

# DDAS Accident Report

## Accident details

<b>Report date:</b> 15/03/2004	<b>Accident number:</b> 325
<b>Accident time:</b> 12:30	<b>Accident Date:</b> 24/05/1996
<b>Where it occurred:</b> Sabie, Maputo Province	<b>Country:</b> Mozambique
<b>Primary cause:</b> Management/control inadequacy (?)	<b>Secondary cause:</b> Inadequate training (?)
<b>Class:</b> Excavation accident	<b>Date of main report:</b> 30/05/1996
<b>ID original source:</b> 1008/1/BF/DG	<b>Name of source:</b> ADP
<b>Organisation:</b> Name removed	
<b>Mine/device:</b> PMN-2 AP blast	<b>Ground condition:</b> bushes/scrub grass/grazing area rocks/stones trees
<b>Date record created:</b> 20/02/2004	<b>Date last modified:</b> 20/02/2004
<b>No of victims:</b> 1	<b>No of documents:</b> 2

## Map details

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

## Accident Notes

inadequate training (?)  
inadequate area marking (?)  
inadequate medical provision (?)  
mechanical follow-up (?)  
inadequate investigation (?)  
no independent investigation available (?)

## **Accident report**

An accident report covering an investigation carried out by representatives of the demining group, the National authority and the UN group operating in the country, was eventually made available in October 2001. [Previously, attempts had been made to cover up the event.] The following is a reproduction of the accident report, edited for anonymity. See also "Related papers".

### **Introduction**

The Krohn Demining System and its basic organisation, known in Mozambique as the Mechanical Mine Clearance System has been active in Mozambique since September 1995. Over several months the original two machine system has been further developed and refined, culminating in a trial of a three machine system in May 1996 at Sabie, Maputo Province. [The demining group] have since September 1995 worked in both the Moamba and Sabie defensive minefield rings and have worked on developing Standing Operating Procedures (SOPs) and an organisational structure to ensure professional operations. By the time of the three machine trial in May 1996 [the demining group] had begun to develop an embryonic operational structure, including the hiring of an Explosive Ordnance Disposal (EOD) operator, [the Victim], to assist with hand clearance operations at the completion of the third machine's tasks.

Since commencing operations in Mozambique, [the demining group] have continued to develop their SOPs, including some instructions of the machine's operations and the tasks of personnel within the organisation.

### **Aim**

The aim of this report is to outline the circumstances of the accident as specified in Reference A.

### **Ground**

The area where [the demining group] has been operating recently is located around the rural township of Sabie, in Maputo Province. Sabie is situated approximately 130 kilometres north west of Maputo. [The demining group] have been clearing the large perimeter minefield ring surrounding Sabie township since late 1995. The area remains inundated with various types of mines. The defensive ring has been fenced in places although the fence is incomplete in many areas and the extent of the minefield is unknown and has not been surveyed. The ground is well covered with grass of varying height, very rocky in places and there are numerous small trees and shrubs. The types of mines that [the demining group] have been detonating since working in Sabie have included PMNs, PMN-2s (anti-personnel) and variants of OZMs (anti-group) mines.

### **Background to the accident**

[The demining group] has their base camp on the northern outskirts of the township of Sabie. They have been working on areas around Sabie during the past few months and had recently completed a trial in early May on their three machine clearance system. This trial also included the need for hand clearance personnel to be utilised for final clearance and disposal once the third machine had completed operations. During the week 20 - 24 May 1996, they had been working around the Sabie area and were due to commence work on a new security strip on the eastern side of the main Sabie/Moamba road 9 kilometres south of Sabie so that work could then commence on the minefield ring located there. A sketch of the accident site is attached at Annex A. [Annexes were not made available.]

As in all mine clearance operations, no work is allowed to commence unless all safety and communications aspects have been adhered to. This includes ensuring that a medic and safety vehicle is in attendance at all operational sites and that all sites have clear communications to [the demining group] HQ, which also has communications with the HQ in

Maputo in case of the need for aero medical and/or road evacuation in emergencies. [The demining group] also cannot work without first ensuring that a safety cordon (with appropriate communications) has been positioned to ensure that local people and/or stray animals do not venture into the area where the machines are working due to the high risk of explosive detonation by mines.

