

EDITORIAL

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# How the BDF Medical Services were prepared for Chemical Warfare

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## INTRODUCTION

The events of 2 August 1990 came as a surprise to most GCC states. With this, and the movement of Iraqi forces to the south of Kuwait - posing the threat of a move into Saudi Arabia and South - came the realisation that a threat now existed against the whole region including Bahrain.

### The Threat

The threat to Bahrain was assessed to be from the Iraqi air force or navy; from special forces, or agents acting on their behalf. Bahrain was not considered to be a high priority target. Nevertheless, whilst the possibility of an attack existed, preparations for adequate defensive measures were vital.

The major subjects of concern were:

- a. **Nuclear, biological and chemical individual training and equipment**
- b. **Warning and reporting of chemical attacks**
- c. **Personnel collective protection shelters and air filtration units**

### Nuclear, biological and chemical individual training and equipment

In terms of chemical defence, the BDF were still in the early stages of development. No training had been undertaken regarding the decontamination of chemical casualties. Nuclear, Biological and Chemical (NBC) defence, as a subject had yet to be included in formal training.

Fortunately, 2 members of Medical Support Group (MSG) had served in units abroad which had exercised and trained personnel in individual protection equipment (IPE), collective protection (COLPRO), medical chemical decontamination and chemical Warning and Reporting procedures. In view of this, the MSG under the director of the hospital became the NBC training organisation to the BDF.

### NBC Defence Planning

Within 24 hours of the invasion of Kuwait, meetings were held to discuss what preparations would be necessary to enable the BDF hospital to deal with chemical casualties, be they from Saudi Arabia or as a result of an air attack on Bahrain. In the succeeding weeks, proposals were produced to cover the following: medical decontamination organisation and training; NBC standard operating procedures (SOPs); purchase of NBC defence equipment; NBC individual protection equipment and training; warning and reporting organisation

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and training; collective protection and training. In addition to the above, the MSG was involved in providing medical support for the disaster plan for the RAF base at Muharraq and the multi national triage area at Bahrain airport.

### Chemical Decontamination Centre (CDC)

The highest priority was given to the organisation of a medical CDC. At this time the MSG had neither the means of detecting the presence of chemical agents on casualties other than by symptoms, nor had they any means of decontaminating patients. Even if these facilities had been available, there was no means of confirming that decontamination had been effective.

The first of 2 medical CDCs was set up in early August in the gymnasium which was connected to the BDF hospital. The layout and organisation of the CDC was based on basic British 1st line Field ambulance practice of 4 stretcher bays, each manned by 4 medics. The actual decontamination procedures were developed to meet the needs of a very different climatic environment.

In UK doctrine, all soldiers wear NBC protective clothing at an early stage in any battle. The procedure involves decontaminating the boots, gloves, mask and mask/hood area of casualties. This is effected by using a powder known as Fullers Earth which absorbs the liquid chemical agent: Fullers Earth is rather like a coarse talcum powder. The NBC suit is then cut off at the seams, leaving a "clean" casualty in combat uniform. At this time, the BDF did not have NBC suits; chemical agents would quickly penetrate normal desert uniforms, therefore all clothing would need to be removed. It was never thought, even in UK doctrine, that Fullers Earth would be used to decontaminate the **whole** body. A different approach was required.

In Bahrain in August, temperatures vary between 35° - 42° centigrade in the shade, (**depending on your mode of dress and workload this can mean an apparent temperature of approximately 50°**). Even if individuals had possessed NBC suits, it was unlikely they would have been able to operate effectively for very long whilst wearing them. Later, when suits **were available**, exercises provided useful information on how long troops could operate when undertaking decontamination drills in high temperatures in full IPE; at 35° - 42°C operation time limited to approx 20 - 30 minutes. Decontamination teams also needed to wear waterproof suits on top of their NBC suits.

The procedure adopted by the BDF included taking off *all* clothes from the casualty, who was then washed with soap and water before being passed over a "clean/dirty" line (Fig 1) for further attention in the secondary CDC before being passed through to the hospital. Dressings on non life threatening injuries were removed routinely and replaced.

The chemical defence respirator was also decontaminated and remained on the casualty throughout this phase. When decontamination was completed, a disposable paper sheet was used to cover the casualty to retain modesty. Fullers earth was not available at this time in Bahrain, and other substitutes were

thought unsuitable in a hospital environment; the casualty would in any event, still require washing before further medical treatment was possible.

In the early stages, before chemical monitoring equipment had arrived, there was no certainty that the washing would be totally effective. The gymnasium became the secondary CDC. An initial CDC was erected in tentage some 30 meters from the hospital entrance at the side of the car park. 3 helicopter landing sites were established in the near vicinity, thus casualties could be flown to the hospital for immediate decontamination if necessary.

