
k) the presence of sub-munitions is often indicated by empty containers and packaging;
l) proximity fuzes should never be approached from the front;
m) the presence of ejection charges and linear cutting charges should be considered;
n) unopened cluster bombs require special demolition techniques to ensure the destruction of all sub-munitions;
o) nose fuzes are often badly damaged during impact and may not be identifiable;
p) tail sections may incorporate powerful springs, which can cause injury;
q) thermal coatings will attenuate the power of demolition charges;
r) weather conditions at the scene of the hazard may impact on the disposal method – high winds for example may cause initiation of DPICM; changes in temperature may initiate sensitive piezo-electric fuzed sub-munitions;
s) when employing point focal charges, pyrotechnic torches or alternate techniques such as the 0.50 cal de-armer and attempting to deflagrate the explosive within a sub-munition, EOD technicians must be aware that detonation of the target munition may occur. Appropriate tamping and safety distances should be applied;
t) many sub-munitions contain cone liners supporting the shaped charge effect required for defeat of armour. The point focal charge should be positioned in such a way that the cone liner is degraded. In the event of a detonation this will significantly degrade the performance of the shaped charge jet;
u) the pyrotechnic torch should be positioned in such a way that an attempt is made to degrade the cone liner. However as this method is several orders of magnitude slower than a HE or shaped charge attack the effectiveness of this approach is open to question. If burning detonation takes place then it is very likely that little damage will have occurred to the cone, therefore an effective shaped charge jet should be expected;
v) destruction of sub-munitions in situ may have an impact on livelihood[17] or personal effects of communities. This can result in extra pressure on the EOD technician as to the choice of method of neutralisation or destruction to be made. It is important not to allow such pressure to override the personal safety of the technician and those working with him; and
w) when employing alternate techniques such as 0.50 cal de-armer and explosively projected plates for example, technicians must be aware that detonation of the target munition may occur. Appropriate tamping and safety distances are therefore to be applied.

9.2. Destruction methods

There are five general methods to destroy or neutralize a sub-munition as referred to above. This TN only discusses the first three and as earlier mentioned, method 4 and 5 should only be carried out by appropriately qualified EOD technicians who are familiar with ALL aspects of the sub munitions and fuze mechanism design. It is expected however that all mine action agencies and operations staff would be fully conversant with these techniques as a result of training and experience prior to use of any of the following tools.

17 A farmer in Lebanon commented that “the war had destroyed 10 % of his citrus grove, the BAC (destruction in situ) of remaining sub-munitions was destroying the rest of it”.

9.2.1. Destruction by detonation in situ

In this method sub-munitions are destroyed in situ without moving or touching the item unless in the case of certain sub-munitions, (such as M42 and KB1), they can be positively identified as being unarmed.

Whilst this is a common method of disposal in Lebanon, it has the disadvantage of creating further damage to the surrounding environment. In some circumstances destruction by detonation is carried out in central demolition sites rather then in situ, where large numbers of items have been gathered as a result of being neutralized before moving.

9.2.2. Point focal charge destruction

This is also a common method in Lebanon. A purpose designed shaped charge system (often referred to as a point focal charge), may be used to induce deflagration of the main filling. This method is generally safer than destruction in-situ by demolition as the munition is not touched and the charge is deployed at a distance from the target, (at least 80 mm).

9.2.3 Deflagration by the use of pyrotechnic torch

The use of a pyrotechnic charge to induce deflagration of the sub-munition has been used with some success; however the risk of deflagration to detonation transfer (DDT) in the sub-munition is higher with this method than any other.

10. Equipment

Various types of equipment are used in sub-munition clearance including detection, protection and marking and recording equipment. These may include:

Detection Equipment:

a) Metal detectors - a variety of makes to allow for changes in ground conditions
b) Large loop detectors
c) Bomb locators

Personal protective equipment (PPE):

d) Helmet
e) Visor,
f) Safety goggles,
g) Demining Apron/Vest etc, i.e., the general items in use in mine clearance operations.