During the 23 May 1996, several personnel of [the demining group] were returned to Maputo for administrative requirements, one of these personnel included the paramedic who returned to Maputo after being released from duty at 14:00 on 23<sup>rd</sup> May 1996. At this stage it would have been appropriate for [the demining group] HQ to advise all personnel remaining at the base camp of the personnel who had returned to Maputo. This is important because of the absence of the para-medical, therefore no work in the operational minefields could be conducted on the 24<sup>th</sup> May 1996. This appears to not have occurred although there is some conflict of evidence about the paramedic's whereabouts (others have stated that the medic returned to Maputo on the afternoon of the 23 May 1996, whilst [the Victim] stated in an interview in Maputo Hospital on the evening of the 25<sup>th</sup> May 1996 that he had briefed the paramedic on the morning of the 24<sup>th</sup> May 1996 with regard to the day's activities. This conflicts with evidence given by the paramedic himself and others.

Despite the absence of a paramedic, [the Victim] who has the position of Team Leader in the organisation, decided to commence work the morning of 24<sup>th</sup> May 1996 on the security strip. After receiving daily orders in the base camp; he, the two machine operators and the security officer proceeded to the vehicle parking area located near where the security strip was to be cleared. Personnel were in location about 06:45. At no stage was a medic or safety vehicle included in the work party nor was a safety cordon positioned around the site before work commenced. No work should have been authorised or even attempted without a paramedic, safety vehicle, safety cordon or reliable communications on site. These are major breaches of safety and SOPs indicating that [the Victim], as a Team Leader, showed a complete disregard for [the demining group's] SOPs and personnel safety by even attempting to work on 24<sup>th</sup> May 1996. Whilst the others conducted maintenance on the three machines in the vehicle park, the Victim decided to inspect another minefield that had been cleared previously. He did this without a medic, safety vehicle and without any communications. This action also seriously contravenes safe working procedures.

The machines began to clear the security strip at approximately 09:30 hours and worked for about 45 minutes. There were several explosions in the security strip and the machine operators decided to return to the vehicle parking area to seek advice on whether to continue the work. At this time [the Victim] had returned from the other minefield and said to the two machine operators that work could not continue without sentries. No mention was made about the lack of a medic or other safety measures. Another advisor to the group had also advised the team to cease work when he had heard the explosions.

Machine refuelling was then conducted at the vehicle park from 10:30 to 12:00 when the Victim decided that he wanted to investigate the security strip and determine why some mines had not exploded. He was advised that, since the machines had not completed their tasks, he should not go into the minefield. The Victim stated that he still needed to go in to have a look. At this stage the security strip had a large number of PMN-2 anti-personnel mines exposed by the machines and was very dangerous. In the course of the morning, [the Victim] had consistently displayed a serious lack of responsibility for his position and authority and for the safety of other personnel. He entered the security strip at approximately 12:00 and approximately 30 minutes later a muffled explosion was heard inside the strip.

Upon hearing the explosion, a machine operator decided to drive the third wheeled machine in the direction of the blast and retrieve the now seriously injured victim, who had apparently stepped on a PMN-2 (anti-personnel mine). At the same moment the other machine operator decided to go back to the base camp in the jeep to get assistance and one vehicle was dispatched to the vehicle parking area. By the time the vehicle was on its way the first machine operator had already retrieved the seriously injured victim and driven him to the Sabie Clinic for immediate first aid. No immediate first aid was attempted in the strip as the machine operator felt it critical to get the victim out of the strip and back to the clinic as soon as possible.

At approximately 12:56 when positioned at the Sabie Clinic, the operations/security officer for the day managed to raise callsign ZERO (HQ - Maputo) by radio and advise them of the accident and request aero medical evacuation. Because of a lack of communications on site and a disregard for normal SOPs the time taken to alert HQ about the accident was nearly 30 minutes after [the Victim] had first initiated the mine. HQ conducted standard medevac procedures which also included having an Ambulance at Maputo airport and calling the specialist doctor to attend to the casualty on arrival at the hospital. The plane was dispatched to Sabie airstrip arriving at 13:45. The aircraft departed Sabie at 14:00 for Maputo arriving at 14:15 hours and the casualty was transferred to Maputo Special Clinic at Maputo Central Hospital where he underwent emergency surgery.

### **Circumstances of the accident**

After ignoring the warning not to go into the security strip, [the Victim] ventured into the partially cleared area just after 12:00 on 24<sup>th</sup> May 1996. He took with him his normal EOD equipment consisting of an Ebinger Mine Detector, prodder and knife and was dressed in blue cotton coveralls and soft skinned runner style boots. There is no evidence to suggest that [he] had safety glasses on and he did not have any personal radio communications. The explosion occurred about 300 metres from the vehicle parking bay at approximately 12:30. This suggests that [the Victim] was in the security strip and surrounding environs for nearly 30 minutes. Evidence from the subsequent on site investigation, conducted the following day on 25 May 1996, indicates that [the Victim] spent most of his time walking inside the strip, hand retrieving and stacking PMN-2's and components in an area that was extremely dangerous and hazardous.