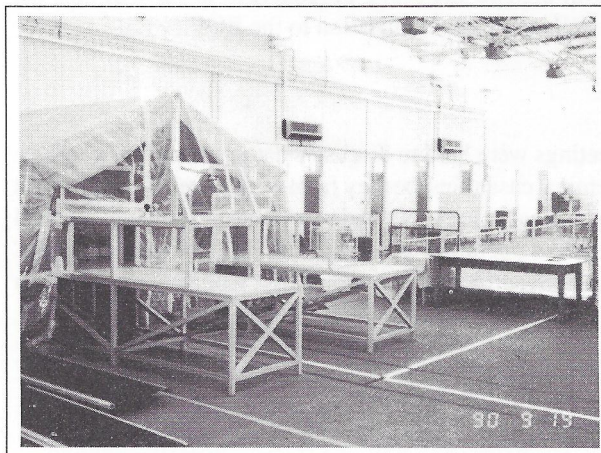


Fig. 1 "Clean/dirty" line

### Initial CDC

The initial CDC was first set up to ensure that until effective chemical monitoring equipment became available, casualties would be processed through 2 decontamination areas. In later tests it was established that washing with water only, reduced the contamination by more than 50%. Decontamination was further refined to include a 2% solution of chlorex (bleach). This proved to be very effective in tests using Methyl Salicylate as a chemical agent simulant and the chemical agent monitor (CAM2) as a detector. After training, decontamination by the teams cleared all traces of the simulant using this process.

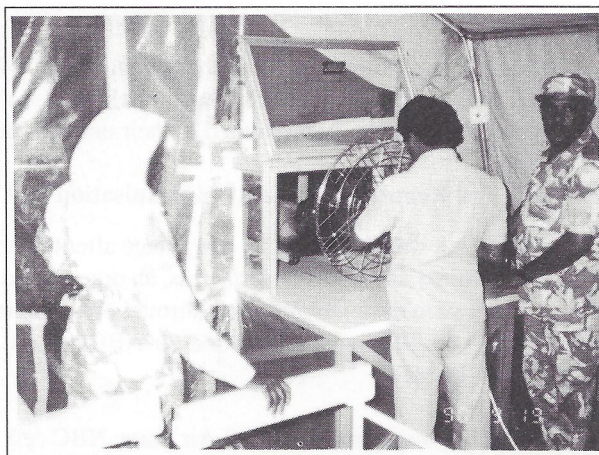


Fig. 2 Transparent coffin. Air purging chamber

After the construction of a second CDC, the BDF hospital had a capacity and manpower to decontaminate up to 80 chemical casualties per hour 24 hours a day. Each CDC had 4 bays of stretchers, a team of 4 men per stretcher – each casualty took between 4 and 6 minutes to decontaminate. After washing and drying, to prevent the chemical agent vapour entering the hospital, casualties were passed through an air purging chamber. This chamber was constructed at table height and had the appearance of a two and one half metre transparent coffin (Fig 2).

There were two of these chambers which had hinged perspex flaps at each end. The casualty was passed into the chamber on a stretcher from the CDC side with the hospital side flap down. With the casualty in the chamber, the hinged flap on the hospital side was opened, a table mounted fan positioned at the aperture, and air from this high speed fan was passed over the body. After remaining in the chamber for 1 minute, more than five fold exchange of air was achieved, sufficient to clear the possibility of any agent vapour entering the hospital. The chamber was connected to a tent entering the hospital trauma area. Walking casualties were processed through a similar but much larger chamber with a capacity for eight standing casualties; in this case the purging time was five minutes.

More than 150 members of the MSG and hospital staff were trained on a continual basis throughout August and September 1990 and tested on a weekly basis until the end of the war.

### Medical Training and Pharmaceutical Management

At an early stage lectures were presented to all medical staff outlining the threat of an attack on Bahrain and the medical implications which might arise from such an attack. The medical effects of chemical agents were known and well documented and extra drugs were ordered to meet anticipated requirements. A document found to be useful amongst many others was the United Nations Medical Commission report relating to Iraq's use of chemical weapons during the Iran/Iraq conflict.

### NBC Policy and Standard Operating Procedures (SOPs)

Coincidentally, in July 90, a report had been prepared at the MSG outlining future NBC Policy for the BDF. This was followed shortly after with the issue of SOPs for the MSG, certain aspects incorporated US policy.

