DDAS Accident Report

Accident details

Report date: 15/05/2006

Accident number: 214

Accident time: 07:15

Accident Date: 10/07/1998

Where it occurred: Aleksa Santic School, West Sarajevo

Country: Bosnia Herzegovina

Primary cause: Inadequate equipment (?)

Secondary cause: Management/control inadequacy (?)

Class: Missed-mine accident

Date of main report: 18/07/1998

ID original source: WL/WM/SB

Name of source: BiH MAC

Organisation: Name removed

Mine/device: PMA-3 AP blast

Ground condition: bushes/scrub
dry/dusty
grass/grazing area
hard
metal fragments

Date record created: 16/02/2004

Date last modified: 16/02/2004

No of victims: 1

No of documents: 2

Map details

Longitude:

Latitude:

Alt. coord. system:

Coordinates fixed by:

Map east:

Map north:

Map scale: Sarajevo

Map series: WGS 84 2782 1

Map edition: 9-DMA

Map sheet: M709

Map name:

Accident Notes

inadequate metal-detector (?)

inadequate equipment (?)

squatting/kneeling to excavate (?)

inadequate area marking (?)

Accident report

The demining group were operating in three-man teams working with one-man drills described as "work-rest-standby", changing role at 30 minute intervals.

A Board of Inquiry report was ordered by the country MAC and carried out by the chairman of the regional MAC and a representative from the overseas funder. A representative from the demining company involved was present. The report was made available and the following summarises its content. The full report (edited for anonymity) is under *Related papers* at the “Other documents” tab. The investigators were not able to interview the Site QA monitor and no report was received from his group.

The accident occurred in an area that was flat and grass covered with occasional low bushes. The ground was described as "hard and dry". There was considerable metal contamination and the normal requirement to remove all metal had been varied. In this case all metal signatures by the detector had to be investigated, but if the deminer was satisfied that the reading was not from a mine the metal could be left. The mine involved in the accident was identified as a PMA-3 by fragments found in the crater, the shape of the crater, and other mines found nearby. 50 PMA-3 mines had been found at the task site and most of these were "surface laid".

Dogs were used at the site "first thing each morning to check access lanes and last thing each afternoon as a quality control measure. Dogs also remained at the site to check areas after they had been cleared manually by deminers."

The tools available to the victim included a small trowel that the investigators said "was not a robust tool", hedge-cutting shears, the Schiebel AN 19/2 detector and "a standard manual prodding tool". The end-of-lane marking stick [called a "base stick" in this theatre] was shorter than required and not marked with the graded "prodding guide" required. The Team Leader carried the detector test piece, so the victim could not check its operation himself. The investigators found that it "appeared to function correctly".

The method used in the area was to first use the metal detector to "sweep over the top of high grass" (30cm or more in photographs) looking for PROM, TMRP-6 mines and tripwires. Then the deminer cut the grass with the shears before making a second detector sweep. Finally the deminer must prod over the entire area "because the metal detector could not always find buried PMA-3 mines”.

The demining operation was working in three teams in different parts of the mined area with a Control Point in a nearby school playground. The Control Point was not marked in accordance with the group's SOPs, but they explained that they had cleared the playground at the start of the task [it was not clear why it should not be marked]. There was no marked access route from the Control Point to the working areas.

The team started work at 06:00 the victim's partner located a PMA-3 and the Team Leader "dealt with this". At 07:00 the victim began his shift. After five minutes he located a PMA-3 and the Team Leader "dealt with this". At approximately 07:15 the victim stepped on a PMA-3 and it exploded. The victim's statement says that he was "in a position half on a knee of ground" with his prod when the mine exploded.

The injuries were described as "minor damage to…right foot. It was stated that "no permanent injuries were sustained". The investigators believe that the victim's "stout boots" saved him from more serious injury. They also believed that the groin protection provided by his protective trousers prevented injury to his body because there was superficial blast damage on the collar, groin and lower legs. [Damage to the cotton cover of the collar and groin area was shown in a photograph in the file.] A photograph of the lower-leg protection showed non penetrative damage to the cover and inner. A photograph of the victim's boot showed it split along the inside.

The medic was about 100 metres away from the accident site. He gave first aid and the victim was taken to the general hospital.

An investigation of the crater led the investigators to conclude that the mine had probably been at a depth of around 10cm, but the uneven ground made it hard to be sure.

Conclusion

The investigators concluded that there was room for improvement in the tools used on site. They found that the Schiebel AN19/2 could find PMA-3 mines to 6cm but may not have been "capable of finding the mine involved in this incident".