The PMN-2 mine appears to have been detonated some 300 metres from the vehicle parking area and [the Victim] appears to have been attempting to locate a mine that he had previously registered with his detector. The detector appears to have been discarded after the blast as [the Victim] was struggling to go back for assistance. [The Victim] stated in an interview in hospital on 25<sup>th</sup> May 1996 that at the time of the explosion he had his detector in his right hand and his knife in his left hand and he was certain there were two mines in close proximity to one another and that he may have set off one of these mines.

After detonating the mine [the Victim] then attempted to extract himself from the minefield. Whilst one cannot imagine what is going through the mind of a victim immediately after a blast it can only be surmised that, because of shock, he was unaware of the additional danger he was putting himself in. He was 300 metres inside an uncleared strip, littered with remnants and complete PMN-2s in various states of operation. He hobbled approximately 100 metres back up the strip towards the road before being found on his back by the machine operator who had driven back into the strip with the third machine. [The Victim] was given rudimentary treatment at the Sabie Clinic by the on-duty sister. [He] was then driven to the Sabie airstrip and evacuated by air to Maputo.

### **On Site Investigation**

The on site investigation of the accident occurred on Saturday 25<sup>th</sup> May 1996. The team departed Maputo for Sabie on 25<sup>th</sup> May 1996 at 08:00. Upon meeting the [demining group] Team at Moamba at 09:30, both parties proceeded to the [demining group] base camp at Sabie. [The investigators] outlined the proceedings of the investigation and were given every assistance by [demining group] staff. Initial statements were taken and recorded, brief interviews conducted with appropriate personnel and a field visit conducted. The following timeline outlines the proceedings of the on site investigation 25<sup>th</sup> May 1996:

- a. 08:00 hours - Investigation Team departs for Sabie.
- b. 09:20 hours - Team meets [demining group] personnel at Moamba Hotel then proceeds to [the demining group's] base camp at Sabie.
- c. 10:15 hours - Arrive Sabie base camp. Outline proceedings of investigation to personnel present and ask those present to provide written statements (which were

subsequently translated into English and attached as Annexes to this report). [Annexes not made available.]

- d. 11:30 hours - Interviews of [witnesses] conducted at Sabie base camp. Premier Secretary of the German Embassy, was also present for the interviews.
- e. 12:05 hours - Investigation team departs for accident site accompanied by machine operators.
- f. 12:15 hours - Investigation team arrives at the accident site, draws initial sketches and investigates site by utilising the third machine to transport the team to and from the security strip. Photographs, distances and locations were obtained from the security of the mine protected vehicle. Many footprints were sighted and three stacks of PMN-2s that could only have been positioned by hand were in evidence. The team photographed where [the Victim] was found, approximately 100 metres from the blast and where the accident occurred. The Victim's detector appeared to have been discarded 5 metres from where the explosion happened, photographs were taken and the detector was retrieved. Additional photographs and coordinates were taken and the team departed the security strip at 13:30.
- g. 13:35 hours - Investigation team departs accident site and returns to [demining group] base camp at Sabie.
- h. 14:15 hours - Investigation team, with German Premier Secretary departs Sabie to visit and conduct interviews with [the Victim] at Maputo Hospital.
- i. 16:35 hours - Investigation team arrives Maputo Hospital.
- j. 17:00 – 18:15 - Bedside interview conducted with [the Victim].

The following [demining group] personnel provided additional information to assist with the investigation and the two machine operators accompanied the investigating team to the accident site:

- a. First machine operator.
- b. Second machine operator.
- c. The demining group's Operations/Security Officer.

### **Facts Established Concerning the accident**

19. The following facts were established at the Sabie base camp from interviews with [The demining group] personnel, from personal statements and final interviews conducted at Maputo Hospital:

The paramedic had departed for Maputo on the afternoon of the 23<sup>rd</sup> May 1996 therefore no operations should have been conducted. This was known by the machines' owner and other members of the demining group.

The team leader [the Victim] was aware that a medic was not available although he insisted that he had briefed the medic the morning of 24<sup>th</sup> May 1996 on the day's proceedings. (This obviously could not have occurred as the paramedic had returned to Maputo the previous afternoon).