It became increasingly clear that because of the cost of a major purchase of equipment; the time frame in which it be **might** be delivered; the acceptance that Bahrain was not likely to be a high priority target, some sort of compromise was required. It was decided that only personnel whose role was likely to require active deployment, would be issued with full individual protection equipment. The BDF would embark on a research project to produce for all BDF units, facilities with locally made air filtration units which would offer protection against all chemical weapons.

### Individual Protection Equipment and Training

The first consignment of NBC equipment was of US design therefore the assistance of the US Forces stationed in Bahrain was enlisted. Two initial courses were run to train BDF officers and SNCOs. Those trained on these courses then returned to their units to train unit personnel.

### Warning and Reporting (W & R) - Organisation and Training

Although it was realised at an early stage after the invasion of Kuwait, that the NBC capabilities of the BDF were limited, there was nevertheless, an urgent need to identify ways in which NBC information could be passed between the coalition forces throughout Bahrain, Dahrn and Riyadh. A W & R organisation was set up within the BDF which provided for NBC cells in all BDF units reporting to a HQ cell manned by members of the MSG.

Again, the assistance of the US Air Force NBC cell instructors was enlisted to assist in the running of W & R courses. Dress regulations in IPE were modified to take account of the high temperatures in Bahrain. After the first course a major exercise was run for senior staff officers at HQBDF, commanding officers of BDF units and the directors of the civil defence organisation.

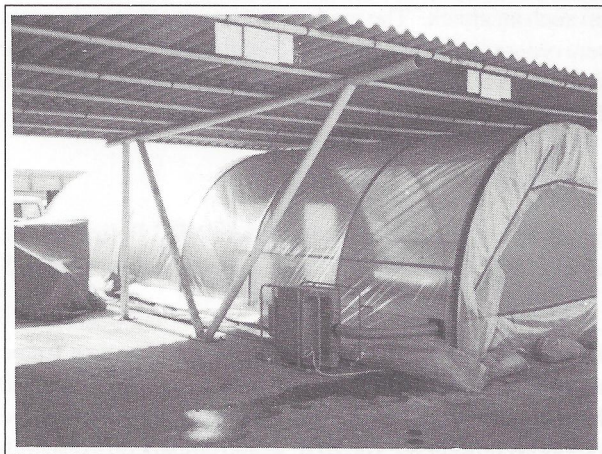
### Collective Protection and Training

The immediate concern of the Medical Services was the provision of collective protection for the hospital. This involved a large complex of some 300 beds. The purchase of collective protection equipment became increasingly unlikely because of the high costs involved. In order to provide some protection, it was decided to embark on research and development for NBC filters for the BDF hospital; a mobile air filtration unit for use in units, and collective protection shelters to be constructed in all static units.

### Hospital Collective Protection (COLPRO)

Activated carbon and high efficiency particulate filters were identified as the principal requirements for chemical filtration. Considerable progress was made in developing activated carbon filters for the BDF hospital. A suitable level of carbon was identified for a design which could be accommodated in the ducts of the hospital air intake units. However, there are approx 23 very large air intakes and each filter bed construction was costed at approx BD 500. This would have achieved only 1 filter change.

It was decided that the threat to Bahrain did not justify this expense. The hospital undertook tests to establish: if all entrances were sealed for the period of one attack (approx 6 hours), could the overpressure be maintained and could the staff still operate? The findings were reasonably satisfactory. They were accepted in the knowledge that if chemical weapons were used, unnecessary areas of the hospital would be closed down. The vital areas would be supplied with clean air from mobile air filtration units being developed.



**Fig. 3** *Collective protection shelters with an air filtration unit.*

### Unit Collective Protection

The design of the collective protection shelters for BDF units required little original thought. Adequate information was available on basic principals; the problem was time and materials. With a recognition that the purchase of recommended materials was most unlikely because of the obvious delays in delivery from Europe of suitable chemical agent resistant material, the least attractive but readily available material was - plastic sheeting.

Bahrain has an abundance of large plastic covered greenhouses used for agricultural. After being modified and fitted with full size purging chambers, a prototype COLPRO suitable for testing, was set up at the MSG. This also provided the BDF draughtsmen with sufficient information to produce formal drawings for the shelters. COLPRO shelters with sealed air conditioning and toilets were constructed by contractors in less than 2 weeks (Fig 3). Two sizes were constructed; a 20 man and 40 man shelter. Every BDF unit had a COLPRO shelter in which to rest troops (in groups of 20 or 40) for 2 sessions of 2 hours in every 24 hours.

### **Air Filtration Unit (AFU)**

In view of the high cost of purchasing imported AFUs, it was decided that an attempt would be made to develop a model locally. The principle on which other AFUs operated was known; it was not a unique principle. At the time there were no manufacturers in Bahrain who had any expertise in this field.

