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DDAS Accident Report

Accident details

Report date: 08/04/2019	Accident number: 814
Accident time: 11:40	Accident Date: 25/09/2017
Where it occurred: Sarichashma MF-10, Shamsiddin Shohin district, TAB, Khatlon Province	Country: Tajikistan
Primary cause: Victim inattention (?)	Secondary cause: Field control inadequacy (?)
Class: Excavation accident	Date of main report: 29/09/2017
ID original source: MAR #1/17	Name of source: [Name removed]
Organisation: [Name removed]	Ground condition: hard; metal fragments; rocks/stones; steep slope
Mine/device: PFM-1 AP blast	Date last modified: 08/04/2019
Date record created:	No of documents: 2
No of victims: 1	

Map details

Longitude: 60° 57' 42" E	Latitude: 37° 34' 02" N
Alt. coord. system: WGS 84	Coordinates fixed by: GPS
Map east: 069° 57' 42.2" E	Map north: 037° 34' 02.9" N
Map scale: Dzhilga	Map series: Series 1984
Map edition: General Staff	Map sheet:
Map name: 1:50000	

Accident Notes

squatting/kneeling to excavate (?)
visor not worn or worn raised (?)
incomplete detonation (?)

Accident report

The report of this accident was made available by the demining group involved in August 2018. Some of the original 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.

Administrative decision of forming the Board of Investigation (BOI)

On 25th of September 2017 [Demining organisation], the HDP Tajikistan Country Director established an internal Board of Investigation consisting of [name removed], Operations Manager (OM), [name removed] Technical Field Manager (TFM), and [name removed], Operations Officer (OO). The Board is tasked to collect information from the accident site,

chain of events at the site, reconstruct actions which caused the accident, make conclusions, and to give a recommendation based on these findings.

On 26th Of September 2017 starting at 10H45 the [Demining organisation] internal investigation team, accompanied with external investigators from TNMAC arrived at the task area "Sarichashma MF-10" and commenced with an internal investigation. Reconstruction of the events at the task on the day of the accident is conducted based on the statements of the team staff present at the task: Task Supervisor (TS), Team Leader (TL), 7 deminers who were in close proximity from the place of accident, paramedic, and ambulance driver involved. The internal investigation team conducted detailed reconstruction at the field within the task area, and place of the accident.

Board of Investigation members are as follows:

[name removed], OM [Demining organisation] HD Tajikistan
[name removed], TFM [Demining organisation] HD Tajikistan
[name removed], OO [Demining organisation] HD Tajikistan

External investigation board members are as follows:

[name removed], QA/QC Officer TNMAC [Tajikistan National Mine Action Centre]
[name removed], QA/QC Officer TNMAC

Introduction

The accident occurred in one of the remote Mine Field (MF) tasks (HZTJ-335-MM10) located in TAB region of Tajikistan, Shamsiddin Shohin district: 30 km from nearest hospital, 60 min of driving by narrow and bad condition restricted border zone road, and was caused due to hand excavation tool (demining trowel) penetration into the liquid explosive container of an AP blast mine type PFM-1. Penetration, fortunately, did not provoke any detonation, but resulted in rupturing the plastic mine casing and spraying of the liquid explosive charge contents into the eyes, mouth and facial area of the deminer operating the demining tool.



On the day of the accident, Multi-Tasking Team (MTT) -2 accompanied by previously deployed MTT-5 started with Land Release operations at minefield Sarichashma MF-10,

supervised by Task Supervisor (TS) [name removed] and acting Team Leader (TL) [name removed]. The acting TL is a [Demining organisation] TS who was acting as a TL in the week 25th -29th of September, of MTT-2, due to the absence of the permanent TL of MTT-2 [name removed] who is participating in the OSCE/USARCENT EOD L3+ training in Dushanbe.

Teams arrived at the Control Point at 07H15 and received a complete brief of the task, NTS report, MF records, progress and findings up to date, MEDEVAC procedure etc. Working routine of 50 minutes of work with 10 minutes of rest was applied throughout the day's work period.

At 11H40 injured deminer [the Victim] requested help from her nearest deminer colleague as her eyes were closed due to pain caused by the spraying of some liquid over her face. Initially, her calls for help were not heard but after 3 calls the closest deminer [name removed] responded and approached her to help. She immediately helped [the Victim] to wash her eyes and face with water and the TS also attended and physically assisted in escorting them by foot to the Medical Point. Initial treatment was conducted by [Demining organisation] Field Paramedic [name removed] and MEDEVAC drill toward Sarichashma hospital started. During the MEDEVAC, the injured deminer ceased breathing once and went into cardiac arrest twice and was recovered by the Field Paramedic.

