

DDAS Accident Report

Accident details

Report date: 19/05/2006	Accident number: 391
Accident time: 12:00	Accident Date: 10/05/2002
Where it occurred: OES 3, MF 147, Bayt Yahun	Country: Lebanon
Primary cause: Unavoidable (?)	Secondary cause: Inadequate equipment (?)
Class: Excavation accident	Date of main report: 16/05/2002
ID original source: Bol: No001/2002, MJF	Name of source: MACC SL
Organisation: Name removed	
Mine/device: No.4 Israel AP blast / frag	Ground condition: agricultural (abandoned) grass/grazing area
Date record created: 22/02/2004	Date last modified: 23/03/2004
No of victims: 1	No of documents: 2

Map details

Longitude:	Latitude:
Alt. coord. system: GR 36 7260 6719	Coordinates fixed by:
Map east:	Map north:
Map scale: UNIFIL	Map series:
Map edition:	Map sheet: A (Tibnin)
Map name: 1:50,000	

Accident Notes

handtool may have increased injury (?)
inadequate area marking (?)
victim working prone (?)

Accident report

What follows is the Board of Inquiry report, edited for anonymity (and with excess pictures removed).

REPORT FOR ACCIDENT INVESTIGATION BOARD OF INQUIRY – No001/2002

MINE Accident that occurred in OES 3 on 10 May 2002 in which [Demining group] Team Leader [name excised] was injured.

Map Reference: UNIFIL 1:50,000 Sheet A (Tibnin).

References: A. Janes Mines Manual.

Introduction

1. In accordance with the National Technical Standards and Guidelines (TSGs), the MACC SL Programme Manager issued a Convening Order on Friday 10th May 2002, for an accident investigation Board of Inquiry. Annex A details the Convening Order.
2. This is a comprehensive report by the Board of Inquiry into the Mine Accident that occurred on the 10th May 2002. Based on the investigation, [Demining group]'s internal report, the statements from [Demining group] personnel involved in the accident (see Annex B), visits to the accident site and the photos from the accident site, this accident is considered preventable.
3. The information provided by [Demining group] to the MACC SL QA Section in the "IMSMA Accident Report", attached as Annex C is confirmed. The accident occurred at approximately 1200 hrs on 10th May 2002, in Minefield (M/F) No 147 at Bayt Yahun. Bayt Yahun is located North of Bint Jubayl at GR 36 7260 6719, (M/F No 147 Command Post). Annex D details a map of the general area.

Events leading up to the Accident

4. At the time of the accident [Demining group] Manual Clearance Team No3 were operational on the Southern sector of M/F 147 clearance site, at Bayt Yahun. Additional [Demining group] Manual Clearance assets were also operational in M/F 147, these being to the North of the accident site.
5. Manual Clearance Team No 3 had been operational on M/F 147 since the 06th May 2002; a total of 11 x clearance lanes had been cut into the Northern sector of M/F 147 during the previous 4 x days clearance activities, resulting in the location of the 4 x minefield mine rows, as per M/F 147 record. Annex E details [Demining group] Team No3 Site Clearance Map.
6. The team had been working in 2 x section boundaries, the Northern section area was commanded by Team leader [the Victim] and the Southern section area was commanded by Team Leader [name excised]. The reasons for 2 x Team Leaders being present on site are that [Demining group] are employing the experienced additional personnel to provide on the job training, whilst other demining contracts are being confirmed.
7. At approximately 1155 hrs, [Demining group] Deminer [name excised] located an Israeli No 4 Anti-Personnel (AP) mine. The mine had been located at a depth of approximately 6cms, in a horizontal position and with the rear portion of the mine facing towards the safe area. [The] Deminer had excavated approximately 25% of the mine. Following this partial excavation, he then informed the Team Leader, [the Victim]. Team Leader [the Victim] then ordered [the] Deminer to move to the rear of the lane into the safe area, whilst full excavation and manual neutralisation of the mine took place.
8. Team Leader, [the Victim] then adopted the prone position wearing his protective jacket and protective visor (down position). He then started to probe around the mine, holding the probe handle in his right hand and supporting the end of the probe with his left hand thumb.

