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Personal Protective Equipment:

THE NEVER-ENDING STORY

HANDICAP INTERNATIONAL

Introduction

Now, as always, there is a huge debate about what protection is required and what Personal Protective Equipment (PPE) should be provided for personnel engaged in demining operations. Current opinion varies drastically between individual demining organizations, countries in which they operate and between governing bodies, which are coordinating the demining efforts.

Each organization within the demining community has a different view of what is required and what should be provided. These views are, in most cases, based on a variety of factors, such as experience, local customs, donor policy, a possible lack of understanding (due to the absence of independent information) and cost.

Very few independent and objective studies about the requirements and possible solutions have been carried out and widely circulated. A good start was made last year by the establishment of a focus group during a meeting in Washington D.C.¹, and the results, which were due to be promulgated in 1999, are eagerly awaited.

Overall, given the multitude of other types of studies carried out each year, many of which tell us

what we already know, the general lack of funding designated for research on PPE is disturbing.

Aim

My goal is to highlight the current standard and type of PPE in use with Handicap International (HI) deminers in the Balkans and to explain why this standard and type of PPE was chosen. If I succeed in contributing to a bit of controversy, so much the better, for this subject deserves a more important place on the agenda. Ultimately, this emphasis should lead to appropriate PPE being supplied to all deminers worldwide as a right. Donors and funding agencies should then be encouraged to enforce this practice by understanding the requirements and insisting that their operators conform to an acceptable and recognized standard.

Our Own Experiences: 1991–1995

All of us involved in mine clearance are, to some extent, victims of our past. My own perceptions were formed as an Ammunition Technical Officer (ATO) for a number of years in the British Army. "Demining is not a sport for ATOs!" my colleagues from the Royal Engineers often remind me. Nevertheless, the concept of PPE is not new to me, both from the perspective of an ordinary soldier and as a Bomb Disposal Technician. I have worn the best equipment the British Army had to offer in a variety of circumstances, and I count myself as one of the lucky ones not to have had it tested by an explosion.

*by Lance J. Malin,
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In March 1991, I went to Kuwait as part of a Royal Ordnance (RO) field evaluation team to look at the EOD problems (including landmines) remaining after the Iraqi occupation and the subsequent liberation by the coalition forces. The task for RO was to clear over 2,500 sq. km of desert, including small villages and oilfield industrial complexes. This task involved both Battle Area Clearance (BAC) and conventional mine clearance. The operations director, who had been specifically contracted for this task, made an assessment at that time that for BAC, ballistic protection was not required. Conversely, in the case of the mine clearance, it was decided that the best available ballistic protective equipment, suitable for the environment and the threat, should be procured and worn during mine clearance operations. This equipment would consist of, at a minimum, a helmet, visor, ballistic jacket and trousers. Also, overboots made of ballistic material that covered the lower leg from knee to foot were made available. Their use was optional.

The protective equipment provided was originally designed for military use and was composed of "off the shelf" items that the military felt were suitable. In 1991, as far as we were aware, there was no such thing as a "demining suit" designed specifically to meet the needs of commercial/humanitarian mine clearance. Figure 1 illustrates the original equipment.

In total, over 361,000 landmines were cleared by RO demining teams during the clearance operations between July 1991 and July 1993. Tragically, during demining operations, three British deminers were killed and six others suffered traumatic amputations to their lower limbs. These mine-related fatalities were caused during location, neutralization and disarming activities. Valmara V69s caused two casualties, which are large AP bounding fragmentation mines, and the third by a PT-Mi-Ba-III AT mine. Unfortunately, in the cases of the fatalities, the deminers were directly over the mines when they detonated, and it is unlikely that any practical protective equipment would have saved them. However, in the case of one victim, it was concluded that if upper arm protection had been available and had been worn, then the damage to the brachial arteries would have been less severe, and the chances of survival, in such circumstances, might have been improved. A redesigned suit, including integral upper arm protection and a high collar, was procured.