Upon arrival at Sarichashma hospital at 12H50 emergency treatment was continued by an on duty doctor. After a couple of hours the injured deminer's condition became stable, and her vision recovered. Due to the serious case of poisoning sustained a final decision was made by the [Demining organisation] CD and OM based on the recommendations of the [Demining organisation] Senior Paramedic [name removed], to arrange the transfer of injured to the Dushanbe main hospital to ensure that all necessary medical tests will be conducted further. The injured deminer [name removed] following the treating physician's prescribed period of observation in hospital was discharged on the afternoon of Friday the 29th September in good health and fully recovered, however upon further recommendation of the [Demining organisation] Senior Paramedic and CD she is currently being allowed to rest at her home and have further health checks before returning to active duty in the next work shift.

History of the minefield and terrain of the land

Minefield Sarichashma MF-10 is relatively remote, 30 km from Sarichashma village and 65 km from Kulyob City, and located inside the Tajik Afghan border (TAB) restricted area.

A chain of minefields was set up by the Russian army next to the Panj River banks as well as in several valleys leading down to the lowland area of the border zone in the early 90's. The mines were laid, including several PFM-1 mine strikes [helicopter delivered], to protect strategic border installations and advantageous hill height positions from Afghan paramilitary forces. Sarichashma border is part of this area and is contaminated with Russian types of different AP mines such as PMN, PMN-2, POMZ-2M, OZM72, POM-2s, MON-50 and PFM-1.

Task TNMAC ID HZTJ-335-MM10 was linked to the minefield record #117/11/10 created on 12th of June 1994, with a total of 1728 pieces of PFM-1 AP mine, and 13 pieces of MON-50 AP mine equipped with self-destruct system MVE-NS up to 90 days. NTS size of the task provided by TNMAC is 65,000 m2.

Minefield MF-10 is covering the top of the hill as well as access valley footpaths on the north side approximately 200-300 metres from the Panj River. [Demining organisation] have noted mine migration due to the seasonal mountain water run-off movement through a valley located at 90 degrees to the Panj River, and this was also the place of the accident.

The task is mixed flat and slope area with seasonal water run-off lines and channels. Vegetation is dense grassland however the vegetation here is not considered as a major obstacle or interference to operations. The ground on the slopes is dry and hard to excavate interspaced and mixed with rocks and stones.

Two manual demining teams were working on the task at moment of the accident. The operational progress of the task so far is as follows:

- Start date of operations: 21st of August 2017
- Cleared by detector MineLab F3S up to date of accident: 2489 m2
- Internal QC up to date of accident: 700 m2
- Items discovered and destroyed up to date of accident: 21 x PFM-1

The accident occurred near the top of a slope where the slope had panned out to a small elevated level section of area and the working surface was mixed with rocks and stones.

The weather during 25th of September 2017 was clear and sunny with a temperature of about 30 degrees Celsius.

[Map removed]

Task ID: HZTJ-335-MM10. From CP to Sarichashma 30 km northwards From CP to Kulyob 65 km northwards. The accident occurred at the task, 30cm outside of cleared and marked area during excavation drill. GPS coordinates of PFM-1 AP mine which caused the accident remains is as follows: 069° 57' 42.2" E: 037° 34' 02.9" N.

Time and date of the accident

Accident occurred at 11:40 am on Monday, 25th of September 2017.

Casualty Background

Name: [Name removed]; Internal Victim ID: #72271; Age: 34; DoB and Sex: August 22th 1983, Female; Job Title: Deminer.

History of Employment: Deminer; April, 2014 – present date

Previously disciplinary action against him/her: None (with the exception of verbal warning on the day of the accident).

Compensation: All medical expenses covered, no disability required.

Protection issued: ROFI Open back body armour, and ROFI ballistic Facemask

Protection used: Open back body armour, Facemask not installed properly.

Personnel present at time of accident

During the accident, the whole Multi-Tasking Team (MTT-2) was present in the minefield. Below are the employee positions and names of staff present during the accident: [Names removed: TS, TL, 8 x deminers]. Control Point: [names removed] Team Medic, Ambulance Driver, Driver.

Actions Leading to the Accident

Accident occurred by unintentionally penetrating into the liquid explosive container of a PFM-1 AP blast mine with a demining trowel (excavation tool), which resulted in the highly toxic liquid

contents spraying upwards into the deminer's eyes and mouth and front face area. During mentioned event deminer's protective facemask was not installed properly which left her face unprotected. Prior to the accident and at the accident location the deminer found remnants of a damaged PFM-1 mine which possibly lead her to continue excavation with less attention and care than required for safe excavation. From the physical evidence at the scene it was apparent that the excavation tool had entered from the top and down into the mine body (the part which contains liquid explosive). The tool blade appears to have glanced off a stone³ while excavating (apparent by scrape marks) allowing enough force and direction to penetrate the mine casing before the deminer could react and created a condition for the liquid explosive under probable pressure to spray out. As the deminer did not have her facemask installed properly, it was sprayed into her face entering her eyes and mouth. As the liquid explosive in the PFM mine is highly toxic, after coming into direct contact with her eyes and mouth it entered her blood stream and affected her vital signs after a short time. The liquid temporarily blinded her, caused a burning sensation on her face and poisoned her resulting in anaphylactic and cardiogenic shock (referred to as only 'toxic shock' as per local medical diagnosis from the Sarichashma and Dushanbe hospital reports). The resultant shock caused her breathing to cease after approximately 10-15 minutes, and for her to then suffer two cardiac arrests during MEDEVAC procedure.