Events following the Accident

9. At approximately 1200 hrs an uncontrolled detonation occurred in the clearance lane. Following the uncontrolled detonation, Team Leader [the Victim] managed to stand upright and started to make his way out of the clearance lane. On hearing the uncontrolled detonation [the other] Team Leader called a stop to all team demining activities and assisted Team Leader [the Victim] out of the minefield to the casualty evacuation point where he was met by the Team Medic [name excised]. Annex F details a schematic diagram of the accident area / scene.

10. Following stabilisation at the casualty evacuation point, the casualty was then transported to Bint Jubayl Hospital for medical treatment. [The second] Team Leader then proceeded to secure and mark the accident scene as per [Demining group] current SOPs and National TSGs.

VIEW OF THE BASE AND ACCIDENT LANES, LOOKING EAST FROM A SAFE AREA



[The “accident lane” spurs off the “base lane” to the right.]

VIEW OF THE ACCIDENT SCENE FROM THE CLEARANCE LANE.



The Victim’s visor is to the right of the seat of detonation.

Work History of the Casualty

11. [The Victim] has been working for the [Demining group] since 1996, prior to this he was employed by [an international commercial demining company] as a Dog Handler. He was promoted from Deminer to Team Leader in January 2000 and has since worked as a Team Leader in both Sri-Lanka and Kosovo. As a Deminer he worked in Kosovo, Mozambique and Zimbabwe. He is a qualified Team Leader, Deminer, Dog Handler and a fully trained Medic. [The Victim] is considered by [Demining group] to be a competent and trustworthy employee; disciplinary action had never had to be taken against him.

Past History of the Area

12. The Israeli Force (IF) initially, and later, the South Lebanese Army (SLA) previously occupied Bayt Yahun. The mine-contaminated areas consist of the following:

- Defensive minefields around 2 x former IF / SLA positions situated at GR 36 7258 6718 (W137) and GR 36 7265 6726 (W139).
- 2 x defensive / protective minefields than run along the South West side of the main road linking the above 2 x positions.

- A protective minefield that runs from former position W129, on the North East side of the village down to and across the access road leading to former UN position 6-20 (M/F 147).

13. The MACC SL designated the minefield above as M/F 147. IF Northern Command reported the minefield details on the 29th May 2000, the minefield details reported were:

- IDF minefield designator No C38.
- Reference Point GR 36 7261 6720.
- Quantity of 840 x Israeli No4 AP mines.
- Mines planted in 4 x rows.
- Mines were laid on in January 1996.
- No minefield map was available.

14. Previously, both the Lebanese Armed Forces (LAF) and Hezbollah have conducted limited clearance in and around Bayt Yahun. No exact cleared area perimeter coordinates details were recorded and therefore are not available.

15. A previous mine accident occurred in Bayt Yahun during the LAF clearance operation on the 12th October 2001, where an LAF Engineer Regiment Corporal inadvertently stood on an Israeli No4 AP mine resulting in the traumatic amputation of his foot.

Sequence, Documentation and Procedure of Tasking

16. Task Dossier (TD) OES 3 #001 was issued to [Demining group] on the 22nd April 2002; the TD contains details of 8 x minefields in and around Bayt Yahun. The clearance operation in M/F 147 commenced on the 06th May 2002 and up to the time of the accident a total area of 544 sq.m had been cleared resulting in the disposal of a total number of 123 x Israeli No4 AP mines. (It should be noted that the sq.m for the days clearance activities prior to the accident, are not included in the above total as they were not available at the time of writing this report).