Note: The national authority in consultation with agencies should set minimum levels of personal protective equipment (PPE) for sub-munition clearance. This will be guided by principles of safety inherent in IMAS. Levels of PPE, e.g. use of visor versus safety goggles, may be influenced by the type of activity conducted, e.g. visual clearance may be conducted with safety goggles. Instrument aided or intrusive searches (rubble, vegetation etc) and sub-surface searches should be conducted using a visor. In Lebanon this has been clearly identified in National Technical and Safety Guidelines and is again the result of discussion between national authorities and agency operators who are involved in clearance in the field. There are certain situations in destruction or neutralisation activities where the use of PPE may actually impede an operator’s access to a sub-munition e.g. accessing a sub-munition in a tree or a fence line and it may be felt that this creates a greater hazard than NOT wearing PPE. Again, national authorities and agencies should work closely to provide full documentation and training to support these risk based decisions.

Marking and recording equipment (apart from standard equipment and accurate map reading, and referencing):

h) Differential GPS[18]
i) Basic GPS
j) Laser finders

Note: Accurate marking and recording and reporting are essential in clearance of sub-munitions particularly when there are a number of methodologies employed and these choices have consequences for future planning of clearance activities. Systems which accurately pinpoint individual sub-munition strikes and which can clearly delineate between choices of clearance methodology will assist effective current and future clearance operations.

11. Innovations

As with all mine action activities, field experience leads to changes based on lessons learned. Often these changes or possible changes generate heated debate and discussion amongst agencies and operators. It is important to encourage, at both national and agency level, a commitment to such discussion and a willingness to analyse the efficacy of innovations based on the potential for improvement in safety, efficiency and effectiveness of operations. Authorities and agencies should make every effort to capitalise on field innovations but with the proviso of a rigorous process of investigation, analysis, discussion, agreement and documentation of any proposed changes. This should also be accompanied by the necessary training and or development to support proposed innovations and information should be widely shared amongst the mine action community.

12. Quality Management

Quality management is an integral process in the clearance of sub-munitions just as in any other part of humanitarian demining. But it is an ongoing process, applicable throughout, for example, in Lebanon; the “Pre-emergency” Phase, the “Emergency” Phase and the “Post-conflict” Phase.

Quality of the service provider is ensured through ongoing accreditation of agencies and quality of service through specific and well documented ongoing quality assurance and quality control checks of agency work.

Critical points identified for quality management in Lebanon include ***other*** aspects of the quality mine action circle. These points include:

a) The initial data identification and recording of SHA – as discussed in the Pre-emergency and Emergency Phase, failure to address the accurate recording and reporting of SHA will result in loss of planning data.
b) The defining of “usable land” as a key to tasking and to guide conduct of clearance and prioritisation of clearance – in Lebanon, this is a key tool and has been addressed through the use of the Community Liaison Officer.
c) The clearance methodology employed (in particular the choice of surface followed by sub-surface at a later date) and the choice of method for disposal of the threat.
d) The need for accurate recording and reporting (e.g. “Suspension” and “Clearance” reports) and subsequent follow up of the documentation, which leads back to;

[18] This is a very expensive option and requires good satellite access and software support

e) Review of the SHA based on initial and/or remaining threat to the community for future tasking.

Annex A
(Normative)
References

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

a) IMAS 04.10. Glossary of terms and definitions;
b) IMAS 09.30 EOD;
c) IMAS 10.30 PPE;
d) IMAS 09.11 BAC;
e) GICHD A Guide to Cluster Munitions – July 2007;
f) GICHD Advisory Note Version 1;
g) NTSG Lebanon – Chapter 14; and
h) CWA 15756 Dec 2007, on Testing of PPE.

The latest version/edition of the IMAS references should be used. UNMAS hold copies of all IMAS references used in this Technical Note. A register of the latest version/edition of the IMAS standards and references is maintained by UNMAS, and can be read on the UNMAS web site: (www.mineaction.org). National mine action authorities, employers and other interested bodies and organisations should obtain copies before commencing mine action programmes.

The latest version/edition of the Technical Notes can be read on the Mine Action Standards web site: (www.mineactionstandards.org)

Annex B
(Informative)
Types of sub-munitions and cluster bomblets

B1. Parachute stabilised

B1.1. Description

Some of the more modern sub-munitions use small parachutes or other forms of flexible airbrakes in preference to rigid fins. Other than the method of stabilisation, the characteristics of munitions within this category tend to be similar to those of fin-stabilised anti-armour bomblets (see below). However, since chute stabilisation tends to be used for newer sub-munitions, some do incorporate more complex components.