Work had commenced at Sabie on 24<sup>th</sup> May 1996 despite the fact that there was no medic, safety vehicle or safety cordon positioned.

[The Victim] had gone to inspect previously cleared minefield in the morning on 24<sup>th</sup> May 1996 without a medic, safety vehicle or communications.

[The Victim] had been warned by both machine operators on two separate occasions that morning not to enter areas without the appropriate safety backup and because of the dangerous situation. Both these warnings were ignored.

By abusing his authority as Team Leader and continuing work in a totally unsafe environment, [the Victim] not only exposed himself to serious injury or death but put additional lives at risk.

[The Victim] displayed a total lack of understanding of the basic principles of EOD, mine safety, [the demining group's] SOPs and machine operations on several occasions on 24 May 1996.

[The Victim] had been in an uncleared security strip for at least 30 minutes on foot with only basic detecting equipment, no medical backup and no personal communications and was not wearing safety goggles.

The machines had not completed their clearance tasks when [the Victim] entered the security strip.

[The Victim] was collecting exposed PMN-2s and placing them in piles within the security strip and had even attempted to disarm one PMN-2.

[The Victim] had been using his detector in the strip and was using the detector when he initiated the mine.

[The Victim] stated in hospital that he had made a huge mistake by going into the security strip but felt his experience was enough to enable him to do what he did with no real concerns.

### **Cause of the accident**

The accident was caused by [the Victim] standing on and initiating a PMN-2 anti-personnel mine which was located in the security strip of the minefield. Photographs detailing the accident site and security strip conditions are attached at Annex H. [Annexes not made available.]

### **Medical Procedures**

Within 30 minutes of the accident [the demining group] personnel had notified HQ in Maputo that an accident had occurred. Maputo carried out the medevac procedure in accordance with SOPs and activated aero medical evacuation from Maputo airfield. The aircraft took off at 13:25 and arrived on site at Sabie at 13:45. Aerial evacuation from the Sabie airstrip occurred at 14:00. Time for the aircraft to reach the site was 20 minutes. Immediate first aid was given to the Victim at the Sabie Clinic once [he] had been evacuated from the security strip. [The Victim] was evacuated by aircraft to Maputo airport, met by Ambulance and transferred to Maputo Central Hospital. [The Victim] was operated on later that afternoon.

### **Casualty Evacuation (Casevac) and Communications Procedures**

Casevac and communication procedures worked according to established SOPs. Messages were passed quickly and both air and road evacuation were timely and well controlled. There is a serious concern with [the demining group's] procedures in that it took nearly 30 minutes for HQ to be notified of the accident and that communications were not available at the work site. This is in contradiction to all known safe operating procedures. There is also concern that an equipped safety vehicle was not on the work site. The lack of a medic has already been covered in detail.

### **Injuries Sustained**

[The Victim] suffered traumatic amputation of the left foot below the knee and remains hospitalised in the Special Clinic of Maputo Central Hospital. A medical summary written by the Orthopaedic Surgeon, is attached at Annex I. [Annexes not made available.]

## **Modification of Equipment or Techniques**

There is no evidence to suggest that the current demining equipment used by the [demining group] was at fault. The lack of a medic, properly equipped safety vehicle, safety cordon and sound communications at the work site displays a serious breakdown in safety aspects considered minimal for any demining organisation.

## **Equipment Used**

At the time of the accident [the Victim] was utilising an Ebinger mine detector, prodder and knife and wearing blue cotton coveralls and soft runner style boots. [The Victim] was not wearing protective eye glasses whilst engaged in clearance operations. The lack of safety glasses and good quality leather boots displays a lack of personal discipline on behalf of [the Victim] and [the demining group] need to address minimal protective dress safety requirements for all personnel engaged in demining operations.

## **Conclusions**

It is the investigating officers opinion that if correct SOPs, techniques and equipment had been used this accident would not have occurred. The accident occurred as a result of extreme carelessness by [the Victim] and over confidence in his own ability. The work should never have commenced as there was no medic, safety vehicle, safety cordon or communications at the operational site. There was a blatant disregard for personal safety displayed by [the Victim] and a complete lack of understanding in the [demining group's] operational procedures and techniques which have been tried and proven successfully over many operational months. A lack of personal responsibility by [the Victim] is also to blame as he not only put his own life at risk but the lives of two machine operators.