Geography and Weather

17. The task site is located in an open area to the North East of the village of Bayt Yahun. Access to the site is via a stone laid track from the main Tibnin / Bint Jubayl road, which dissects the village of Bayt Yahun. The area is on a natural incline, sloping downwards in a North Easterly direction from the high point of 864m to the South East of the village. The mined area was previously pastoral and arable agriculture land, used for tobacco cultivation and cattle grazing; there are no forested areas within the immediate district. The weather at the time of the accident was fine and sunny with a temperature of approximately 24 to 26 degrees Celsius.

Site Layout and Marking

18. The site layout and minefield marking prior to the accident was in accordance with National TSGs and [Demining group] SOPs; as was the post accident marking.

Management Supervision and Discipline

19. [Demining group] clearance operation is supervised by an International Operations Manager and an International Operation Field Manager was in overall charge of Bayt Yahun task site. 2 x International Team Leaders, as previously detailed, commanded the Manual Clearance Team No3. There are no reports of disciplinary action being taken against [Demining group] personnel on the Bayt Yahun task.

Quality Assurance and Quality Control

20. [Demining group] Internal Quality Assurance is achieved through a system of on-site checks by an International QA Team to ensure adherence to National TSGs and [Demining group] SOPs. External QA is carried out by the MACC SL QA Section. The last MACC SL QA visit was on the 08th May 2002 where site "Setting Up" was evaluated, the evaluation result was good.

Communications and Reporting

21. Communications in-between the Bayt Yahun task site and [Demining group] base location is maintained via HF vehicle Codan radios and VHF hand-held Motorola radios. On site communications in-between teams is maintained via the VHF system.

22. On the day of the accident, the site had proper and appropriate communications and managed to pass all relevant accident information back to [Demining group] base location, which in turn passed the information to the MACC SL via the HF system. Annex G details [Demining group] Radio Log.

Medical Details

23. Manual Team Leader [the Victim] suffered a traumatic amputation of his left hand thumb (above the knuckle), multiple closed fractures of his left hand index finger, an open fracture to his left hand middle finger, primary and secondary fragmentation injuries to both hands and arms and flash burns to both hands and arms. [Demining group] Team No3 Medic, [name excised], administered medical treatment and stabilisation on-site to [the Victim]; casualty evacuation by road to Bint Jubayl civilian hospital then took place.

24. On arrival at Bint Jubayl hospital, [the Victim] was transferred to the X-Ray Department where wide-ranging x-rays of both hands and arms were taken. He then underwent a 3 ½ hour operation in theatre to surgically amputate his left hand thumb (below the knuckle), wire his left hand index finger, remove the primary and secondary fragmentation from both arms and hands, dress the flash wounds and set the fractures. Annex H details the medical reports from Bint Jubayl hospital. [Annex H not made available.]

25. On the 11th May 2002 [the Victim] was moved to the hospital at Sidon as his blood plasma platelet count was very low (40/150).

Personnel

26. A list of all personnel and their duties is detailed at Annex B. Written statements from [Demining group] personnel involved in the accident and [Demining group] internal report form part of the Appendices to the Annex.

Dress and Personal Protective Equipment (PPE)

27. At the time of the accident, Manual Team Leader [the Victim] was wearing his protective apron and protective visor. On inspection of the protective apron, the following points were noted:

- The outer cover was ripped in several places.
- There was blast debris concentrated at the top left hand side.
- There was part primary fragmentation penetration of the Kevlar lining.
- There was no complete penetration of the Kevlar lining.

TEAM LEADER [the Victim]'s PROTECTIVE JACKET



[Pictures of the inside of the apron (beneath the cotton cover) have been omitted. The apron is made using ballistic aramid, not Kevlar, and has a NATO STANAG V50 rating of 380 m/s.

The insertion of a small 5mm polycarbonate chest plate does not raise the protection to the required levels.]

28. On inspection of the protective visor, the following points were noted:

- A large proportion of the blast effects were concentrated on the outer face of the visor.
- There was part fragmentation penetration of the polycarbonate visor.
- There was no complete fragmentation penetration of the polycarbonate visor.

THE PROTECTIVE VISOR



Blast effects across the face of the visor.