In addition, to emphasise that prior to the accident and during the same work shift that day, the deminer was verbally warned by the TL for not obeying safety procedures in having her facemask not properly installed during Metal Detector drill.

Also, it is important to note that NO DETONATION occurred during this accident. All injuries to the deminer were caused due to poisoning from the highly toxic liquid explosive VS-60D that constitutes the main explosive charge of the PFM-1 mine.

Procedures used (reference to the SOP)

[Demining organisation] HD Program Tajikistan SOP, Chapter 7: Manual demining procedures.

Personal Protective Equipment

Casualty was found to be wearing her Rofi type PPE Body armour /open back model correctly at the time of the accident. Team medic and deminers assisting in providing first aid confirmed that all belts were fixed and fastened properly. Signs of liquid explosive was not noted or found on PPE body armour during the BOI.

Facemask Rofi type was installed in upright [raised] position. No visible sign of liquid explosives was found on the mask during the BOI.

Monitoring process during Land Release operation prior to accident

Internal QA/QC by TS [name removed].

Date 22.08.2017; No negative comments

Date 24.08.2017; No negative comments

Date 14.09.2017; Few untreated signal was found in two deminer working positions, the area of MTT-5 deployment and deminers are ordered to the re-clear area. Disciplinary actions are recommended.

Date 15.09.2017; No negative comments/recommendation for TL to conduct QC inside cleared progress on a daily basis

Date 16.09.2017; No negative comments

Date 18.09.2017; No negative comments

Date 19.09.2017; No negative comments

Date 20.09.2017; No negative comments

Date 21.09.2017; No negative comments / remind deminers and TL to apply maximum attention during excavation

Date 22.09.2017; No negative comments

Date 23.09.2017; No negative comments

External QA/QC by TNMAC

Date 31.08.2017

No mistakes and no negative comments

Recommendations: TL to conduct more practice of visitor briefing together with [Demining organisation] TS.

Metal Detector signal investigation to be conducted according to [Demining organisation] SOP. Recommendation for additional training of signal excavation. - Training conducted on 12th and 13th of September 2017.

MEDEVAC process

MEDEVAC map for minefield was developed and prepared jointly with Field Paramedic [name removed], Senior Paramedic (SP), and TS on 21st of August 2017. Distance and time to a hospital in accordance with the approved MEDEVAC plan is as follows: 30 km, estimated duration 60 minutes.

Casualty was delivered to a medical point within 05 minutes after the accident occurred.

Medic assessed the casualty, assured that the injured was conscious, and provided immediate first aid as follows:

1. Washing of both eyes, face and mouth with 0.9% NaCl solution, frequent instillation of eyes with Novocain 0.5% solution and 20% Albucide solution, IV solution of Atropine 1mg-1.0, Dexamethasone solution 4mg-1.0, in / m solution of Diazepam 10mg-2.0. A/D 70/50 of mm Hg, thread pulse. By 11H48 casualty had been fixed by belts on a stretcher, carried to and placed into [Demining organisation] ambulance which then departed for the Hospital in Sarichashma.
2. At 11H50, during the transportation the arterial pressure (A / D) is 50/30 mm Hg, the pulse is threadlike, the body temperature is lower, the respiratory rate is disrupted, abnormal superficial breathing, the rehydration of the muscles, and then convulsions and cardiac arrest begin. Measures taken: Adrenaline solution 2.0 in / in, CPR-indirect cardiac massage, O-2 (oxygen) supply with Ambo bag, for one minute. After that, the work of the heart restored. A / D 50 / 40-mm. r.st. Pulse 40 beats per minute. Respiratory rate 12.

3. At 12H05 the hemodynamic changed again, the A/D decreased, the pulse disappeared. The measures taken at point 2 were repeated, after which hemodynamic restored. Infusion therapy with Ringer's solution was connected. A / D 80 / 50mm Hg, pulse 52 beats per minute, BH 16.

For maintenance of frequency of respiration carried out artificial ventilation of the lungs by Ambu bag until arrival in the Sarichashma community Hospital at 12H50.

