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# DDAS Accident Report

## Accident details

<b>Report date:</b> 08/07/2011	<b>Accident number:</b> 724
<b>Accident time:</b> 08:55	<b>Accident Date:</b> 21/12/2010
<b>Where it occurred:</b> MF 385, Kum Al Ruff Sabha 10, Mafraq, North Border Project	<b>Country:</b> Jordan
<b>Primary cause:</b> Victim inattention (?)	<b>Secondary cause:</b> Unavoidable (?)
<b>Class:</b> Handling accident	<b>Date of main report:</b> Not recorded
<b>ID original source:</b> None	<b>Name of source:</b> Demining group
<b>Organisation:</b> [Name removed]	
<b>Mine/device:</b> M-19 AT blast	<b>Ground condition:</b> dry/dusty hard
<b>Date record created:</b>	<b>Date last modified:</b> 08/07/2011
<b>No of victims:</b> 1	<b>No of documents:</b> 1

## Map details

<b>Longitude:</b>	<b>Latitude:</b>
<b>Alt. coord. system:</b> Not recorded	<b>Coordinates fixed by:</b>
<b>Map east:</b>	<b>Map north:</b>
<b>Map scale:</b>	<b>Map series:</b>
<b>Map edition:</b>	<b>Map sheet:</b>
<b>Map name:</b>	

## Accident Notes

no independent investigation available (?)

## Accident report

A study of a fatal accident in Jordan was made available by the demining group in April 2011. Received as a PDF file with many pictures, some of the formatting and pictures have been lost/removed as it was prepared for inclusion in the DDAS. The substance of the report is reproduced below, edited for anonymity.

Mine Accident Report

## Study and Analysis of the fatal AT accident

NBP — East Sector — Sabha 10 — MF 385

**Accident description:**

On 21 Dec 2011, the deminer [the Victim] started his work as usual in the assigned task for him to continue the clearance of the Mine Line (SML) which was laid as a cluster with one AT mine (M19) guarded by 3 APs M35 and after recovering and defusing one AT (19) and 2 APs (M35 / no defusing), the deminer started his work for the second period at 8:45 and he reported one signal to the team leader. The team leader left him to proceed with the proper procedures to recover and defuse the mine and at 8:55 hrs a big explosion was heard in the deminer working site, then the CASEVAC followed and the deminer reported to be dead due to the accident and the site closed for the investigation (see the attach 1 for the preliminary demining accident report).

**Working methodology in the site**

The work methodology used in the accident site is the manual method using the metal detector (Mine Lab F3) to indicate the suspected objects and the RAKE to investigate metal detector signal remotely from a 2.2m distance and based on the type of the laid mines in this site the AT mines (M19) have to be Render Safe Procedure (using the approved key pic1) according to the approved render safe procedures for this project (see the Attach 2) , and the AP mines have to be **moved to the mine collecting pit to be disposed** as stuck mines by the accredited burners.

**Collected evidence from the accident site**

- 1. All the tools approved for the deminers found in the site with no damage except:
  - a. The base stick (found broken into two pieces).
  - b. The M19 defuse key (found broken and damaged).



Light and heavy RAKE                      Base Stick                      M19 Defuse Key  
Recovered M19                      Recovered M35                      Demining Tools

2. The deminer's body and PPE were destroyed totally and found in an area around the explosion hole with about 150 m diameter :

- a. The deminer's left leg
- b. The deminer's right foot boot(damage)
- c. Pieces from the deminer's cover head and PPE

- d. Piece from the deminer's face mask
- e. Pieces from the deminer's PPE, uniform and t-shirt
- f. Pieces from the deminer's body

**Facts:**

1. The accident happened with M19 AT mine:
  - a. All the visible mines in the pattern (accident site) were M19 and M35
  - b. The deminer recovered in the first working hour one M19 and two M35s. The MF record (supported from REC) reported that the type of AT Mines in this pattern were M19 and M35
2. The accident happened during neutralization phase:
  - a. The metal detector didn't have any damage
  - b. The Light RAKE didn't have any damage
  - c. The Heavy RAKE didn't have any damage
  - d. The Grass cutter didn't have any damage
  - e. The rubber hammer didn't have any damage
  - f. The only missing tool was the M19 defuse key and part of it was found broken, bent, pressed and inflated about 25m to the west south of the explosion hole, and according to the SOP the deminer doesn't have to bring that tool from the tool bucket till he totally recovered and identified the mine.
3. The deminer's body were totally over the mine except his left leg which was totally touching the ground away from the mine to the north east side and the right foot which was on the ground close to the mine from the north west side.



