

Cite as: Bogerd CP, Den Hartog EA, Houwelingen T, De Kant S & Langenberg J (2013). Whole system test evaluation of a novel layered concept for improved ergonomics and adaptable protection levels. 2nd International Symposium on CBRN Physical Protection, 26-28 November 2013, Munster, Germany.

Whole system test evaluation of a novel layered concept for improved ergonomics and adaptable protection levels.

Cornelis P Bogerd^{1*}, Emiel A den Hartog^{1,2}, Tiny Houwelingen¹, Saskia de Kant¹ & Jan Langenberg¹

¹TNO CBRN Protection, Lange Kleiweg 137, 2288 GJ Rijswijk, the Netherlands

²North Carolina State University, College of Textiles, USA

*Corresponding author: niels.bogerd@tno.nl

INTRODUCTION

Many relevant standards state that CBRN protective clothing should provide protection for 24 h. This guideline has been present since the Cold War which ended several decades ago, despite changing CBRN threats and advancements in (clothing) technology. Furthermore, a disadvantage of the 24 h norm is that the protective requirements to the clothing materials needs to be high. Since there is still an inverse relationship between protection and user effectiveness and comfort, the present CBRN clothing systems are likely suboptimal for performance-periods much shorter than the 24 h norm. In addition, threats are changing and will likely include much shorter periods of exposure for a soldier and/or first responder. Finally, also the expected tasks or activities are different from what was envisioned during the Cold War. This provides a strong basis for investigating novel solutions in CBRN protective clothing which let go of the 24 h norm and focus on increasing user effectiveness and comfort with lower levels of protection. In this presentation we will present a novel concept of CBRN protection based on a layered system. In this concept each layer provides a certain protection level, aimed at increasing effectiveness and comfort, corresponding to lower level threats and/or shorter exposure durations. Unique to this concept is that it facilitates the regulation of protection, by wearing selected layers only. Wearing one layer provides a minimum protection, e.g., for 4 h at classic threat levels (but maximum user effectiveness and comfort), wearing all layers provides maximum protection at the expense of user effectiveness and comfort. The main focus of the present study was to investigate the effect of combining layers on the protection.

METHODS

Manufacturers were asked to produce prototypes of a base layer as well as a comfortable CBRN outer garment, all layers based on active coal technology (Figure 1). Three systems were received and evaluated using Whole System Tests (also known as Man In Simulant Tests), using Methyl Salicylate as the simulant. The evaluations were carried out according to NATO AEP 38, with an exposure time of 1 h and an airflow of 4-5 m/s (in most cases). The prototypes will be referred to anonymously and additional details will be given in the presentation.



Figure 1 An evaluated prototype, consisting out of the base layer (left) as well as the CBRN outer garment (right).

RESULTS AND DISCUSSION

The results indicate that combining layers results in substantially higher protection factor than the sum of the individual layers. Figure 2 gives a typical example. The results indicate that the base layer is maximally effective if the airflow is reduced by a covering layer. Additional benefits of a base layer are they can be more tight fitting, with a correspondingly smaller microclimate than an over garment. Smaller microclimates reduce pumping effects. Additional details will be given in the presentation.

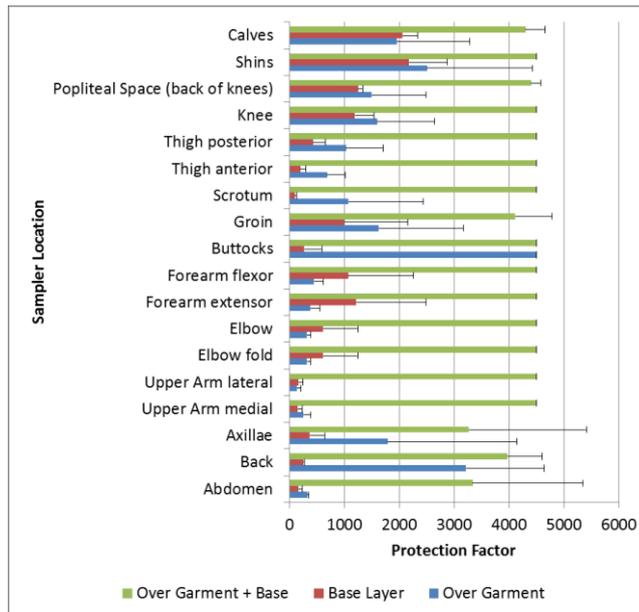


Figure 2 Typical results for one system for the layers as indicated.

ACKNOWLEDGEMENT

This study was executed as part of the CBRN Protection research program, funded by the Netherlands Ministry of Defense.