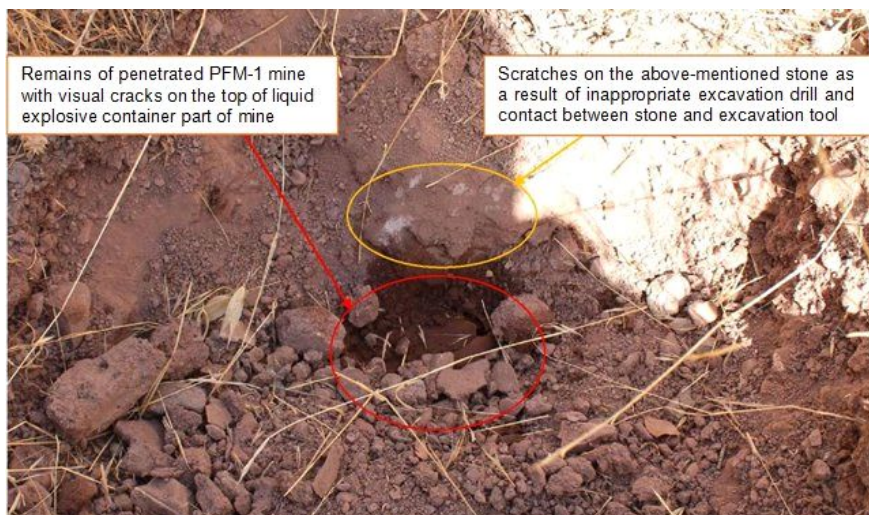
While on route to the hospital in the ambulance, the [Demining organisation] Paramedic continuously monitored vital signs of the injured.

Due to poisoning with highly toxic substances, from which the liquid explosive is composed, the [Demining organisation] Paramedic concluded that the deminer suffered anaphylactic and cardiogenic shock (referred to as only 'toxic shock' as per local medical diagnosis from the Sarichashma and Dushanbe hospital reports), resulting in one incidence of ceased breathing and two cardiac arrests, and was revived by the field paramedic during MEDEVAC to the Sarichashma hospital using heart massage drill, Ambu bag ventilation and administering of relevant emergency medication (adrenalin, atropine etc. as explained in the details of section above).

After 68 minutes following the first MEDEVAC radio call, the ambulance arrived at the hospital and handed over the injured deminer to local doctors. The [Demining organisation] paramedic, later accompanied by the [Demining organisation] Senior Paramedic continued to observe the injured deminer who declared personally that feel much better a couple of hours later. On the morning of the 26th of September the deminer was transferred to the Dushanbe main hospital for further examination and treatment.

Collected evidence from the accident site

As detonation did not occur, there is no crater or other similar remaining signs of an accident. Remains of the PFM-1 mine are still at the accident location and approximately 30 cm from the base stick.



An additional fragment/ remnant of PFM-1 mine was found during the investigation above the penetrated mine, leading the board to believe that there was a fragment/ remnant of one PFM-1 found before the PFM-1 mine which caused the accident. It is assumed that the deminer may have believed that there is no risk as she had found just a fragment and therefore excavated less cautiously.



Her rubberised working gloves were found next to the base stick with stain signs of what could be the results of liquid explosive spraying onto them.

Other equipment was collected and removed by the TS/TL after the MEDEVAC as they did not realise at that stage the serious nature of the accident and did not recognize it as one, due to the fact that no detonation had occurred.

Chain of events

05H00 Team woke up at camp in Sarichashma FB, morning routine.

06H00 Departure from camp to the task.

07H15 Arrival of team to control point. Loading off and preparing of equipment.

07H20 Daily task and safety briefing by TS and TL and Field Paramedic.

07H30 Start of operations in the task.

07H50 First rest 10 minutes break of daily routine announced by TL.

08H00 Second working hour in the field.

08H50 TL announced second regular break to the team.

09H00 Third working hour in the field.

09H50 TL announced third regular break to the team.

10H00 Fourth working hour in the field.

10H50 TL announced fourth regular break to the team.

11H00 Fifth working hour in the field.

11H40 Accident occurred/ Injured deminer requests for help from closest deminer.

11H42 Initial request for Paramedic help was issued.

11H45 Casualty reached CP with TS assistance and Paramedic start treatment.

11H48 Team medic finished providing first aid to casualty who had been strapped in a stretcher and loaded into [Demining organisation] ambulance.

11H48 [Demining organisation] ambulance departed toward Sarichashma hospital.

11H55 During the transportation the arterial pressure (A / D) is 50/30 mm Hg, the pulse is threadlike, the body temperature is lower, the respiratory rate is disrupted, abnormal superficial breathing, the rehydration of the muscles, and then convulsions and (point 2)

cardiac arrest begin. Measures taken: Adrenaline solution 2.0 in / in, CPR-indirect cardiac massage, O-2 (oxygen) supply with Ambo bag, for one minute. After that, the work of the heart restored. A / D 50 / 40-mm. r.st. Pulse 40 beats per minute. Respiratory rate 12.

12H05 The hemodynamic changed again, the A/D decreased, the pulse disappeared. The measures taken at point 2 repeated, after which hemodynamic restored. Infusion therapy with Ringer's solution was connected. A / D 80 / 50mm Hg, pulse 52 beats per minute, BH 16.