The objective had been to produce a unit which could generate 100 cubic feet per minute (CFM) of filtered air. The AFUs would be used with the collective protection shelters which were ultimately designed for use in all BDF units.

The original concept envisaged protection only from chemical agents; as the crisis developed, the threat of biological weapons emerged. As the design of the AFU became more advanced it was realised that as a proportion of the cost, the high efficiency aerosol and particulate filters needed for complete protection, were relatively cheap: they were therefore included in the final design. The completed AFU provided protection against all known nuclear, biological and chemical agents.

### **Tests**

Throughout the period of development, the AFU prototypes were subjected to continuous testing. The initial steel models continued to filter out concentrations of methyl salicylate after more than two months of frequent use on exercises. The final models were manufactured of fiberglass. Smoke and air flow test were made to ensure that an adequate overpressure was being maintained by the filters.

The end result produced was an AFU which benefitted from a carbon specially impregnated with copper and chromium salts - for chemical conversion, which when fitted with the high efficiency aerosol pre-filters offered probably more protection than the abundance of filters that eventually became available as the crisis became more protracted. The UK chemical Defence establishment assessed that the BDF AFU would last for approx 150 minutes in an hydrogen cyanide environment. At the temperatures in Bahrain, the tactical advantage of using a non persistent agent (if it could be successfully delivered!) would be minimal; the danger from the agent disappears in less than 10 minutes. Therefore, the filters were good for 15 attacks.

BDF Standard Operating Procedures (SOPs) were produced to have filters changed after five chemical attacks. This provided an adequate safety margin, bearing in mind that units only possessed detector paper to determine chemical contamination within the COLPRO. The filter life was considerable longer during liquid persistent chemical attacks; this was assessed as being the most likely threat to Bahrain; again five attacks was the SOP for changes.

In addition to local help, the hospital had considerable help in this project from a number of sources from abroad, mainly from Holland and Belgium.

At the outbreak of the ground war, all BDF units had been provided with collective protection shelters and air filtration units to provide a clean air environment. The cost of each AFU was approx BD 400. The cost of the collective protection shelters which included a concrete floor, all services, lights, chemical toilet, and 2 split AC units was approx BD 2000 for the 10 metre and BD 3000 for the 15 metre shelter. A commercial firm in August quoted BD 17000, for a small inner and outer shelter with generator, lights and 2 AFUs with small trailer!

## Training

As the COLPRO shelters were completed, a course was begun at the MSG to train unit representatives who had been nominated within their units as the NBC staff. Included in the course was advice on items to be stored in COLPRO, entry and exit drills, and the control times for the purging chambers. The procedure for changing filters in the BDF AFUs was also included.

## Civil Defence

There was close cooperation between the BDF and the civil defence organisation. In view of the threat from SCUD missiles (there were five attacks - 2 landed), joint exercises were mounted with all the emergency services which included the BDF bomb disposal unit, the MSG medics and MSG chemical recce.

Since the beginning of the air war, the MSG had mounted an island wide 24 hours a day vehicle mounted chemical recce. The vehicle was equipped with radio and chemical agent detection equipment, the US equivalent of NIAID (the M8A1); it was also covered in strategic places with detector papers, and if all this failed, it carried a caged budgerigar!

## CONCLUSION

**There is little doubt that along with all troops in the region, the medical services were kept fully occupied throughout the 8 month period of the crisis. Soldiers of the Medical Support Group were utilised to the fullest and were involved in all forms of NBC and First Aid training. At times it seemed the approach to the crisis was conservative but it was nothing if not pragmatic.**

**The medical services grew in confidence throughout the crisis. In the beginning, the idea that they had the background or experience to run the NBC organisation for the BDF was taken very lightly. However, as soon as MSG personnel were trained and seen to demonstrate and teach IPE, CS chamber tests, warning and reporting, chemical survey/recce and then produce the COLPRO and a BDF AFU, there was an acceptance that considerable progress had been achieved.**

**It was fortunate that some members of the MSG had a background not only in normal NBC training but in the aspects that specifically affected the medical services. The production of the BDF AFU unit and collective protection was probably a unique experience in the Gulf area during the crisis.**

**With very little to start with, in a very short period, NBC equipment was provided and BDF soldiers were instructed in all the basic NBC subjects; NBC protection was provided for all BDF units as well as facilities to treat and decontaminate chemical casualties for the BDF and the coalition forces in Bahrain. The successful preparation of medical facilities for chemical casualties would have been a major factor in saving the lives of many casualties.**