Picture above: BLU 97

B1.2. Typical operation

Shortly after deployment from the carrier, a drag chute or small inflatable 'air brake' is ejected from the rear. This often allows a telescopic body to extend and arms the fuzing system. When the bomblet strikes a hard object nose-first, the detonator at the rear of the shaped charge is initiated to produce an anti-armour effect. This can be achieved using a piezoelectric fuze or a rod, which strikes a stab-sensitive detonator at the rear of the casing to energise a piezoelectric element.

Secondary fusing variants can exist to initiate the bomblet if it fails to land on its nose; these use all-ways acting mechanisms that incorporate a ball-bearing housed in a chamber with sloping sides. Sideways movement of the ball-bearing acts on the sloping surface to push a pin into a stab-sensitive composition. If these mechanisms are not actuated during impact, they can act like anti-handling devices when the sub-munition is subjected to further sudden movement. Like their fin-stabilised variants, most chute-stabilised sub-munitions produce an anti-personnel/anti-materiel effect as the body is shattered, and many are scored to produce consistent fragmentation.

B2. Dual Purpose Improved Conventional Munitions (DPICM)

B2.1. Description

Dual Purpose Improved Conventional Munitions (DPICM) are dispensed in large numbers using projectiles or artillery rockets, such as MLRS. Most DPICM are very similar in appearance and operation, tending to be based on the design of the US M42. The tubular body is normally made from steel with the open end housing a copper shaped charge liner, which is inset to provide stand-off on impact. In some examples, the side-wall of the casing is internally notched or fitted with a matrix of small steel balls set in plastic. The other end of the body is generally domed and has a simple impact fuze fitted. The fuze incorporates a small threaded striker attached to a loop of fabric ribbon, which is folded over the fuze. The striker retains a spring-loaded transverse slide fitted with a small stab-sensitive detonator. The configuration is designed so that the bomblets can be packed closely, nose to tail, in tubes within a dispenser.

Picture above: KB-1

B2.2. Typical operation

Once released from the dispenser, the ribbon unfurls and brings the bomblet into a nose-down attitude. As the ribbon vibrates in the airstreams, the threaded striker unscrews and releases the detonator slide. Once free, the slide is moved across by its spring, bringing the detonator into line with the striker. On impact, inertia carries the striker forward into the detonator, beneath which is a small booster pellet and the main charge. The body is shattered and the shaped charge fired downwards into the target. Ball-bearings can surround the body to increase the anti-personnel fragmentation effect.

B3. Fin-stabilised (anti-armour)

B3.1. Description

The majority of the older designs used fixed fins with a central void to enable the sub-munitions to be packed tightly nose to tail. The US M118 'Rockeye' was one of the first such designs. This bomblet has a cylindrical body incorporating a HEAT warhead with a rear-mounted fuze and fixed plastic fins. Most fin-stabilised anti-armour bomblets have arming impellers and either piezoelectric or impact fuzes, though many variations exist. All types create some stand-off for the shaped charge, either by mounting the charge well back in the body, or by placing a probe on the front. Configurations vary, and the presence of a HEAT warhead may not be obvious from the external shape.

Picture above: Mk 118

B3.2. Typical operation

On ejection from the cluster bomb, folding fins (if present) deploy to bring the bomblet into a nose-down attitude. The air-stream passing over the vanes on the arming impeller causes it to rotate, eventually arms the fuze. When the bomblet strikes a hard object nose-first, the detonator at the rear of the shaped charge is initiated to produce an anti-armour effect. Most also produce an anti-personnel/anti-materiel effect as the body is shattered, and many are scored or notched to enhance fragmentation.

B4. Fin-stabilised (fragmentation)

B4.1. Description

Fin-stabilised fragmentation bomblets are normally dispensed from cluster bombs carried on fixed-wing aircraft. They generally have cylindrical cast steel casings that are relatively thick in proportion to the size of the munition. Exceptions include the casing of the US BLU-3/B, which is made from aluminium with steel balls set into it. Fins are normally made from sheet steel or plastic, and may be either fixed or spring-loaded. During transit, spring-loaded fins tend to be folded around the body to make the bomblet compact, allowing more sub-munitions to be carried within the dispenser. Most use simple impact fuzes, which are normally fitted to the nose.