In all fatal cases, there was little penetration of the body armor (including helmets and visors) worn. Unfortunately, the massive explosions at such close range caused terrible blast and fragmentation injuries to unprotected extremities. Demining personnel stepping on small AP blast mines caused all the traumatic amputation cases. VS-50s caused two accidents, and T72s caused four.

Partly as a result of this high number of accidents to lower limbs, foot protection was considered, and a market study was undertaken. The only practical type available, at that time, was the Pakistani Blast Boot, which was actually in use in Kuwait by the Pakistani Army demining teams. The boots are worn by the deminer in Figure 1. This type of boot had the advantage of having been "tested" operationally in Kuwait by several Pakistani military deminers who had inadvertently activated PMN AP mines during their operations. The protection afforded by the standoff distance and the Kevlar materials in these boots appeared to prevent traumatic amputation.

Accordingly, this type of foot protection was procured and issued to RO deminers as soon as it became available. As this action took place toward the end of the contract when the Gurkha teams were carrying out the majority of the demining, there were fortunately no further "test" incidents.

During my time in Kuwait, I experienced several graphic and tragic illustrations of what could go wrong during demining operations. I had the opportunity to experience first hand the "pleasures" of wearing full body armor in the heat and humidity of the Kuwait summers during 1993-94, when temperatures reached in excess of 50 degrees Celsius. In short, the comments on the subject of PPE that follow are derived from my personal experience and are made in full awareness of the limitations that PPE can impose on the practical aspects of demining activities in a variety of environmental and threatening conditions.

International Standards for Humanitarian Mine Clearance

During my time in Kuwait, the concept of humanitarian mine clearance was developing within the international community. One concern for funding demining was deminer security. There were differing views on whether this concern was about the deminers or about limiting donor responsibility. The need for some kind of standard was not disputed, but the question of who should determine these standards and how they should be implemented and monitored still has not been fully explained.

In July 1996, at a conference in Denmark, the broad outlines of a set of international standards were proposed by working groups. These were revised and developed by a separate U.N. led working group that promulgated in March 1997, at a conference in Tokyo.

These standards were issued under the auspices of the U.N. and were effective upon receipt. They were to be the framework for the creation of Standing Operating Procedures (SOP), and it was generally assumed that they were to be taken as the *minimum* standards to be adopted by all U.N. sponsored demining programs worldwide. They were to provide "an example or principle to which others conform, or should conform."²

In the case of PPE, there were concerns expressed by some manufacturers and their spokespersons regarding the suitability of the testing standards³ (V50 rating NATO STANAG 2920), as outlined in the U.N. International Standards document. As far as I am aware, no one has come up with a suitable alternative.

Demining for HI in Bosnia: 1997-1999

In September 1997, I assumed responsibility for the HI Demining and EOD program in Bosnia. This project was UNMiBH funded and equipped with technical oversight from the UNMAC in Sarajevo.

In the U.N. project documents and terms of reference for the project, the importance of conforming to the U.N. International Humanitarian Demining Standards was repeatedly underlined. The concern about adherence to these standards turned out to be so intense that the U.N. took responsibility for the procurement of all of the original equipment. Yet, despite HI protestations, the PPE supplied was not thought to be compliant with U.N. standards. In particular, the helmet and visor (6mm-polycarbonate) combination was well below requirements, and the "protective vest" was no more than an off-the-shelf military flak jacket procured on the basis of cost, rather than effectiveness. This equipment was better than the PPE worn by a great number of deminers in many countries but was, in the opinion of HI, well below the intended equipment in accordance to the U.N.'s own standards. This failure to meet U.N. regulations was particularly unfortunate since the budget for the project included funding for much more suitable, substantial and probably more cost effective equipment.

Despite numerous requests from HI regarding the testing standards of the equipment, the UNMAC

refused to discuss the level of protection offered by the equipment it supplied nor would it confirm in writing that the equipment met the minimum requirements as stated in the U.N. standards. Figure 2 illustrates the PPE issued by the UNMACC to HI deminers in Bosnia in 1997.