**Possible scenarios:**

1. The deminer missed the mine and stepped on the pressure plate:
 

If this were the scenario then the deminer had to have with him the metal detector and both of his legs would have been vulnerable as they were not protected (but the metal detector, right boot and left leg found with no damage) and the statement of the team leader was that the deminer reported a signal of suspected M19 mine (based on MF record and type of buried mines).
2. The deminer activated the mine while he was trying to investigate a signal:
 

The investigation tools (Light RAKE, Heavy RAKE and Grass Cutter) were found in the area where the deminer has to keep them if they were not in use with no damage.
3. the mine was attached with an anti-handling device:
  - a. The REC (MF record) didn't report any anti-handling device.
  - b. About 21627 recovered M19 AT mine were recovered and no anti handling device reported

c. The SOP is to defuse the mine then keep the fuse in the fuse box in a safe area and return back the M19 Key, then if this scenario then at least the fuse, the M19 key or the pressure plate has to be found in the site.

4. The mine was activated while the deminer was applying the RSP (turning the mine from the Armed to Safe mode):

If this the scenario then the mine blast effect will push the deminer to one side and all the parts have to be found on the same side. However this is one of the possible scenarios and the trials will be shown later to clarify the probability of this scenario.

5. The deminer lost his balance while he was applying the RSP and then fell down on the mine and activated the mine:

This is the most probable scenario and the trial will be shown later to clarify the probability of this scenario.

### **Trials:**

Three trials were made to analyze assumptions 3 and 4:

#### **Trial 1:**

1. Purpose: trial was made to discuss the 4th assumption that the mine went off while the deminer was trying to turn the arming key to the safe mode using the designed M19 defuse key The detonation could have been due to friction caused from:

- a. Manufacturing mistake that the mine trigger pin was pressing on the fuse and when the deminer turned the arming key, the friction would initiate the fuse.
- b. The mine pressure plate was under pressure from an external force, and the trigger pin hit the fuse but the mine didn't activate and when the deminer tried to turn the arming key to the safe mode the friction caused the fuse to initiate.

2. Preparations: 5 M19 pressure plates and 5 M19 Fuses collected from the MFs where the accident happened were used in the trial. The fuses were as follow:

- a. One of the fuses found had already been hit by the trigger pin and the edge broken while the deminer tried to change the arming plate to the safe mode
- b. One of the fuses affected by the erosion and covered with yellow spots
- c. The three remaining fuses were not affected and looked like new

3. Trial procedures:

- a. four fuses out of five included (a and b) were mounted onto a pressed pressure plate while on the safe mode (the trigger pin pressed down) then the arming plate changed repeatedly between the Safe and Arm mode, resulting in breaking the edge of the fuse. No fuse detonated as a result of this trial.
- b. The four fuses from (3.a) were scratched remotely using a nail attached to RAKE handle with 2.2 m length and the result that all the fuses filling was disturbed and came out of the fuse without detonating any of them.
- c. Two fuses out from (3.b) were hit remotely using the long RAKE handle with a nail at the end and one of them detonated. The fourth was mounted on the pressure plate and pressed but did not detonate (the sensitive filling was deteriorated due to the hard scratching).

**4. Result :** the result shows that not one of the fuses detonated or high ordered due to friction.

**Trial 2:**

1. Purpose: trial was made to discuss the 5th assumption that the mine went off because the deminer lost his balance while he was trying to RSP the mine then hit the mine with his right knee and activated the mine:

2. Preparations: 5 M19 pressure plates and 5 M19 Fuses collected from the MF's where the accident happened to use them with the trial :

3. Trial procedures: The pressure plate was buried in the ground to simulate the real M19 laid in the MF then the following trials were made :

a. The pressure plate(fused) pressed with the max weight can been applied by the deminer while trying to RSP the mine , but the mine have not been activated , then a weight scale used to scale the pressure applied by the deminer in this case and found to be not more than 50 Kg.

b. The pressure plate covered with PPE (as an absorbance material between the mine and the outer effect) then the deminer simulated a fall on the pressure plate with the right knee(the pressure gauged with 70 Kg), but the mine was not been activated. Then the same pressure plate was stepped on by a deminer(80 Kg) and still it was not activated. The third time the same pressure plate was stepped on with the same deminer but applying more pressure by gently jumping (the pressure gauged with 90 Kg) and the fuse went off.

c. The pressure plate was prepared for the trial without fuse and not covered with any barrier between the deminer knee and the pressure plate. The deminer simulated a fall on the pressure plate with the right knee (the pressure gauged with 100 Kg) and the pressure plate was pressed down which meant that the mine would have been activated. The same trial was repeated for the second time and it gave the same result.