Recommendations

The investigators recommended that the demining company issue each deminer with a test piece for his detector, that they try other detectors (which they were doing during the drafting of the report), that improved end-of-lane markers be used, that 100% metal clearance be attempted anywhere that a detector could be used, and where detectors could not be used and prodding to 10cm was not possible - excavation should be carried out. [See Analysis.]

The recommendations also included advice to consider using a bayonet or "small shovel" to replace the trowel, to mark prodders to indicate depth, and to use one-handed shears for better control. They added that refresher training should be carried out and that the site Monitor should always be present for a site investigation.

DISTRIBUTION

Senior Technical Adviser BH MAC

Director Federation MAC

[Demining group]

US State Department

Federation PIU

Victim Report

Victim number: 276

Name: **Name removed**

Age:

Gender: Male

Status: deminer

Fit for work: presumed

Compensation: not made available

Time to hospital: not recorded

Protection issued: Frag jacket
Helmet
Short visor
Trousers/leggings

Protection used: Frag jacket, Helmet, Short visor, Leggings

Summary of injuries:

minor Foot

COMMENT

No medical report was made available.

Analysis

The primary cause of this accident is listed as *"Inadequate equipment"* because it appears that the victim was provided with an inadequate detector and handtools. The secondary cause is listed as a *"Management/control inadequacy"* because the provision of inappropriate equipment is a management responsibility.

The investigators recommended marking a prodder to show when a depth of ten centimetres had been achieved. They seem not to have realised that to achieve a depth of 10cm at 30º to the ground surface requires a penetration of 20cm - which in my experience is impossible on all but loose sand without exerting excessive force. Pushing the blade 10cm into the ground at 30º achieves a depth of only 5cm.

The injuries resulting from stepping on a PMA-3 vary from bruising to traumatic amputations. The picture above shows why this happens. It shows a cut-away section through a PMA-3. The 35g Tetryl is in the top and centre of the mine. The area of pressure-plate surrounding the HE is actually larger than the area of pressure-plate over it. If a victim is fortunate, they step on the pressure plate but the explosive charge is not beneath their foot.

Related papers

The Accident file included photographs of the site and the crater, and a crude sketch of the working area. It also contained a document stating that the regional MAC recommended only the Foerster MINEX 4, Guartel MD8, MineLab F1A4 and Vallon ML 1620B detectors.

Original BoI report

What follows is the original BoI report, edited for anonymity. There are striking similarities between it and the BoI report for the accident on 27th June 1998.

Original BoI report

What follows is the original BoI report, edited for anonymity.

REPORT OF BOARD OF INQUIRY INTO ACCIDENT 10 JULY 1998

18 July 1998

References:

Map WGS 84 2782-1 M709 Edition 9-DMA – Sarajevo.

RONCO SOPs dated 1 December 1997.

UN MAC Technical and Safety Standards Guidelines Dated 17 June 1998.

INTRODUCTION

1. As a result of a mine accident on 10 July 1998, a Board of Inquiry was convened by the Bosnia and Herzegovina Mine Action Centre to investigate the accident on behalf of the Government and in accordance with the national Technical Guidelines.

2. This is the second mine accident on the same site within two weeks. The accidents are not related but there are some similarities between the two.

3. The recommendations from the last accident report were accepted by [Demining group] senior management and are currently under consideration for implementation. MAC will seek confirmation of action taken as part of normal monitoring visits to [Demining group] sites during the near future.

4. The Board comprised:
   a. Chairman - BH MAC
   b. Member – United States State Department
   c. [Name excised] representing [Demining group] Corporation was present throughout the Board of Inquiry investigation and interviews at the task site.

5. A copy of the Board's Terms of Reference are attached at Annex A

6. [Demining group] staff members were helpful and cooperative throughout the course of the investigation. [The demining group was an international commercial company operating with a National commercial company.]

SEQUENCE, DOCUMENTATION AND PROCEDURES OF TASKING

7. [Demining group] were tasked by the PIU in accordance with the provisions of their contract and had been provided with information on known minefields in the area by BH MAC prior to the commencement of work. This Task was number 570.

GEOGRAPHY

8. The task site where [Demining group] were operating is a rectangular grassed area next to the Aleksa Santic children's school in Nedzarici, West Sarajevo.

