

HFM-057: Biotechnologies for Assessment of Toxic Hazards in Operational Environments

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ABSTRACT

A general overview is given on the activities of HFM057 TG009 which include research and development in the area of biotechnology applied for the assessment of toxic hazards in operational environments. These environments are increasingly dangerous from a toxic hazards point of view whereas today's acceptance levels are increasing becoming lower.

1.0 INTRODUCTION

1.1 Background

Public opinion demands an increasing level of safety and health care for military personnel under operational and peacetime conditions, not restricted to traditional aspects such as battle injury and (infectious) diseases. Operational environments are becoming increasingly dangerous within the context of peace-enforcement and peace-keeping missions. Troops may be exposed to harmful chemicals as a result of inadequate environmental protection in the area of operations, industrial accidents, sabotage, or the intentional or unintentional actions of enemy or friendly forces.

Traditionally, the medical protection of soldiers against non-battle injuries has been concentrated on infectious diseases. Consequently, risk assessment of non-weaponized toxic hazards in the operational areas and on the battlefield has been relatively neglected. Pertinent toxicological research should involve source and levels of exposure, and effects thereof on the military. Eventually, this should lead to better health and safety care of the military through improved risk management during operations.

Given these concerns, it was recommended that an explicit effort to identify, quantify and minimize the effects of toxic exposures, especially those which are characteristic for the military environment should be pursued. Such an effort could serve as a venue for initiation and effective co-ordination of military-toxicological research by experts.

The justification for this effort is as follows: An increased level of safety and health care for military personnel under operational conditions will improve combat readiness and effectiveness, and therefore the probability of successful mission completion. An additional (non-operational) benefit is that risk of post-deployment illness and disability, resulting from exposures during deployment, will be reduced.

1.2 TG009

Task Group(TG)-009 on ‘Protection against adverse effects of toxic hazards’ was established in 2000 as a follow-up to Exploratory Team(ET)-005 with the same name after approval of its Terms of Reference (TOR) and Programme of Work (POW) by the HFM-panel. The original end date for TG-009 was December 2002. However, due to the vastness of the topic and many changes in the members to the TG, extension of the life-time under the same TOR was granted until December 2003. Due to organizational problems the final meeting was in fact held in February 2004.

At that meeting it was concluded that continuation of the activities of TG-009 was necessary. The field of operational toxicology is enormous, diverse and complex. It has taken the TG quite some time to find a suitable strategy to deal with this topic, but the feeling was that this stage was reached at the end of the first term. In view of the many problems that arise during and after military missions the unanimous opinion of the members was that TG-009 can significantly contribute to addressing these problems. Since Task Groups need to deal with coordinating and promoting scientific research, it was proposed to change the name of TG-009 into ‘BIOTECHNOLOGIES FOR ASSESSMENT OF TOXIC HAZARDS IN OPERATIONAL ENVIRONMENTS’, which was considered to be more appropriate than ‘PROTECTION AGAINST CHEMICAL HAZARDS’. In recent years new (bio)technologies have emerged that may be relevant to address the problems mentioned above. The added value of these biotechnologies should therefore be explored.

A new TOR and POW were drafted and approved by the HFM-panel. The end date of the second term of TG-009 will be December 2006.

In the following the activities and results of the first term of TG-009 are described, as well as the current activities.

2.0 FIRST TERM OF TG-009 ON ‘PROTECTION AGAINST CHEMICAL HAZARDS’

2.1 Members and meetings

Delegates from BE, CA, FR, GE, NL, and USA participated in TG-009 from the very start. SE joined the TG in 2002. NO did participate in ET-005 but decided not to take active part in the TG. Various other countries were invited to join in, but without success. As already mentioned above, TG-009 had a difficult start due to many changes in representatives from the participating countries. By 2002, this had settled down. However, the TG has lost contact with French representative after 2001, which is a reason for concern. This problem has been brought to the attention of the Dutch and French representatives in the HFM panel, but without any result. The chairperson and secretary of TG-009 were representatives from NL.

TG-009 has held meetings in:

- May 2000 at the TNO Prins Maurits Laboratory in Rijswijk (NL);
- March 2001 at the USACEHR in Fort Detrick (USA);
- June 2002 at Schloss Oranienstein in Diez (GE); and
- February 2004 at the TNO Prins Maurits Laboratory in Rijswijk (NL).

At the meetings the developments in the national programmes related to operational toxicology were presented and discussed. Furthermore, the members held scientific presentations on new and emerging technologies and methodologies that might be of importance for this area of work. Experiences from out-of-area missions (e.g. Kosovo, Eritrea, Afghanistan) were shared, which provided TG-009 with insight into the problems encountered in relation to operational toxicology during actual missions. Examples are exposure during missions to permethrin, TNT from partly exploded ordnance, carbon monoxide in confined spaces, various insecticides due to uncontrolled use, dioxins via waste incineration, and depleted uranium.

By sharing these kinds of information the TG learned how to deal with the vast and complex field of operational toxicology, and how to direct scientific research in order to address the problems in this field.

Actions were assigned to the various members where appropriate and these were completed on a short or longer term.