The accident would not have occurred had the [demining group's] SOPs been adhered to and all [the demining group's] personnel were made aware of them. Mine clearance is a disciplined procedure and all individuals in a team are responsible to each other for the safety and adherence to correct procedures and safety. [The demining group] must ensure that its organisational culture is attuned to the safety and operational aspects of the operation. The safety of all personnel in mine clearance operations, particularly in peace time, must remain paramount to all organisations that undertake mine clearance in whatever form.

## **Recommendations**

It is recommended that:

- a. All [demining group] personnel are made aware of the [demining group] SOPs, in particular the need to have a medic, safety vehicle, communications and a safety cordon in place for all operational tasks.
- b. All [demining group] personnel are advised of the circumstances of the accident and how and why it occurred.
- c. All [demining group] personnel be advised of their responsibilities to ensure that safe operating practices are adhered to and to prevent such a blatant break-down in supervision and safety procedures.
- d. That [the demining group] ensure that all personnel comply with the dress standards required when conducting demining operations.
- e. That [the demining group] review their current SOPs to ensure that all aspects of operational safety are included and that all personnel are made aware of the operation regardless of their position in the organisation.
- f. [One machine operator] should be commended for his quick actions in retrieving [the Victim] from a disastrous and life threatening situation.

Signed

30<sup>th</sup> May 1996

## Victim Report

<b>Victim number:</b> 409	<b>Name:</b> Name removed
<b>Age:</b>	<b>Gender:</b> Male
<b>Status:</b> supervisory	<b>Fit for work:</b> yes
<b>Compensation:</b> not made available	<b>Time to hospital:</b> 1 hour 45 minutes
<b>Protection issued:</b> None	<b>Protection used:</b> none

### Summary of injuries:

AMPUTATION/LOSS

Leg Below knee

### COMMENT

No medical report was made available. The Victim was working as field manager of a European demining operation in early 2002.

### Analysis

The primary cause of this accident is listed as a "*Management/control inadequacy*" because the victim was a senior (ex-pat) site supervisor and was in breach of many basic safety rules, and may have been trying to alter test results (see Related papers).

The secondary cause is listed as "*Inadequate training*" because it seems that the victim did not understand the risks he was running.

The accident is classed as an "excavation accident". The investigators found that he had both his bayonet and his detector in his hands at the time, and was trying to locate a signal. This may have been with the bayonet or the detector, so it may have been a "detection accident".

### Related papers

A report on the clearance operation underway at the time of this accident was obtained during 2002. This report had been with-held for years due to a legal dispute between the machine's owners and the National Mine Action authority. It may also have been with-held because it was "sensitive". The full report is held by the researcher.

The clearance operation was "testing" the concept of reliable mechanical clearance that had been claimed. All land cleared with the machine was followed up by manual clearance.

The Krohn mechanical clearance system involved the use of two [or sometimes three] machines. One was broken-down some of the time, and multiple passes with the second machine substituted. Originally designed to clear forest tree-stumps, the heavy machines "mill" the ground.

The totals recorded for the trial in 5 mined areas (one of which turned out to be unmined) are:

The Krohn system worked for 401 hours

Manual follow up took 785 man hours

222,556 square metres were cleared



The Krohn system detonated or broke up 386 AP mines

The Krohn system detonated or broke up 19 AG mines (Anti-Group – fragmentation mines)

Manual follow up found 21 AP mines

Manual follow up found 96 AG mines (Anti-Group – fragmentation mines)

[The mines that the victim in this accident was collecting were PMN-2 AP mines left intact after the passage of the machines. These mines have an “overpressure” resistant design and may have proved especially resistant to the machines. The victim collected “piles” of them prior to stepping on one, which implies that the results of the Krohn system against AP mines was even worse than that formally recorded by the UN trial monitors.]

The formal trial report concluded:

“The object of the exercise was to assess the value of mechanically assisted clearance using the existing KMMCS [Krohn system] already in Mozambique.

The designer of the system has long claimed that the system is a stand alone operation. This is a claim that had to be proved one way or another, and several trial and assessments have been carried out to this end.

The principles of mine clearing are:

- Safety
- Production
- Speed
- Cost

With the above principles in mind the operation was deployed on known minefields.

6.1 “These minefields were selected by the United Nations Accelerated Demining Programme (UNADP) and permission was sought from the Mocambique National Demining Commission (CND) to operate.....”

6.6.2 “The KMMCS does leave behind mines and UXO and therefore cannot be used in a stand alone role.”

7.1 “Ground contamination was considerable. Metal pieces from AG mine shrapnel slowed manual clearance. Broken AP mines, especially PMNs and PMD-6s contaminated the ground with small fragments of explosives....”