9. The site is generally flat and grassed, with a line of trees on two sides, and occasional bushes throughout the area. The nearest buildings are on two sides of the area, approximately 20 metres and 200 metres away. The ground was hard and dry. A sketch plan of the site is shown at Annex B. Photographs of the site are shown at Annex D.

PRIORITY OF TASK

10. The site is next to the Aleksa Santic children's school and close to a residential area. Priority was set by the Federation PIU.

SITE LAYOUT AND MARKING

11. A plan of the site is attached at Annex B showing the areas of clearance. Marking in clearance lanes was adequate.

12. The team was split into three parties and worked in different sections of their allocated areas of the site. Each clearance lane was worked by one three-man team, working a work-rest-standby schedule of operations at half-hourly intervals.

13. The Control Point for the team was situated next to the children's playground at the school. The CP was not marked in accordance with [Demining group] SOPs. It was stated that this was because the team had cleared the area at the start of the task.

14. There was no marked Access Route from the Control Point to the clearance lanes. From the ground markings it was obvious that a single route was used between the Control Point and the Start Points.

15. Marking of the area between cleared and uncleared areas was by use of one-metre high red topped stakes. Red and white nylon cord was fixed between the stakes.

16. Points where mines had been discovered earlier were marked with one-metre high blue topped stakes.

SUPERVISION AND DISCIPLINE ON SITE

17. [Demining group] have seven teams working in this regional area. Managerial staff visit sites regularly and a supervisory structure as shown below assists in the maintenance of standards. These supervisors were either permanently stationed at the task site or visited the task site frequently, daily or every second day. The [Demining group] Regional Manager, [Name excised], last visited the site on the morning of the accident at approximately 0630hrs. The site was running normally at that time.

a. Sprind Regional Manager - Regular visits.

b. Operations Officer - Regular visits.

c. Deputy Operations Officer - Regular visits.

d. Team Leader - Permanently on site.

18. Operations Manager. [Name excised] [Demining group] Operations Manager also visited the site from time to time as part of his operational responsibilities.

19. PIU Representative. PIU monitors rotate between sites and teams on a monthly basis. Every task site has a PIU monitor deployed to it at all times when operations are in progress. The current Site Monitor was [name excised]. The PIU Site Monitor was not available for interview during the investigation and no report was received from PIU.

QUALITY ASSURANCE

20. Part of the Quality Assurance process is the presence at each site of Site Monitors employed by the Regional PIU, as stated above. The role of the Site Monitor is to ensure that the contractor carries out the work as agreed with the PIU, particularly with respect to working methods, safety and effectiveness.

COMMUNICATIONS

21. [Demining group] radio communications network is comprehensive and works well. Each team leader has a hand held VHF radio and is able to speak direct to all levels of Supervision including [Demining group] base at Sprind.

22. VHF radios are supplemented by vehicle-mounted HF radios. [Demining group] regional office is equipped with a base station and PTT telephones.

23. On this site the medic was responsible for radio communications to the [Demining group] Regional Office. The site radio log shows that on the morning of the accident the medic had confirmed communications at 0620hrs.

MEDICAL

24. Three medics were at the site at the time of the accident. Each was equipped with a comprehensive medical and trauma kit. One ambulance was at the site.

25. The Team medic, [name excised] responded to the scene of the accident from the Medical Aid Point at the Control Point, approximately 100 metres away. He had a full trauma medical kit and stretcher. After initial first aid the casualty was evacuated to the Kosovo General Hospital.

26. The injured deminer was [the victim]. Injuries were minor damage to [his] right foot. No serious or permanent injuries were sustained. The injured deminer was wearing stout working boots. It is the opinion of the board that these boots saved [the victim] from more serious injury and that the groin protection provided by his ballistic trousers saved further injury to the body.

27. Casualty Evacuation after the accident was reported as successful and efficient.

PERSONALITIES INVOLVED

28. Team involved in the accident was Team No. 1. This team comprised more members than is usual for a [Demining group] demining team. Extra deminers were deployed to the team because it was anticipated that most of the work involved would be manual clearance drills.
    a. Team Leader
    b. Deputy team Leader
    c. Medic
    d. No. 1 Deminer sustained injuries.
    e. No. 2 Deminer
    f. No. 3 Deminer
    g. Deminer
    h. Deminer
    i. Deminer
    j. Dog handlers
    k. Mine Detection Dogs

EQUIPMENT AND TOOLS

29. The injured deminer was carrying a small trowel. This was not a robust tool and was not efficient at removing turf from the area when digging.