**3. Result:** the result shows that the mine can be activated by a sudden fall on the mine pressure plate with a sharp point of the body like the knee. The velocity created (speed and weight) will activate the fuse.

**Conclusions:**

1. The procedures of locating, recovering and disposing the mine can't be considered as a reason for this accident :

a. The deminer recovered one M19 and two M35 the same day using the same procedures and also he has been working in the NPA NBP for 3 years with no disciplinary actions ever taken against him.

b. More than 12800 AT M19 were recovered, RSP disposed in NPA NBP with the same procedures and no accident or incident reported from this type of mines.

c. The procedures reevaluated after the accident and found to be safe.

2. The tools used for indicating, investigating the signal, and using for RSP can't be consider as a reason for the accident:

a. The metal detector was used by the same deminer on the same day of the accident and he indicated 2 M35 and one M19 with the same MD that day.

b. The deminer reported the signal of the M19 to the team leader prior to the accident.

- c. All the tools issued for the deminer were found without any damage except for the defuse key.
- d. The same tools were used from the beginning of the NPA NBP and no accident has been caused with a similar device.
- e. The trials showed that the M19 defuse key was not the reason of the accident.

3. From analyzing the accident scenery, evidences collected from the accident site, statements collected from the team member, review of the NPA NBP SOP, the trials mentioned above, and the panorama picture for the accident site, it can be concluded that the accident happened as a result of a direct pressure equal to the needed pressure to activate the mine applied on the mine from the deminer himself when he lost his balance while he was trying to change the arming plate to the safe mode using the approved device. Hitting the pressure plate hard with a relatively sharp point like the knee gives enough combined velocity in one single point of the pressure plate to initiate it and subsequently detonate the M19.

**Recommendations**

To continue with the same procedures using the same tools and apply the following changing for the render safe Procedures (RSP)

- 1. for the M19 remove the pressure plate directly without trying to move the arming lever from the Armed mode to the Safe mode even if the trials showed that the fuses have not been activated by the friction. This precaution has to be considered and that's mentioned already on the current approved SOPs.
- 2. When apply the RSP for any type of mines the deminer have to get in a stable position with both knees on the ground (see the pic)



Old Position



New Proposed Position

Investigation Committee: Signed, undated.

**Attachment 1 (preliminary accident report)**

Preliminary Demining Incident Report

From: [Demining group] 21 Dec 2010, 03 : 20 hrs

To: National Committee for Demining & Rehabilitation, Amman, Jordan

[Demining group], North Border Project (NBP), Manual Team ( Juliet )

Mafraq , Sabha , Kum Al Ruff ,MF ID Sabha 10 ( 385 )

Date and time of incident: 21 Dec 2010 08:55 hrs

Name of the injured: [Name removed]

Names or casualty identification numbers (CIN) [Removed]

Description of injuries: Death.

Treatment given: NA

Current condition of casualty (ies): Dead

Time of accident: 08 : 55 hrs

Time of arrival at the section medical point: NA

List equipment/facilities/infrastructure damaged: PPE, Visor and Mine boot

Describe how the incident occurred: The Deminer during disarming M19 AT mine, with approved wrench, the AT mine blasted accidentally

Device type (if known): Anti Tank (AT) M19

## **Attach 2 (M19 RSP)**

M19: Anti-Tank blast mine (9.5kg Comp. B - RDX/TNT)

This mine may be rendered safe by suitably trained deminers BUT if the mine is not in good condition, the deminer should mark the mine's position and call the TL.

[Picture removed]

The mine above is one found in the NBP minefields.

To render the mine safe to move for destruction, the following sequence should be followed. Turn the arming lever so that the lever moves from pointing at "A" (armed) to "S" (safe). If the lever cannot be moved, either destroy in-situ or move to the fuzed mine Collection Area and mark with a red flag.

[Picture removed]

The mine on the left is "A"rmed. The mine on the right is "S"afe.

2) Turn the fuze assembly anti-clockwise by hand or with an approved tool. Lift the fuze. If the fuze cannot be removed, the mine has been neutralised, but not disarmed. Move the mine to the fuzed mine Collection Area.