12H06 For maintenance of frequency of respiration carried out artificial ventilation of the lungs Ambu bag when required before arrival in hospital.

12H50 Casualty arrived at the Sarichashma hospital and was admitted to the emergency unit.

Accident investigation

Investigation of the accident was conducted the day after the accident occurred, on 26th of September 2017.

First, upon arrival to control point OM, TFM, and CD as well as TNMAC QA/QC officers and field staff presented in the field, were briefed by TS about the accident. Additional observer [name removed], GICHD Consultant on an NTS Country Study of Tajikistan and also a former Swiss Army EOD Technician, was accompanying the TNMAC QA/QC Team at the time and was therefore also invited by the BOI to observe on the investigation.

TS briefed WHOM. WHEN. HOW. Explanation of position and actions of each team member during and after the accident.

Team members were asked at the control point to submit own written statements about the accident. Investigation on site included exploring of the location, collecting evidence at the place of accident and coordinates of the position of all staff relevant to the case.

External TNMAC investigation team also was present on site to conduct an official investigation in presence of [Demining organisation] CD, OM, and TFM. After initial brief the joint investigation team proceeded to the place of the accident. Task staff were also interviewed by TNMAC on site, and appropriately written statements were submitted.

Photographs of all evidence were taken.

Conclusion

Accident occurred by human error of the victim. Casualty breached two crucial [Demining organisation] SOP safety procedures:

1. Violation of [Demining organisation] SOP Manual demining procedure by conducting incorrect excavation drill (SOP Chapter 5. Manual demining procedures).
2. Violation of [Demining organisation] safety procedures, PPE, Rofi Facemask was not installed properly during the time of manual excavation [Demining organisation] SOP Chapter 2. Safety).

Deminer was warned by TL about not installing facemask properly, approx. 2 hours prior to the accident during performance of Metal Detector drill.

Additional observations and assumptions:

Prior to the accident, the deminer found a fragment of PFM-1 AP blast mine which may have led her to believe that the indication which the metal detector gave her, belonged to other

remains of the same mine. Unfortunately, another PFM-1 mine was under the mentioned fragments. Due to the above mentioned, she started excavation with less attention than required for safe excavation performance and because of the inappropriate drill, hit the rock above the mine covered by a thin layer of soil. Excavation tool glanced off the rock and penetrated into the top of the PFM-1 mine liquid explosive container. Due to the applied force and possibly increased pressure inside the explosive container on the liquid explosive (due to heat it is also possible that at the moment of accident the liquid explosive was turned into a gaseous state) spraying over the deminer's eyes, nose, and mouth.

[Demining organisation] HO Chief Technical Advisor (CTA) has raised some concern regarding the initial diagnosis and order of treatment administered to the injured deminer by the attending Paramedic, and this is to be further reviewed by him during an already scheduled CTA visit to the programme from the 14th – 21st October 2017, and will be followed-up accordingly with strengthened medical SOPs and training where, and if, required.

Additional notes to raise awareness from the accident:

The PFM-1 is a Soviet anti-infantry 'scatterable cluster' landmine, known as a butterfly mine (NATO name: Green Parrot). It is very similar to the BLU-43 US Army landmine. Both devices are alike in shape and principles, although they use different explosive. PFM-1 AP blast mine weighs 75g and contains 37g of VS6-D or VS60D liquid explosive. Its body contains liquid explosive and is made from low-density polythene.

Despite the fact that we know that all explosives are generally toxic in some way or another, VS60D liquid explosive (1,5-dichloro-3,3-dimethoxy-2,2,4,4- tetranitropentane) in PFM-1 mines, is highly toxic and produces cyanides, dioxins, furans, phosgene, biphenyls, lead oxide and aluminium oxide. It residues, at levels 1800–2000 times higher than the European Economic Community maximum permissible level, and in this accident, casualty contact with it was almost lethal. Only the quick reaction of the [Demining organisation] Field Paramedic prevented this accident from being fatal.

The accident is a phenomenon not experienced before in Tajikistan, or by TNMAC, [Demining organisation] or any other operators after having removed and destroyed literally thousands of this type of AP mine without any recorded, or known such similar incident. It has been seriously noted that even without any detonation having occurred, this Mine Accident could have ended fatally due to direct exposure with the liquid explosive and it's toxic poisoning. Additional notes will be incorporated into [Demining organisation] SOP revision raising awareness and precautionary measures when dealing with PFM-1 AP mines. [Demining organisation] Senior Paramedic will be consulted on this matter. Initial additional precautionary measures have been implemented immediately.

Mitigating circumstances:

Investigation showed that aside from the violation of SOP there are also some mitigating circumstances as follows:

1. Field conditions inside area of operation are very difficult. The terrain is on very sloped surface with a high density of metal indications, the ground is dry and hard to excavate interspaced and mixed with rocks and stones.
2. During one of the rest breaks, deminer had a verbal conflict with a colleague which possibly disrupted her attention and made her less concentrated on her work task.