30. A base-stick was in use in the clearance lane. The base-stick was cut short by approximately 15 centimetres and it was not marked with gradations to assist the deminer in gauging the distance required between prods.

31. The injured deminer was using garden hedge-cutting shears to cut the grass in the clearance lane.

32. Metal detector used by the team was a Schiebel AN-19/2. During an on-site test it appeared to function correctly. It remains normal practice in [Demining group] teams for the Team Leader to test the metal detector and carry the test piece, as stated in the report for the last accident.

33. Because the area is heavily contaminated with metal fragments and shrapnel, 100% metal-free clearance is currently considered as unreasonable or impractical. If the metal detector gives a signal, the area of the signal is prodded. If the deminer decides at this point that the signal is not a mine, the fragment or shrapnel piece is left and the operation moves forward. If it is decided that the signal could be a mine, normal excavation drills are carried out.

34. An informal on-site evaluation showed that the Schiebel would detect a PMA-3 fuze buried in the ground near the clearance lane at a depth of 6 centimetres.

35. The injured deminer was using a standard manual prodding tool. Team Leader states that, in this lane, normal prodding depth was to five or six centimetres.

DETAILS OF MINE INVOLVED

36. The mine involved was a PMA-3 Anti Personnel blast mine. This was confirmed by fragments around the crater, other mines found nearby and the size and shape of the crater. Photographs of the crater are shown at Annex E.

37. Blue-topped stakes were placed in the ground at the site, approximately 3 metres from the point of the accident, to show exact locations where five similar mines had been removed. These were all within an area approximately two metres long by one metre wide. Eighteen more mines had been found within ten metres of the point of the accident.

38. A total of more than fifty PMA-3 mines had been found at this task site. Most of these mines were surface-laid.

39. Deminers at the task site stated that the mine was buried so deep that the Schiebel metal detector in use could not locate it. The crater left after the explosion was symmetrical in shape and depth, commensurate with a conventionally laid mine at a depth of approximately 10 centimetres. Precise depth of this particular mine is difficult to assess because the ground on one side of the crater is approximately ten centimetres higher than ground on the other side.

40. A PROM-1 bounding fragmentation mine had also been found by [Demining group] on this area. A TMRP-6 Anti-Tank mine, fitted with a tilt-rod and a tripwire and laid on its side, was also found nearby, approximately ten metres from the point of the accident.

EVIDENCE OF RE-MINING

41. There was no evidence or suspicion of re-mining at any part of the task site.

DRESS & PERSONAL PROTECTIVE EQUIPMENT

42. Each member of the Demining Team was equipped with a helmet with a visor attached and a ballistic jacket. The injured deminer was wearing a helmet with visor, ballistic jacket and ballistic trousers at the time of the explosion.

43. Examination of these items of protective equipment showed approximately fifty superficial holes from blast damage. These were in the collar, groin and lower right and left leg areas. There were no perforations through the protective suit. Because the deminer was wearing full-protective trousers as part of his protective suit, his injuries were probably less than they would have been if he had been wearing only a “flap” style groin protector.

44. The injured deminer was wearing standard working boots. The right boot was damaged in the blast. The boots probably saved the deminer from further injuries.

45. Photographs of injured deminer’s Personal Protective Equipment are shown at Annex F.

USE OF DOGS

46. Because of the amount of mines known to be in the area, Mine Detecting Dogs are usually used at the site only first thing each morning, to check access lanes and last thing each afternoon, as a quality control measure. Dogs also remained at the site to check areas after they had been cleared manually by the deminers.

47. [Demining group] Regional Manager states that there were six dogs on the site at the time of the accident and these were available throughout every day at the site.

DETAILED ACCOUNT OF ACTIVITIES ON DAY OF ACCIDENT

48. The following account summarises the responses to questions by members of the Board, directed to members of the Supervisors, Team Leader and team members. Statements are shown at Annex C.

49. The team started work on the morning of the accident at the usual time of 0600hrs.

50. Demining operations progressed as normal throughout the morning before the accident.

51. At approximately 0645hrs, the then No. 1 deminer, [name excised], reported that he had discovered a PMA-3 mine in the clearance lane. The team leader dealt with this and at about 0700hrs [the victim] took over as the No. 1 deminer in the clearance lane.

52. Approximately five minutes into his shift [the victim] discovered a PMA-3 The team leader dealt with this and [the victim] then went back to work. A few minutes after this, [the victim] stepped on the mine that injured him.