Picture above: BLU 3/B

B4.2. Typical operation

Once ejected from the dispenser, fins bring the bomblet into a nose-down attitude. Fragmentation sub-munitions generally use basic mechanical fuzes; some arm as the fins deploy (for example the BLU-3/B, which uses a sliding shutter) while others (such as the Russian AO-2.5) are armed by vanes rotating in the air stream. The fuze fitted to the Russian AO-1SCh simply uses a pin suspended in front of the detonator; it is permanently armed and relies on the structure of the fuze body for protection during transit and deployment. Fuzes function on impact, normally by the direct action of a pin being driven into a stab-sensitive detonator assembly. As the main charge detonates, the body is shattered to create a lethal radius of 10 - 20 m.

B5. Spin-armed

B5.1. Description

Spin-armed sub-munitions are dispensed from cluster bombs dropped from fixed-wing aircraft. Most of them are basically spherical, though some have parallel-sided bodies with hemispherical ends. All types have external vanes to induce spin as they fall from the dispenser; these may be built into the shape of the casing, or fixed onto it in the form of a band or tail assembly.

The casing is normally cast steel and may be internally or externally notched to improve fragmentation; some of the US variants are made from aluminium with steel balls set into it. The casings tend to be made in two halves, which may be crimped together or joined using a metal band. In most cases, the fuze mechanism is in the centre of the sub-munition, surrounded by the main charge.

Picture above from left to right: BLU26, BLU 61 & BLU 42

B5.2. Typical operation

When dispensed at sufficient altitude, the vanes impart spin to the bomblet as it drops. Centrifugal force is used to arm the fuze once the speed of rotation is high enough, with sprung weights moving outwards to release a rotor containing the stab-sensitive detonator. Most bomblets then function on impact, though some are also initiated by a decrease in centrifugal force.

For impact initiation, the all-ways acting fuzes use weights, either falling directly on the firing pin, bearing on it at a tangent as they ride down internal slopes, or a cam moves a ball bearing out of a recess. Most detonate immediately on impact, though some may incorporate a short delay. In unexploded sub-munitions, all-ways acting fuze mechanisms can behave like an anti-disturbance device and may function if subjected to sudden movement. In addition, some scatterable sub-munitions contained anti-disturbance long-delay fuzing, as well as trip wire-activated anti-disturbance fuzing, as with the BLU-42 WAAPM.

Annex C
(Informative)
Example Terms of Reference - Community Liaison Officer

Community Liaison Assistant (CLO)

Project:	LEB/00/R71 (Mine Action Coordination Centre)
Unit:	Public Information Section
Post:	Community Liaison Assistant
Contract/Level:	NSPP III
Duty Station:	Tyre, South Lebanon
Reporting to:	Public Information Officer

Objective

To provide the link between the Clearance Organisation and the Local Community on behalf of the Mine Action Coordination Centre in Southern Lebanon.

Geographical area of responsibility

From the Litani River to the Blue Line.

Duties and Responsibilities

- Provide the link between the Clearance Organisation and the Local Community regarding mine clearance activities in their area of operations.
- Keep the Landowner or his representative, Mukthar and Local Community informed of clearance activities taking place.
- Ensure that CLO certificates are completed prior to, during and after clearance has taken place.
- Ensure that the final CLO clearance certificate is completed and signed by the relevant parties during the QA handover completion.
- Attend all handover completions as scheduled.
- Report any possible reported dangerous or suspected areas and UXO to the MACC SL Operations Department in the required MACC SL report format.
- Ensure that any additional information obtained during the clearance phase is reported to the MACC SL Operations Department and the Clearance Organisation.
- Provide reports to the MACC SL Public Information Officer on any MRE requirements in the Local Communities so this can be reported to the NDO for further action.
- Conduct community liaison on an ongoing basis as required.
- Follow up with victims and communities after incidents involving civilians and complete the casualty reports for input to IMSMA.
- Assist with Post Clearance Assessments as required by the MACC SL PM.
- Act as English translator in both oral and written dialogue as required.
- Able to work eight hours per day for six days of the week in line with clearance organisation operational hours.
- Needs to be contactable 24 hrs per day seven days per week for any emergencies requiring liaison with Local Communities.
- Assist with MRE as required by the PIO.
- Other duties as required by the MACC SL UN PIO or the UN Operations Officer.

Necessary Attributes

- Good communication and interpersonal skills with people of all ages and backgrounds.
- Self-starter who can work independently and adhere to tight deadlines.
- Sound written and oral skills in English and Arabic.
- Ability to work in a multi-cultural equal opportunities environment.
- Ability to read and interpret maps.
- Ability to use GPS.
- Computer literate.
- Holder of a clean Lebanese driving license and experience in driving vehicles with manual transmission.