Recommendations

- Remind, and increase field staff knowledge of safety procedures and respect of Manual demining drill accordance with SOP (chapter #2: Safety; and chapter #5: Manual demining procedures);
- Increase supervision by field management over deminers work in the minefield up to the highest possible level.
- Refresher training on demining procedures with the teams, to be conducted with a focus on SAFETY and MANUAL DEMINING PROCEDURES.
- Practical testing of all deminers to be conducted upon completion of refresher training. Report being provided and archived in Ops Department archive.
- Suspend accident-working lane for several days until all liquid explosive toxic residue has evaporated.
- All violations of safety in the field, including even minor ones to be immediately reported to TFM and OM and followed up with written warning (no more verbal).
- QC by TSs and TLs to be conducted on a daily basis.
- New QA/QC officer position to be implemented as it was already agreed before the accident, as of 1st of October 2017.
- Due to the high toxicity of the main liquid explosive charge when working in a field contaminated with PFM-1 mines additional precautionary measures are to be applied:
 1. Mandatory use of rubberised gloves at all times.
 2. Avoiding of any contact with the liquid explosive if any leaking or sweating around a PFM-1 mine is observed.
 3. Immediate treatment by Paramedics if contact with liquid explosives has occurred.
 4. High hygiene of hands and face as well as of equipment to be applied if contact with liquid explosive occurred. More regular cleaning of clothing, tools and equipment when working in the area.
 5. Disciplinary actions to be applied where found appropriate.

Action Points

- The minefield was suspended the same day. The team was sent to camp and next day rest time was provided by management.
- All field staff were briefed about the accident and preliminary conclusions of BOI on 26th September by CD and OM.
- After attending the BOI CD addressed all field staff explaining that following the accident any breach of safety SOP would be cause for disciplinary action in writing (no more verbal warnings) with '3 strikes and out' principle, and that certain breaches would be elevated to instant dismissal (e.g. visor up while excavating). TNMAC showed their full support for this as well.
- CD further cautioned all staff that any personal issues between colleagues should be resolved after work and not taken into the task. TL or TS must be requested to mediate.

- Refreshment training was conducted on 27th of September.
- Practical examination upon refresher training was conducted on 28th of September by [Demining organisation] OM and OO and results are a matter for additional reporting.
- Teams resumed deployment on 28th of September after the practical exam was conducted.

[The report is signed by the demining organisation's Operations Manager, Country Manager, the Director of TNMAC and the TNMAC QA/QC officer.]

Victim Report

Victim number: 1018	Name: [Name removed]
Age: 34	Gender: Female
Status: deminer	Fit for work: yes
Compensation: None	Time to hospital: 70 minutes
Protection issued: Frontal apron; Mask Visor	Protection used: Frontal apron, Mask visor

Summary of injuries: poisoning

COMMENT: Ingestion of volatile nitrated hydrocarbon explosive. See Medical report.

Medical report

A formal medical report was not made the available. The summary below was included in the demining organisation's internal investigation.

Summary of injuries:

Temporary poisoning from highly toxic liquid explosive, which is a main explosive charge of the PFM-1 AP blast mine. Poisoning is a result of direct contact of the toxic liquid with the eyes and in the mouth of the injured deminer. The liquid is reported to have sprayed upwards into the deminers face upon rupturing of the mine casing (no detonation occurred). Due to this toxic poisoning the deminer suffered anaphylactic and cardiogenic shock resulting in one incidence of ceased breathing and two cardiac arrests, and was revived by the field paramedic during MEDEVAC using heart massage drill, Ambu bag ventilation and administering of relevant emergency medication (adrenalin, atropine etc.). Precise description of initial medical treatment is described in Paramedic report as part of this report

Minor Injuries:

The toxic substance also resulted in temporary blindness when coming into direct contact with the eyes. Following initial treatment of the injured deminer's eyes by a deminer colleague (with water washing) and the paramedic (with saline solution and other medicaments) and final treatment in Sarichashma hospital, after a couple of hours her vision recovered to full capacity. Final evaluation of an Ophthalmologist in Dushanbe hospital declared that there is no permanent damage to the deminer's vision.

Statements

The staff statements

Statements of the staff who were on the task when the accident occurred were written in Tajik

or Russian then translated into English by the OO and the [Demining organization] Internal QA/QC Officer, and submitted to OM next day. On September 25th, casualty's statement was taken by the [Demining organization] Senior Paramedic with relevant witnesses present.