[The investigators interpreted the burned-out fragments pitting the visor face and scratch-guard as partial penetrations. No fragments penetrated fully.]

Tools and Equipment

29. At the time of the accident, the only item of equipment that was being used was a standard [Demining group] metallic probe, one of 4 x different probes types currently used by [Demining group]. On inspection of the probe, the following points were noted:

- The end of the probe had bowed at an angle of approximately 110 degrees from the normal horizontal position.
- The tip of the probe had melted and become deformed.
- The probe was located at a distance of 2.15m from the seat of detonation.

DEMINE PROBE USED BY TEAM LEADER



[The picture above shows the bent probe with a burnt tip. It is made “candytwist” reinforcing bar and has been criticised in other theatres where this demining group works.]

Details of Mine Involved

30. The Israeli No4 AP blast mine consists of a plastic box with a hinged lid that overlaps the sides. The main charge is 188g of cast TNT, housed in an internal plastic compartment, which occupies just over half of the volume of the box at the hinged end. The wall of this compartment is threaded to accept the fuze assembly; the remainder of the box is empty.

31. The metal fuze assembly, which incorporates a lead-shear arming delay, is fitted through a hole in the end of the mine and screwed into the wall of the charge compartment and sealed with a rubber O-ring. The arming pin protrudes through the end of the mine opposite the hinge. The arming pin is attached to a pull ring, which is looped over the fuze body and retained by a plastic cap during transit for additional safety. The striker is retained and secured by a square shaped slotted plate on which the open end of the box rests.

32. The mine is designed purely for direct pressure operation. To arm the mine, the plastic cap on the end of the fuze is removed to release the pull ring; the arming pin is then removed. The spring-loaded striker is retained until it has sheared through a lead wire, which runs through holes in the end of the fuze. The arming process normally takes several hours. Once armed, the striker is retained only by the slotted plate; pressure on the lid (in excess of 8kgs), simply pushes the slotted plate out which in turn releases the spring loaded central striker. The striker then impacts with the integral fuze detonator, which then passes the detonating wave to the main TNT charge causing the mine to disintegrate. (Paragraphs 30 – 32 inclusive extracted from Reference A)

33. There have been instances reported where foreign bodies have embedded themselves in between the recess in the striker mechanism and the slotted striker retaining plate, therefore allowing the partial downward release of the plate. The spring-loaded striker is now therefore only being held by the foreign body.

34. Accumulated pressure over a period of time (especially in heavy soil conditions), can also slowly release the slotted striker retaining plate. This therefore reduces the direct pressure required to activate the mine.

ISRAELI No.4 AP BLAST MINE



Account of Activities

35. The following is a description of the events before and after the accident. The information from the investigation forms the basis of the description of events:

10/05/02

- 1200hrs – Uncontrolled detonation at M/F147.
- 1207hrs – Casualty evacuation of casualty to Bint Jubayl hospital.
- 1208hrs – Notification of accident to MACC SL.
- 1214hrs – Arrival of casualty at Bint Jubayl hospital.
- 1225hrs – Notification of accident to NDO.
- 1235hrs – BOI Convened.
- 1255hrs – BOI Leaves MACC SL to move to [Demining group] base location.
- 1350hrs – BOI Arrives at [Demining group] base location to inform Colonel [name excised] of BOI.
- 1359hrs – BOI Leaves [demining group] base location to move to accident site.
- 1405hrs – BOI Arrives at accident site to conduct accident investigation.

- 1545hrs – BOI Leaves accident site to move to [Demining group] base location.
- 1555hrs – BOI Arrives at [Demining group] base location to conduct witness interviews and collate the task information.
- 1800hrs – BOI Leaves [Demining group] base location to move to Bint Jubayl hospital.
- 1810hrs – BOI Arrives at Bint Jubayl hospital to interview medical staff and [the victim].
- 1855hrs – BOI Leaves Bint Jubayl hospital to move to MACC SL.
- 1945hrs – BOI Arrives at MACC SL.