Arguments fell on deaf ears, and it soon became obvious that the U.N. was implementing its international standards, as they claimed the need for flexibility that they did not practice. The notion that "whistle blowing" would create difficulties did not go unnoticed by other agencies dependent on U.N. channelled funding or approval in Bosnia. Sadly, the most vociferous critics of the UNMAC confined their protestations to bars in Sarajevo on Friday nights. When asked to become part of a united front to express the concerns of the demining community in a manner that the UNMAC would have to acknowledge, support was sadly lacking.

It would be unfair to assume an absolute equivalence of attitude between institutions and individuals. Eddy Banks, one of the World Bank advisors, was attempting to gain some clarification about the whole subject of PPE and injuries and was producing some interesting statistics. In his paper, "Protection or Deception," he tried to quantify the benefits (or lack thereof) of various PPE systems used by deminers when they had been involved in accidents in Bosnia. One of his conclusions was that a scientific study involving doctors as well as PPE designers was needed to evaluate the majority of PPE that was in current use and to come up with designs specifically for humanitarian demining. One fact that emerged was that over half of the demining accidents in Bosnia at that time (57 percent) had involved deminers stepping on mines, yet no protection for feet and lower limbs was provided by any organization.

New, Improved Protection?

Despite an apparent lack of tangible concern about PPE, HI based its decision on concrete evidence and sought donors for funds to replace the UNMAC issued PPE in addition to protection for the deminers' feet. The Irish Government was sympathetic to HI's requests, and it made funds available for the purchase of improved PPE and foot protection for all field personnel.

Meanwhile, in the general marketplace for demining equipment, a number of manufacturers had produced and started to market what they termed "humanitarian demining suits." Most of these units were development prototypes that had never actually



Figure 1: The original demining suit worn by the Royal Ordnance field evaluation team in Kuwait.

Photo c/o HI



Figure 2: The U.N. issued demining suits to Handicap International deminers in Bosnia in 1997.

Photo c/o HI

been tested by deminers carrying out routine duties in realistic environments over normal lengths of time. Investigation revealed that the "testing procedure" for the marketed PPE systems had amounted to little more than having various persons trying them on during focus groups and seminars. This method was not the only source of testing, but it did seem to be the one that carried the most weight among those responsible for setting procurement standards.

As cynical as the above may sound, to be fair, I must admit that I speak from experience. My scepticism is based on my own career as a successful salesman in the defense industry. Based on my experience, I am well aware of how to influence the decision-makers who purchase PPE. There is rarely enough input from the deminer who has to wear or use the equipment. It is from my experience with both perspectives, the commercial and the end-user, that I come down heavily on the side of developing a system that minimizes the effects of these differing priorities.

During our search for new equipment, one supplier who seemed to be asking the right questions regarding the perceived requirements and who was willing to discuss and develop a product with the actual users was UK based RBR. A prototype of proposed designs for humanitarian deminers operating in temperate climates was sent to HI in Bosnia, and several deminers wore this kit for regular operations over a number of weeks. Comments were solicited, and a few modifications were discussed. The requirement to protect the head, neck, torso and main arteries in the arms and legs was satisfied by the final modified prototype.

The collar of the jacket extends beyond the visor (contrary to U.N. International Standards) in order to deflect blast and debris over the visor and helmet. A visor that extends beyond the collar can, in effect, funnel blast and debris into the

deminers' face. For deminers, the complete system consists of a helmet (V rated at 450m/s for a 1.102g fragment), a visor (V50 rated at 600m/s for a 1.102g fragment) and protective jacket and wrap around trousers (V50 rated at 475m/s for a 1.102g fragment). Figure 3 illustrates the complete system.