Deminer [the Victim] (casualty):

I [name removed] on 25.09.2017 at 6 o'clock am went from our field base which is located in Sari Chashma village Shamsiddin Shohin district, towards Tajik - Afghan border to frontier post #3 (Bogh), minefield HZTJ335MM10. At 7:15 am we arrived at minefield HZTJ335MM10, wear our PPE. TS [name removed], TL [name removed], and Paramedic [name removed] have provided safety and medical briefing. Due to our first working day in the above-mentioned task, they have provided to us full briefing regarding the situation in the task and types of mines. After the briefing, we took our working equipment, entered to the minefield and I has started work at 7:30. After a third working hour, during the break, deminer [name removed] approach to me and we had verbal conflict. She declares that I am spreading rumours about her, that she has bad behaviour. When regular break (10 minutes) finished, I have started my job, but I felt bad myself. I could not breathe and I pull up my facemask. TS [name removed] saw it and warn me to pull down my facemask. When I felt better myself, I pull down my facemask, but after 2-3 minutes I felt bad myself again and I pull up my facemask. This time our TL [name removed] warned me, to pull down my facemask. On that moment I did not work. I pull down my facemask and continue my job. I have excavated two anti-personnel blasting mine type PFM (they was not armed) and put them into my bucket with the trowel.

I checked with metal detector their position and I discover signal. I have started to excavate the signal, during excavation I have seen one part of PFM. I stopped my work because I felt bad myself, I couldn't breathe. I look toward [name removed] and I call her to come and help to me. [Name removed] didn't hear me, and I call her second time, again she didn't respond. Then I try to stand up from my place, but I felt dizziness and I has fallen into my working lane.

When I stood up, I felt pain in my eyes and my face (burning). I sit in my place and call [name removed] louder. This time she heard me, and approach. When she approached, she thought that I could not breathe at all and she calls immediately TS. While TS was coming, I asked [name removed] to give me water, to wash my face and eyes because I was feeling pain (burning) in my eyes and face. I with [name removed]'s assistance washed my eyes and face. Later on, I heard voices around me, but I could not open my eyes because I was feeling pain (burning). Later on, I do not remember anything. When I approach paramedic [name removed], I felt better myself. I felt how she washing my eyes and making the injection. Later on, I do not remember anything. Close to the Sari Chashma hospital, I regain consciousness.

TS [name removed]:

By the explanatory letter, I want to inform you that 25th of September in minefield HZTJ335MF10 before entering safety briefing was conducted to all staff. During my briefing, I pass information to staff about existing mines in the task, depth of the mines, about existing of stones in this minefield, and about mines which were washed by water. When I accomplished my briefing I provided a briefing to MTT-5 separate and TS [name removed] who was acting TL provide a briefing to MTT-2.

After that, we took both teams and entered to the minefield. I pass all relative information to Supervisor [name removed] and showed to him the area of operations for MTT-2. When we set up deminers on their positions, I went back to MTT#5's working area. Approximately, at

11H30, deminer [name removed] called me, he found from his working lane anti-personnel blasting mine type PFM-1, and I went to his area and took the mine to the safe area.

In this time approximately I heard deminers ([name removed])'s voice. She was calling [name removed] request medical assistance for her colleague. I took deminer's ([name removed])'s metal detector and I passed through un-cleared area toward deminer's ([name removed])'s working lane. When I approached [name removed]'s working lane and I asked her what happened to you?

She answered, that liquid explosive from PFM-1 hit into her eyes. I stopped deminer's works and we took her to the paramedic.

Paramedic [name removed] has provided first aid and she washed [the victim]'s eyes. After that paramedic told to me that she has to be evacuated to the hospital. I, together with paramedic [name removed] transported deminer [the victim] to Sari Chashma hospital.

Acting TL [name removed]:

By this explanatory letter, I want to inform you that in 25th of September we were deployed to conduct land release operations in minefield HZTJ335MF10. Before entering to this minefield TS [name removed] provide us safety briefing regarding operations in the minefield. During his briefing, [name removed] warned deminers about difficulties in this minefield and at the same time he informed us about mines that could be found in this minefield as PFM-1, POM-2, and MON-50. Also, he mentioned that some of the mines are in depth of 40 cm therefore be careful and accurate during excavation. After TS accomplished his briefing I as an acting TL has repeated TS's words to be accurate and work in accordance with five procedures. When TS and I entered to a minefield, he showed and explained to me the task and after that, I started to deploy the team. During operation at 11H39 I was called by deminer [name removed] when I approached her I heard that [name removed] was calling me and I directly went to see him. When I approached [name removed] I saw that deminer [the victim] was sitting on the ground and [name removed] told me that liquid explosive from anti-personnel blasting mine PFM-1 hit her face and eye. I immediately stopped operation of both team and informed our paramedic. After that, me and [name removed] took [the victim] and guided her to paramedic and I went back to minefield closed it and with both teams went out to the control point.

Deminer [name removed]:

Before we start the clearance activities, TS provide us a briefing. During the briefing, TS told us about kind of mines that we could find in this minefield and he mentioned the depth of the mines in this minefield. Then we enter to the minefield went to our lines and start clearance activities with five demining procedures. The incident occurred approximately at 11H40. I was in distance of 20 or 30 meters from the incident place and I didn't hear any voice and didn't see anything. TS told us to close our lines and go out of the minefield.