11/05/02

- 1300hrs – BOI Leaves MACC SL to move to Bint Jubayl hospital.
- 1355hrs – BOI Arrives at Bint Jubayl hospital to collect medical report and to see the casualty.
- 1435hrs – BOI Leaves Bint Jubayl hospital to move to [Demining group] base location.
- 1445hrs – BOI Arrives at [Demining group] base location to collect remainder of the task information.
- 1520hrs – BOI Leaves [Demining group] base location to move to MACC SL.
- 1615hrs – BOI Arrives at MACC SL.

Insurance Details

36. [The victim] is covered by the standard [Demining group] insurance for all International personnel in mine/UXO clearance activities in Lebanon. All insurance policies for [Demining group] are through HMT Insurers of London.

Conclusions

37. Based on the investigation, the statements and visits to the site, the Board of Inquiry conclude the following:

- There was a sub-surface detonation of an Israeli No4 Anti Personnel mine. Evidence shows that the crater had heavy blackening to the sides, was of a bulbous shape with primary fragmentation lining the sides. Lifting had formed 360 degrees around the edge of the seat of detonation. The excavated crater size was 22 cm in diameter and 20cm at the deepest point.
- The traumatic amputation of [the victim]'s left hand thumb was due to the downward movement of the probe following the uncontrolled detonation.
- [The victim]'s other injuries were sustained from both primary and secondary fragmentation, resulting from the disintegration of the Israeli No4 mine, on the detonation of the high explosives.
- There is no evidence to ascertain that prior to the accident, [Demining group] SOPs were being infringed or that the proven work procedures were not being adhered to.
- The medical treatment and subsequent evacuation of the casualty by the on-site medic was very good
- The post-accident marking of the accident site was carried out in accordance with current SOPs.
- The passage of information in between the accident site, [Demining group] base location and the MACC SL was very good, with all relevant information was passed in a timely manner.
- The BOI agrees with and accepts [Demining group] Accident Report.
- The BOI has the following comments regarding [Demining group] IMSMA Report:
 - Full details are required in the "Accident Description" box, as data entry clerks may not have access to the preliminary accident report.
 - All explanatory sketches and maps require a signature and date.
- The protective jacket and visor maintained their integrity following the uncontrolled detonation of an Israeli No4 AP mine at a distance of approximately 80 cms.

- The end of the probe had bowed at an angle of approximately 110 degrees from the normal horizontal position due to the pressure generated during the detonation of the high explosive fill.
- The tip of the probe had melted and become deformed due to the extremely high temperatures generated on the detonation of the high explosive fill.

38. The BOI concludes that the most likely explanation why there was an uncontrolled detonation is that the base of the Israeli No4 AP mine was moved in an upward direction by the demining probe. This would have caused the release of the slotted striker retaining plate through counter-lever action, therefore allowing the spring-loaded striker to move forward and impinge on the detonator.

39. Evidence to substantiate this explanation are:

- In order for the tip of the probe to melt and deform, it must have been intimate contact with the mine prior to detonation.
- If the probing action had been taking place above the mine, the probe would have been located at a distance greater than 2.15m away [sic?]; the bowing and deformation of the probe would also not have been as substantial.
- The omni-directional blast effects, sub-surface levels are far higher and more concentrated than those on or near the surface.
- It was the downward movement of the probe, which caused the traumatic amputation of [the victim]'s thumb.

40. As explained previously (Para 33 & 34), it must also be noted that there is the possibility that the slotted striker retaining plate may not have been securely fitted around the spring-loaded striker through either foreign bodies being present or accumulated downward pressures over a period of time.