Desirable Attributes

- Previous CLO experience.
- Sound knowledge of Southern Lebanon.

Annex D
(Informative)
Example of Crop Cycle Analysis

Crop Cycle South Lebanon/Cluster Bomb Clearance Priorities

CROP	MONTH				NUMBER OF WORKERS	AREAS	PLANTATION ALTITUDE	REMARKS
	SOWING	FIRST AGRICULTURAL PRACTICE *	FERTILISATION AND CONTROL	HARVEST				
Banana	If the plantation is new planting takes place in early spring - March	May	April	**From Sep till April/ Mainly Oct-Nov-Dec**	One per 5 Dunum*	**Major areas of cultivation: Naquoura, Al Mansouri, Al Ma'liya, Deir Quanoun.**	0-150 m	**Banana harvest depends mainly on the surface planted, so the area can be harvest several time, twice or more. Mainly, one person can harvest 5 dunums.**
Olive	Already set plantation	Nov-Dec	**March**	Oct-Nov	One per 7 Dunum/ BUT for harvest 3 /dunum/2 days	**Major areas of cultivation: Hassbayya, Rmaich,Ain Ibil, Yater**	300-1000 m	**During March the plantation is plowed and fertilized, and usually it is done following the traditional way because of the unorganized planting of the trees, so this will oblige the workers to do everything manually**
Tobacco	March-April	**March-April**	Jun-Jul-Aug/ 3 sprays each month	Jun-Jul-Aug/ 6 harvests, one each 15 days	One per 2 Dunum Full Time	**Major areas of cultivation: Rmaich, Touline, Aitaroun, Deir Kifa**	0-till Wazzani area	**Mainly Tobacco is sprayed for disease control, and the control is manually, rarely automatically. Most Tobacco plantations are handled by traditional means.**
Citrus	Already set plantation	Dec	Dec	Sep-Oct-Nov-Jan-Feb- Jul	Number varies	**Major areas of cultivation: Naquoura, Hosh, Bazourieh, Rass El Ain, Qlaili, Al Mailiya**	0-300 m	**Harvest depends on the variety of Citrus, for eg. Valencia variety is harvested in July, Oranges and Tangerine in Nov-Oct and Dec.**

Annex E
(Informative)
Example of Battle Area Clearance Plan

The following describes the concept of clearance in Lebanon for certain target areas classified by location. The sub-munition hazard in all cases where this has been applied is "M" series DPICM and BLU, Spin armed sub-munitions and generally involves hard surfaced terrain.

Type 1 Rural – Open Ground, no previous clearance, evidence of cluster munitions contamination.

a) Identify UTM on the ground
b) conduct visual search of "usable" land to fadeout
c) mark up for internal suspension.

Type 2 Rural – Open ground with previous clearance (Level 1 Emergency response) and continuing evidence of cluster munitions contamination remaining.

a) Identify UTM on ground.
b) Conduct visual search of **"usable land"**[19] to fadeout.
c) Conduct sub-surface search if visual above is 5 clearance days duration or less.
d) Mark up for internal suspension and / or completion.

Type 3 Rural – Open ground with previous clearance (Level 1 Emergency Response) and no evidence of continued cluster munitions contaminations.

a) Identify UTM on ground.
b) Conduct visual search "**4 box cross**" of **"usable land".**
c) Conduct instrument search of min 10%.
d) Mark up for completion.