Paramedic [name removed]:

To your knowledge today 25th of September at frontier post number 3/Bogh Sari-chashma community Shamsidini Shohin region at 7:20 was conducted briefing to MTT #2 and 5 by Supervisor [name removed], Team Leader [name removed] and myself in minefield #10. When deminers start clearance, activities and Supervisor deployed them to there working lanes I entered to minefield saw all positions of each deminer and record it for myself. Day

was as usual. Team Leader and Task Supervisors checked each hour communication. At 11H42 team, Leader [name removed] called me on radio and informed that deminer [the victim] needs medical support, after that I immediately wear on my PPE took my medical bag and entered to the minefield. When I arrived, I saw deminer [the victim] her eyes closed and Supervisor with Team Leader were supporting her from both side. I told them to put her in smooth place and asked [the victim] to open her eyes. She could not open her eyes as she had severe burning of eyes, she told me that liquid explosive of anti-personnel mine PFM-1 hit her eyes.

My taken actions:

3. Washing of both eyes, face and mouth with 0.9% NaCl solution, frequent instillation of eyes with Novocain 0.5% solution and 20% Albucide solution, IV solution of Atropine 1mg-1.0, Dexamethasone solution 4mg-1.0, in / m solution of Diazepam 10mg-2.0. A/D 70/50 of mm Hg, thread pulse.
4. At 11H55, during the transportation the arterial pressure (A / D) is 50/30 mm Hg, the pulse is threadlike, the body temperature is lower, the respiratory rate is disrupted, abnormal superficial breathing, the rehydration of the muscles, and then convulsions and cardiac arrest begin. Measures taken: Adrenaline solution 2.0 in / in, CPR-indirect cardiac massage, O-2 (oxygen) supply with Ambo bag, for one minute. After that, the work of the heart restored. A / D 50 / 40-mm. r.st. Pulse 40 beats per minute. Respiratory rate 12.
5. At 12H05 the hemodynamic changed again, the A/D decreased, the pulse disappeared. The measures taken at point 2 repeated, after which hemodynamic restored. Infusion therapy with Ringer's solution was connected. A / D 80 / 50mm Hg, pulse 52 beats per minute, BH 16.

For maintenance of frequency of respiration carried out artificial ventilation of the lungs by Ambu bag before arrival in hospital. At 12H50 she was delivered to Hospital of community Sarichashma.

Analysis

The primary cause of this accident is listed as 'Victim inattention' because it seems that the deminer had found parts of another PFM and believed that the signal she was investigating was only another part, so not hazardous. She struck the ground with enough force to mark a stone and the blade of her excavation tool glanced from the stone onto the body of a second PFM-1 mine. The body split and the volatile high explosive hit her in the face. She was not wearing her face mask, or not wearing it in a down position, so the toxic explosive struck her face, entered her eyes and was inhaled.

The secondary cause is listed as a 'Field control inadequacy' because the deminer was not wearing the face mask appropriately and the error was not corrected. This breach of safety discipline had been corrected previously on the same day and the offence repeated, but the deminer was not withdrawn from the field. The deminer was upset by an argument with a colleague and was 'distracted', but this was not recognised as being significant until it was too late. In fairness, visibility at the site was restricted, so complicating field supervision. The demining organisation recognised the supervisory failings and determined to increase field discipline, issue written warnings, enforce instant dismissal for failure to wear face protection while excavating and to reinforce the correct procedures with refresher training.

This investigation was professionally conducted in a way that identified causes and measures that could be taken to prevent risk of repetition. Although conducted by internal demining

organisation staff, representatives of the Mine Action Centre (MAC) were present and agreed the conclusions and recommendations, so achieving a measure of independent investigation which the MAC lacked the capacity to conduct. The demining organisation's response and investigation were professional, honest and praiseworthy – as is their willingness to share the report with others.

The risk presented by the ingestion of volatile toxins from PFM mines during bulk demolition of stockpiled munitions is well known, but this accident required the medics to respond appropriately to a risk that had not occurred in any other recorded demining accidents and had not been predicted so could not have been prepared for. Senior demining group staff suggested that the medical response may not have been ideal but in the unforeseen circumstances, the medical response managed to keep the Victim alive until her crisis passed so should be applauded.

The accident raises questions over why a live PFM-1 did not detonate when pressure was applied to its flexible body. The PFM-1 mines were deployed from a helicopter, so were not intentionally buried. The weather (snow and rain) had washed them to a level ridge where they had subsequently become buried. The potential for the mines to have been gathered in close proximity or on top of each other was obvious. However, most PFM-1 mines that have been exposed to sunlight (UV) for a long period in Tajikistan have split and their volatile liquid explosive has been dissipated as shown below.



The casing of the mine involved in this accident was intact but may have been hardened by the sun before it became buried, so making it easier to accidentally break open without the case flexing and pushing the liquid explosive into the fuze and making it detonate.