Recommendations

41. The following are recommendations based on the BOI conclusions:

- No amendments are necessary to the National TSGs for Mine/UXO Clearance.
- A [Demining group] SOP covering the subject of “wetting of weather-hardened areas prior to the excavation of mines” is developed and submitted for approval to the MACC SL QA Section.
- All mines that prove be difficult to excavate or neutralise are to be destroyed in situ (by detonation only).
- The conclusions detailed in this report be distributed and discussed among all [Demining group] Operational Field Staff.
- A period of refresher / confidence training is conducted with all [Demining group] Operational Field Staff, to include the following subjects:
 - Manual probing and excavation techniques.
 - Manual neutralisation techniques of all in-country mines.

Signed: QA Officer, Mine Action Co-ordination Centre South Lebanon

Annexes: [Not made available.]

- A. MACC SL convening order for accident investigation Board of Inquiry.
- B. List of personnel involved with attached statements as Appendices.
- C. IMSMA Mine/UCO accident report.
- D. Map of the general area.
- E. [Demining group] Team No3 current site map.
- F. Schematic diagram of the accident area/scene.
- G. [Demining group] Radio Log.
- H. Medical reports from the Bint Jubayl hospital.

Comments by the MACC SL Operations Officer

I concur with the conclusions and recommendations of this accident report involving [Demining group] Team Leader [The victim].

[Demining group] is to integrate those recommendations as stated in the report.

All mines that prove difficult to excavate or neutralise are to be destroyed in situ by demolition.

[Demining group] is also to provide MACC SL with a SOP amendment on manual neutralisation techniques for all mine types (incl Israeli No4).

MACC SL will produce a Mine-Fact Sheet detailing the neutralisation procedures and any applicable additional hazard information, for all mines encountered in Lebanon.

[Name excised] Operations Officer, Mine Action Co-ordination Centre South Lebanon

Comments by the MACC SL Programme Manager

I confirm that I have read the BOI Report and presented documentation. I concur with the findings of the BOI.

I note the efficient Casevac procedures carried out by [the demining group] during the initial reaction and the procedures followed by the Team Leader in securing the incident site.

I note the efficiency and accuracy of the Investigating Team in completing their investigation and report within seven days.

I endorse the recommendations made by the Board, in particular I emphasize the recommendations regarding the need for refresher training, for the development of a SOP for the watering of hardened ground to aid excavation and probing procedures, and for the destruction in-situ on mines which may be hazardous to excavate or neutralize.

Signed: [Name excised], Project Manager, UNOPS, Mine Action Coordination Centre Southern Lebanon

Victim Report

Victim number: 506	Name: Name removed
Age:	Gender: Male
Status: supervisory	Fit for work: not known
Compensation: not made available (insured HMT)	Time to hospital: not recorded
Protection issued: Long visor Frontal apron	Protection used: frontal apron, Long visor

Summary of injuries:

INJURIES

severe Arms

severe Hand

AMPUTATION/LOSS

Finger

COMMENT

No medical report was made available.

Analysis

This accident is classed as an "Excavation accident" (rather than a "handling accident") because the victim was using the prodder to expose the mine at the time of the detonation. It seems likely that he had both hands on the prodder because both hands were injured.

The primary cause is listed as "Unavoidable" because it seems likely that the victim was working properly in line with approved SOPs when the accident occurred. The secondary cause is listed as "Inadequate equipment" because the prodder being used is an unsuitable tool. Approximately 12mm in diameter, it is a length of cheap reinforcing bar intended for use in concrete buildings. The wide diameter and "candytwist" make it hard to use effectively as a "feeling" probe. The lack of a proper handle (a bent loop serves this purpose) is probably what caused the victim's thumb to be torn off. This demining group have been criticised for this prodder in other theatres.

The investigator's seemed to be unaware that the protective apron being used did not meet the IMAS requirement for fragmentation protection, although it has proved completely effective against blast mines in at least 25 accidents recorded in this database. The armour and visor are designed to be used in a kneeling position. Both the top of the head and the user's shoulders are vulnerable is working prone. (The researcher designed this particular armour and visor ensemble as part of a technology transfer programme in 1997/8).

Maps

The Annexes referenced in the Board of Inquiry report were not made available. A site sketch map and a section of a printed map were found among the pictures supplied.