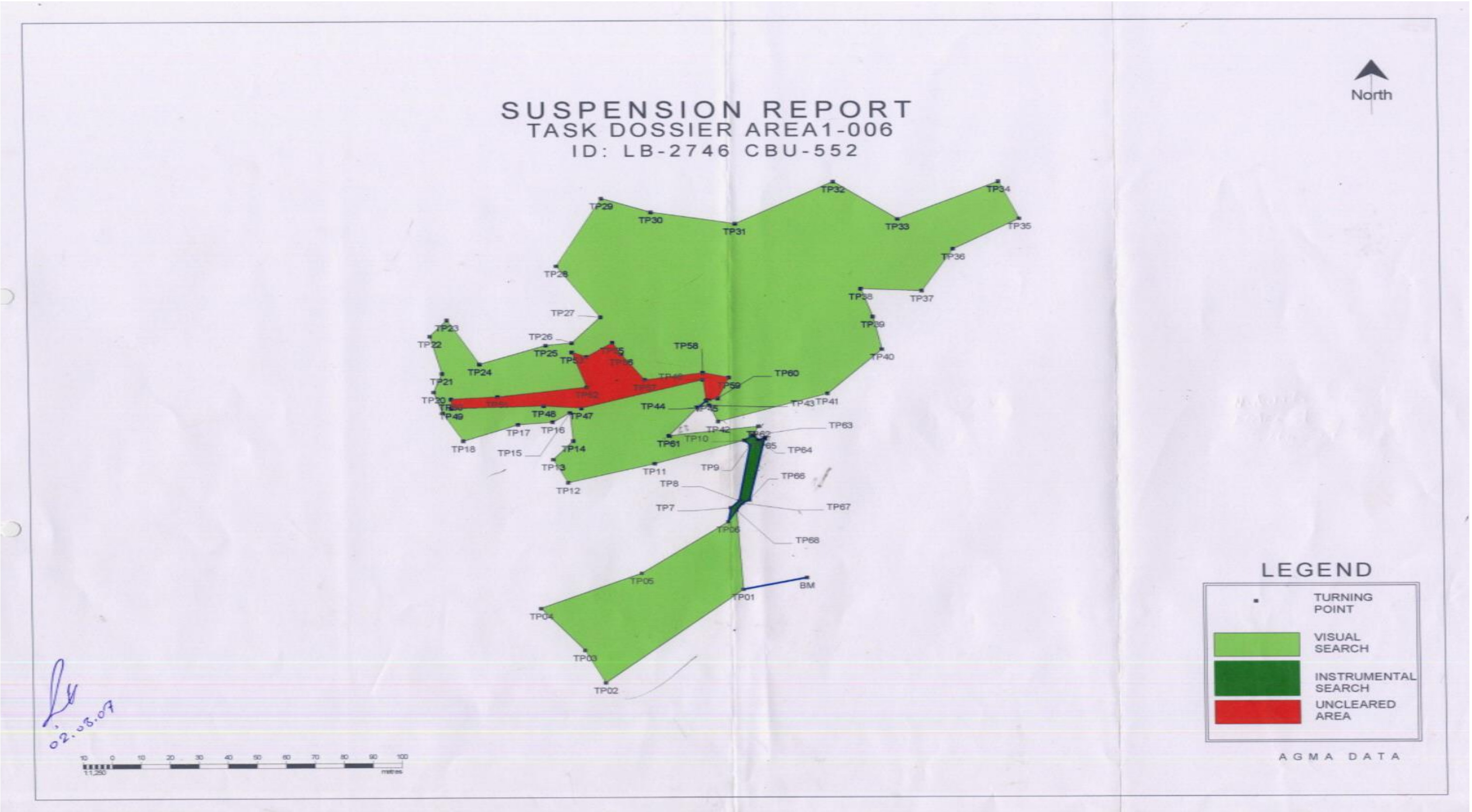
Type 4 Urban – Village with previous clearance and evidence of continued cluster munitions contamination – Identify UTM on ground.

a) conduct visual search of Village to fadeout
b) mark up for internal suspension.

This clearance concept forms the basis for operations and discussion on the ground. It also allows for the planning and operations officers to follow up as necessary with future tasking.

19 Usable land is defined as that land which is currently used for cultivation, grazing or movement of civilians – through discussion with community and Community Liaison Officer.

Annex F
(Informative)
Example Suspension Report – Sketch Map



Amendment record

Management of Technical Notes amendments

Technical Notes (TN) are subject to review on an 'as required' basis. As amendments are made to this TN they will be given a number, and the date and general details of the amendment shown in the table below. The amendment will also be shown on the cover page of the TN by the inclusion under the version date of the phrase *'incorporating amendment number(s) 1 etc.'*

As reviews of TN are made new versions may be issued. Amendments up to the date of the new version will be incorporated into the new version and the amendment record table cleared. Recording of amendments will then start again until a further version is produced.

The most recently amended TN will be the versions that are posted on the IMAS website at www.mineactionstandards.org.

Number	Date	Amendment Details
01	01 July 2013	1. Inclusion of amendment No, date in the title and header. 2. Updated links and email addresses. 3. Minor text changes in fifth Paragraph of Foreword. 4. Removed Annex A definitions and inclusion of a reference to IMAS 04.10 in Clause 3. 5. Annex B, C, D, E and F relabeled. 6. Inclusion of amendment record.