The wraparound design of jacket and trousers brings up one important point about our approach to protection for demining personnel, an approach regarding the level of protection that should be offered to the back and sides of deminers. This belief is not universally shared by other organizations. Many argue that the main threat while demining in the kneeling, squatting or standing positions (the most common positions used by deminers despite what SOPs may say) is to the front and to the groin. This fact is not disputed, but when group fragmentation mines, such as the PROM-1 and PMR series of mines, are also present, each possibly attached to 16m long tripwires, then the possibility of a fragment hitting other deminers in the vicinity is very real. This scenario would be the case even if spacing between deminers in such circumstances were increased to 50m. It is unlikely that all deminers would, at the time of detonation, be facing the mine when it was activated. In fact, it is possible that a mine in such circumstances may detonate to the rear of several deminers who may be, at that moment, standing up.

Based on this argument and supported by what we consider to be "duty of care" for demining personnel and common sense, the PPE used by HI in Bosnia and Kosovo has 360 degrees protection for the head, neck and torso. It also includes integral protection for the upper arms, armpits and groin. With the combination of trousers and jacket worn during demining activities, there is twice the thickness of ballistic material protecting the groin (femoral arteries). The rear panel of the jacket can be removed, if necessary, as dictated by the threat. For field support staff not involved in actual location, neutralization and disarming of mines, the trousers are optional.

For Bosnia and Kosovo operations, the Americans manufactured Welco's Blast Boot, which was issued by the U.S. Armed Forces to several of its units. Various other sources of boots were investigated, but the Welco boot appeared to be the most practical. Figure 4 illustrates these boots, which are issued to all demining staff.

The entire system, from head to foot, was developed keeping in mind the obvious limitations imposed by the deminer's need to move relatively freely, to have vision unimpaired and to maintain a level of

physical condition and mental alertness throughout the day. The objective is to achieve the best possible compromise between absolute protection and practical constraints.

What Protection Is Required?

One of the characteristics of Western consumers is that having made a purchase they develop arguments to confirm that the decision to buy a particular product was correct. We are no different in the demining world, and the reduction of "post purchase dissonance" is a factor to be considered. This discontent is why it was somewhat reassuring to see an article about fragmentation injury in the *World EOD Gazette*⁴, which seemed to confirm that the factors considered in the decision to purchase the PPE were generally sound.

The article concludes that "the NATO STANAG V Test Specification system was never designed to be, nor should it be employed as, a procurement comparison tool." This statement implies that the object of procurement of PPE should not be purchased to "standard," but rather purchased to "threat." Threat analysis is something deminers do know about and are capable of debating and explaining within an essentially shared knowledge framework. In the absence of any other analysis system, it is unlikely that the U.N. International Standards for Humanitarian Demining will deviate from the NATO STANAG set benchmark in the foreseeable future. However inadequate, or indeed unrealistic, the current method of assessing the performance level of materials, it will remain the criteria against which products are judged.

Conclusion

Until some other more suitable criteria for evaluation than the current V rating is developed, those of us who are forced to choose between PPE manufacturers and designs will have to go on educated guesswork. The need is not so much for standards but for measures. Such measures must provide the means to determine the level of PPE appropriate to a given set of actual circumstances and threats. PPE in one situation does not have to look or be exactly like PPE in another, but until operators can explain their choices in coherent and comparative terms, donors, procurement officers and deminers alike will have to live with, in the best case, educated guesswork. In the worse case, deminers will live—or die—according to an all too loose definition of the minimum standard. ■



Figure 4: Welco Blast boots used by Handicap International deminers in Bosnia and Kosovo. Photo c/o HI

¹See JMU *Journal of Mine Action* Summer 1999, "Body Protection Systems for Use in Humanitarian Demining," by Richard L'Abbe, Dr. Aris Makris, Mr. Derrick Poon Young.

²Concise Oxford Dictionary.

³World EOD Foundation Gazette, July 1998 – Blast effects on the Human Body, R.A. Purvis.

⁴World EOD Gazette, January 1999, Fragmentation Injury, page 42.

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Figure 3: The modified demining suit worn by Handicap International deminers in Bosnia and Kosovo.

Photo c/o HI