53. Accident occurred at approximately 0715hrs.

54. [Demining group] Regional Manager reports that normal manual clearance operations on this site involved the following sequence:

    a. Metal detector sweep over top of high grass. Although this would not find any PMA mines, this was used in order to locate any PROM mines and any TMRP-6 anti-tank mines or tilt rods.

    b. Cut grass and vegetation using two-handed garden shears.

    c. Second metal detector sweep.

    d. Search with manual prodder over entire area. It was stated that this was because the metal detector would not always find buried PMA-3 mines.

55. Manual and visual searching throughout supported this procedure.

SUMMARY

56. The area where this accident occurred is very heavily contaminated with mines. Most mines on the area were laid on the surface, the main problem lies with buried PMA-3 mines and with the high level of fragments and shrapnel at the site. One accident has already occurred on the area. Schiebel metal detector in use at the site probably could not have located the mine involved in the accident. Evidence shows that the mine involved was probably laid conventionally. Injuries sustained by the one deminer involved were minor and a full recovery is expected.

CONCLUSIONS

57. Supervision and management procedures at the site were sufficient. Medical and safety coverage was in place and worked well. Drills and procedures should be reviewed. Tools used at the site could be improved.

58. The Schiebel AN19-2 metal detectors in use at the site are capable of finding PMA-3 mines in this area only at shallow depths, up to 6 centimetres deep. It is not certain whether the metal detectors used on this site were capable of finding the mine involved in this accident.

RECOMMENDATIONS

59. This area should be regarded as exceptionally high-risk. SOP drills and management supervision should be applied with utmost care and precision. Progress at the site should be anticipated as very slow.

60. Other types of metal detectors held as stock by [Demining group] should be trialled on the area to attempt to find a better performance than what the Schiebel currently provides. If this is successful, deminers should be encouraged to use the more appropriate detector.

61. **Note**. During the drafting of this report, [Demining group] have tested MD-8 and MINELAB metal detectors on the area. Comparisons have been made with the Schiebel detector in use at the time of the accident and this evaluation will be used by [Demining group] in the selection of metal detectors to be used in the future.

62. Improved, full-length base-sticks should be used. These should be marked with gradations at 2.5 centimetre intervals and 10 centimetres at the ends should be brightly coloured to show where lanes overlap.

63. 100% metal clearance should be aimed for in all areas where metal detectors are used. All signals given by the metal detector should be investigated.

64. Where necessary lanes should be sapped to provide a base from which to search for buried mines. Consideration should also be given to marking prodder blades to show depth of penetration into the ground.

65. Deminer No. 1 should be equipped with a better trowel or small shovel than is currently issued. The use of a strong-bladed bayonet or similar tool should also be considered to assist in excavation of areas of ground where metal detector signals are received.

66. Consider the use of dogs to check lanes as part of the changeover procedure between deminer shift changes.

67. Retraining should be carried out to confirm the following points.

- Manual prodding techniques.
- Procedures and use of metal detectors, including the confirmation of a second sweep over the clearance area in front of the base stick, after the grass has been cut.

68. In areas where the metal detector is ineffective, Prodding should be to a depth of 10 centimetres. Where this is not possible, and dogs or mechanical devices cannot be used, excavation is required.

69. After any accident at a demining site, the PIU monitor should always be available throughout the course of any investigation.

COMMENTS BY THE BOARD

70. All areas used by a demining team as administrative areas, rest places, control points etc. should be marked with pickets and tape, in accordance with page 16 of the National Technical Guidelines. This marking should be particularly applied to access lanes.

71. The use of two-handed shears for cutting vegetation should be discouraged. This should especially be the case in areas where mines with protruding fuzes or tripwires are suspected. The use of two-handed garden shears provides less control than smaller, one handed shears.

Consideration should be given to the use of metal detectors approved by MAC. MAC recommends only the following metal detectors.

Vallon ML1620B

Foerster MINEX 4

Guartel MD8

Minelab F1A4

72. As stated in the last accident report, every operator should be in possession of a test-piece for the metal detector. It should be the operator's responsibility to test his own detector at least every ten minutes.

Signed: Operations Coordinator, BH MAC, United States State department, Sarajevo

Annex A – Terms of Reference.
Annex B – Sketch map of site.
Annex C – Statements of team members.
Annex D – Photographs of site.
Annex E - Photographs of crater.
Annex F - Photographs of Personal Protective Equipment.

DISTRIBUTION
Senior Technical Adviser BH MAC
Director Federation MAC

[Demining group]
US State Department
Federation PIU