[Picture removed]

3) Unscrew the detonator assembly from the bottom of the fuze. If the detonator assembly cannot be removed, do NOT use excessive force. The picture below right shows the detonator removed from the underside of the fuze.

Whether or not the detonator assembly has been separated from the fuze body, the mine body and the fuze assembly have been separated. Move the disarmed mine and the fuze/detonator separately to the designated mine and fuze Collection Areas.

NOTE: The size of this mine means that other mines within a six metre radius may be detonated sympathetically if it is destroyed in-situ.

NOTE: The small copper-cased detonator and stainless steel firing -pin are the only metal components in this mine. This may make it very difficult to detect with a metal-detector.

## Victim Report

<b>Victim number:</b> 915	<b>Name:</b> [Name removed]
<b>Age:</b>	<b>Gender:</b> Male
<b>Status:</b> deminer	<b>Fit for work:</b> DECEASED
<b>Compensation:</b> Not made available	<b>Time to hospital:</b> Not made available
<b>Protection issued:</b> blast boots; Frontal apron; Mask Visor	<b>Protection used:</b> Frontal apron; Mask visor; Blast boots

### Summary of injuries:

FATAL

COMMENT: No Medical report was made available. Complete destruction of head and body: one leg surviving intact.

## Analysis

The primary cause of this accident is listed as *Victim Inattention* because the investigators concluded that the most likely explanation was that he accidentally applied high pressure on the mine with his knee while disarming it. The operating pressure listed in Janes Mines and Mine Clearance is 118-226kg which is more than they managed to apply during their tests, so making their conclusion less than 100% convincing, (but the listed operating pressure in Janes is only a manufacturer's claim and the mine was old). The secondary cause is listed as *Unavoidable* because it is possible that the Victim was working as directed when the accident occurred.

The injuries sustained by the Victim, with total destruction of head, body, PPE, both arms and one leg reinforce the investigator's view that he may have fallen forward landing on the mine with one knee, while both hands were holding the disarming tool directly above the mine. The spread of parts in a 360 degree circle around the point of detonation seem to confirm this position, but do not help determine why the mine detonated when it did.

The only person to see the mine before the accident was the Victim, so it is not known whether the mine was damaged or "different" in some way. Age or damage could have made it more sensitive to pressure, or it may have been badly made, poorly assembled, etc.

Also, it cannot be known whether the Victim was moving the mine from "Armed" to "Safe" or unscrewing the pressure plate (both are done using the same tool) at the time. If he had been unable to rotate the switch from Armed to Safe and still unscrewed the pressure plate, this would have been a breach of the Render Safe Procedure (RSP) approved in the demining group's SOP. Nonetheless, he might have been doing this and it is what has subsequently been implemented as a revision to the approved RSP.

With more than 30,000 M19s neutralized and disarmed using the old RSP in Jordan without any accident it is not certain that any change to the RSP (beyond ensuring that the deminer was stable when conducting the procedure) was necessary. The original RSP can be seen on page 49, Chapter 10, of the Demining Handbook:

[http://www.nolandmines.com/Generic\\_SOPs/V2.0%20Generic%20SOPs%20Chap%2010%20Destroying%20Mines%20and%20ERW.pdf](http://www.nolandmines.com/Generic_SOPs/V2.0%20Generic%20SOPs%20Chap%2010%20Destroying%20Mines%20and%20ERW.pdf)

The revised SOP advises the deminer to unscrew the pressure plate first, then move the switch from Armed to Safe. If it were not necessary to apply downward pressure to unscrew the pressure plate, the revision would not concern me. This revision appears to be the result of a need to change something to increase confidence rather than the result of evidence that the change would see an improvement in safety. But I personally wrote the RSP that was used in this accident, so I have “an interest”. I do not anticipate that unscrewing the pressure plate before turning the switch will lead to further accidents, but would still prefer to turn the switch to Safe first, whenever it moves easily.

One scenario that was not considered was the possibility that the Victim was kneeling on one knee with his foot beside the mine with the disarming key in his hands when he stepped on an AP mine that was alongside the AT mine. The large M19 is known to be sensitive to sympathetic detonation and it is possible that this occurred. The picture of the deminer’s right boot included in the report does not show the sole, so does not help assess this suggestion. The top front of the boot has been torn away, so confirming that the foot was likely to have been beside the large AT mine. A picture of that boot has been requested.