2.2 Products/deliverables

At the end of its first term TG-009 had realized nearly all of the planned products/deliverables:

1. A software architecture to access literature relevant to operational toxicology (GE): rather than creating a database, which would require extensive maintenance, a system has been set up to find relevant literature.
2. A Technical Report on biomarkers for exposure and effect of diesel fuel has been drafted by CA. Originally it was intended to produce a Technical Report on the use of biomarkers for operational toxicology purposes (SE, CA, NL), which would be quite an effort.
3. A Technical Report on components in explosives and propellants has been drafted by GE. A problem identified with respect to the toxicology of explosives, propellants and pyrotechnics is that the manufacturers usually do not disclose the ingredients in these products, whereas this is primary information for hazard assessment. FR had offered to produce a similar report on pyrotechnics, but since the TG lost contact with the French representative, the status of this potential deliverable is unknown.
4. A Technical Report on the toxicology of combinations and mixtures (CA). This is one the most difficult topics in toxicology. Various approaches to assessment of mixture toxicology, occupational exposure and environmental exposure are described and evaluated. The paper contains links to relevant websites. This paper is transformed into the NATO RTO Technical Report format.
5. A brief summary on available methods for evaluating neurobehavioral toxicology (USA).
6. Trilateral (CA, NL, SE) co-operative research is established with respect to 'human verification' of exposure to toxicants. This co-operative group was established in October 2003. Apart from exchange of information, joint projects will be performed.
7. A report on the toxicology of jet-propulsion fuel 8. The toxicology of JP-8 has been a reason for concern for many years. The topic has been discussed at each TG-009 meeting. Recently (2003), the National Research Council of the National Academies has published a comprehensive report on this topic entitled 'Toxicologic assessment of jet-propulsion fuel 8' (ISBN 0-309-08715-5). Although this is not a true deliverable of TG-009, the work of some of its members has been used in this assessment.

Two planned deliverables were not realized:

1. A workshop on Mass Chemical Casualty Care (BE). Such a workshop was planned in the UK in January 2004, to be organized by Wilton Park, but however did not take place.
2. A 'roadmap' showing the short, intermediate and long term goals of scientific research addressing operational toxicology items to our assignors (USA). This deliverable has been incorporated into the deliverables for the second term of TG-009.

3.0 CURRENT, SECOND TERM OF TG-009 ON 'BIOTECHNOLOGIES FOR ASSESSMENT OF TOXIC HAZARDS IN OPERATIONAL ENVIRONMENTS'

3.1 Members and meetings

The second term of TG-009 started out with delegates from BE, CA, GE, NL, SE and USA. CZ joined the group in April 2005, which is a valuable extension. Currently, the chairperson and secretary of TG-009 are still representatives from NL. However, the group is currently run by a co-chair from the USA, as the Dutch chair has other obligations, preventing him to pay insufficient attention to TG-009. NL will soon decide how to resolve his situation.

Sofar TG-009 has held meetings in:

- August 2004 at the Department of National Defence Public Affairs Office in Toronto (CA);
- April 2005 at the Royal School of Medical Services in Ghent (BE).

The next meeting is scheduled for October 2005 at the U.S. Army Research Institute of Environmental Medicine in Natick (Ma, USA).

3.2 Activities

The objectives for the second term of TG-009 are:

1. Evaluation of new and emerging biotechnologies to assess toxic hazards and exposure under operational conditions. This evaluation should lead to identification of areas in which coordinated research efforts are required.
2. Facilitation of the communication and coordination of environmental and occupational health research and toxicological research among the participating countries. This goal will be realized by regular meetings of the Task Group.

More specifically, the Task Group will address the following topics:

- Evaluate the potential benefits of emerging biotechnologies to protect health and mission performance;
- Provide input to improve guidelines for health and mission performance risk assessment of military-relevant compounds in the operational environment;
- Identify knowledge gaps in inhalation toxicology of military-relevant compounds;
- Identify knowledge gaps in neurobehavioral toxicology of military-relevant compounds and other environmental stressors;
- Identify and propose development of (specific) biomarkers for diagnostic and prognostic purposes;

- Promote development of biomarkers of susceptibility, such as polymorphisms;
- Promote investigation of the interactive effects of physical (e.g. heat) and psychological stress on the toxicity of military-relevant compounds;
- Evaluate new methods for studying the toxic hazards of exposure to military-relevant mixtures or combinations of exposures to multiple stressors;
- Consider technologies (e.g. molecular epidemiology) for assessment of health risks through the life cycle of military personnel;
- Identify the unique risks of exposure to military-relevant compounds in confined spaces;
- Promote the importance of health risk communication research;
- Awareness of meetings relevant for the Task Group.

The following products/deliverables are planned:

- The major product will be a technical report on biotechnologies for assessment of toxic hazards in the operational environment.
- Publish an inventory and critical evaluation of existing databases for biomarkers for prognostics and diagnostics and field relevant assessment methods.
- At least one workshop on biotechnologies will be organized and conducted by the Task Group.
- Publication(s) of the key findings of the Task Group in relevant open literature journals.

Several draft chapters for technical report have already been written and are being reviewed and discussed within the group.

The meetings of TG-009 are characterized by their open, cooperative atmosphere. The participants are willing to share information as well as their problems among each other. These are ingredients that are needed for a successful completion of the tasks of TG-009.

